



## Document 526 Post Implementation Report

Chapter: Worcester Polytechnic Institute

Country: Guatemala

Community: Guachtuq

Project: Rainwater Harvesting

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ENGINEERS WITHOUT BORDERS USA  
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## Post Implementation Report Part 1 – Administrative Information

### 1.0 Contact Information

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Responsible Engineer in Charge	Rodney Rookey	<a href="mailto:rodrookey@gmail.com">rodrookey@gmail.com</a>	(860) 982-6567	Centurion Waterproofing, Inc.
Traveling Mentor	Rodney Rookey	<a href="mailto:rodrookey@gmail.com">rodrookey@gmail.com</a>	(860) 982-6567	Centurion Waterproofing, Inc.
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Health and Safety Officer	Evelyn Grainger	<a href="mailto:egrainger@wpi.edu">egrainger@wpi.edu</a>	(845) 249-8847	EWB-USA WPI
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In-country Local Government Contact	Julio Romeo Suram Chun	<a href="mailto:cecep@intelnet.gyt">cecep@intelnet.gyt</a>	+502 7950-4039	Municipalidad de San Cristóbal

## 2.0 Travel History

Dates of Travel	Assessment or Implementation	Description of Trip
7/20/2010 - 8/03/2010	Assessment	This first trip consisted of meetings with the community members and town officials. Health surveys and water quality samples were collected.
7/23/2011 - 08/07/2011	Assessment	Collected more data on water consumption and existing rainwater harvesting practices. Developed a memorandum of understanding with the community.
12/31/2012 - 1/10/2013	Implementation	Pilot implementation of rainwater harvesting systems on two homes, assessment of homes for future implementation, and established a monitoring system.
5/2/2013 - 5/15/2013	Assessment	Assessment of pilot implementation, health survey, and census of community. Home assessments for the next 10 homes and preparations for next two implementations were completed.
1/2/2014 - 1/14/2014	Implementation	Implementation trip funded by an EPA grant. Therefore, there are no official EWB reports. A last minute itinerary change led to implementations at 2 homes and the team also re-assessed 8 homes for future implementation. Finally, further monitored project success.
5/8/2014 – 5/25/2014	Implementation	Implemented on 8 homes in the community, conducted water quality tests, conducted family interviews and assessed the remaining homes for implementation.
1/3/2015 – 1/11/2015	Assessment	Verified Home Designs and MOUs with the remaining 22 homes in the community. Visited construction stores to get quotes for the quantity of materials needed for the planned May implementation.
5/9/2015 – 5/25/2015	Implementation	Completed implementation of the rainwater harvesting systems on the remaining 22 homes in the community. Continued with water quality testing and ongoing monitoring.

### 3.0 Travel Team

#	Name	E-mail	Phone	Chapter	Student or Professional
1	Aaron Pepin	<a href="mailto:aipepin@wpi.edu">aipepin@wpi.edu</a>	(603) 689-3869	EWB-USA WPI	Student
2	Lenna Quackenbush	<a href="mailto:lquackenbush@wpi.edu">lquackenbush@wpi.edu</a>	(413) 626-2966	EWB-USA WPI	Student
3	Evelyn Grainger	<a href="mailto:egrainger@wpi.edu">egrainger@wpi.edu</a>	(845) 249-8847	EWB-USA WPI	Student
4	Brandon Clark	<a href="mailto:bclark2@wpi.edu">bclark2@wpi.edu</a>	(508) 455-8864	EWB-USA WPI	Student
5	Sienna Mayer	<a href="mailto:simayer@wpi.edu">simayer@wpi.edu</a>	(603) 315-7062	EWB-USA WPI	Student
6	Karen Orton	<a href="mailto:korton@wpi.edu">korton@wpi.edu</a>	(719) 216-6252	EWB-USA WPI	Student
7	Rodney Rookey	<a href="mailto:rodrookey@gmail.com">rodrookey@gmail.com</a>	(860) 982-6567	EWB-USA WPI	Professional
8	Laureen Elgert	<a href="mailto:lelgert@wpi.edu">lelgert@wpi.edu</a>	(508) 450-3313	EWB-USA WPI	Professional

### 4.0 Health and Safety

#### 4.1 Incident Reports

Did any health or safety incidents occur during this trip?  Yes  No

### 5.0 Planning, Monitoring, Evaluation and Learning

#### 5.1 Canceled/Non-functioning Projects

Has the status of any of this program's past-implemented projects changed to Canceled or Non-functioning?  Yes  No

#### 5.2 Updated 901B

Is the updated version of the 901B – Program Impact Monitoring Report included with this report?  Yes  No

#### 5.3 Final 903

Is the signed Final 903 - Implementation Agreement included as an appendix to this report?  Yes  No

## 6.0 Budget

### 6.1 Project Budget

EWB-USA TRIP BUDGET			
EWB-USA Chapter Name ::		Worcester Polytechnic Institute	
Project Name ::		Guachtuq Water Supply	
Type of Trip ::			
Trip Type: A= Assessment; I= Implementation; M= Monitoring + Evaluation NOTE: The fees associated with each trip type will auto-populate the EWB-USA HQ section.	I		
Lines with an asterisk are automatically calculated.			
		BUDGET (PRE-TRIP)	ACTUAL EXPENSES (POST-TRIP)
DIRECT COSTS			
Travel + Logistics			
Airfare	\$5,990	\$8,480	
Food + Lodging	\$3,260	\$2509.76	
Other Travel Expenses (ex: Rental Vehicle, Taxis/Drivers, Exit Fees/Visas, Inoculations/Medical Exams, Insurance)	\$1,190	\$1,439	
<b>Sub-Total*</b>	<b>\$10,440</b>	<b>\$12,429</b>	
Labor			
In-Country Logistical Support	\$1,882	\$2,888	
Local Skilled labor	\$2,353	\$257	
<b>Sub-Total*</b>	<b>\$4,235</b>	<b>\$3,145</b>	
EWB-USA HQ (this section is auto-calculated based on trip type)			
Program Quality Assurance/Quality Control + Infrastructure*	\$4,900	\$4,900	
Less EWB-USA HQ Subsidy*	\$3,690	\$3,690	
<b>Owed by Chapter Sub-Total*</b>	<b>\$1,210</b>	<b>\$1,210</b>	
Project Materials + Equipment (itemized, as appropriate)			
Parts and Tools	\$19,630	\$21102.3	
<b>Sub-Total*</b>	<b>\$19,630</b>	<b>\$21,102</b>	
Misc. (details required)			
Phones	\$150	\$145	
Delivery of Material	\$0	\$52	
Mother's Day thank You	\$0	\$19	
Water Quality Tests	\$480	\$480	
<b>Sub-Total*</b>	<b>\$630</b>	<b>\$696</b>	
<b>TOTAL DIRECT COST*</b>	<b>\$35,665</b>	<b>\$38,583</b>	
IN-KIND CONTRIBUTIONS			

Community In-Kind Contributions to Project Costs			
	Labor	\$10,000	\$10,000
	Materials	\$100	\$100
	Logistics	\$100	\$100
<b>Sub-Total*</b>		<b>\$10,200</b>	<b>\$10,200</b>
<b>TOTAL IN-KIND CONTRIBUTIONS*</b>			
FUNDS RAISED			
Funds Raised for Project + Grants Received			
Cash from community (EWB-USA requires a minimum 5% contribution)		\$100	
Rotary Global Grant		\$35,000	
Total \$ in Project Fund at EWB-USA HQ		\$3000	
Total \$ in Project Fund at University		\$0	
<b>Total*</b>		<b>\$38,100</b>	
Funds Raised for Chapter			
Total \$ in Chapter General Fund at EWB-USA HQ		\$6,212	
Total \$ in Chapter General Fund at University		\$500	
<b>Total*</b>		<b>\$6,712</b>	

## 6.2 Professional Mentor Team Hours

Name(s) of Professional Mentor(s)	Pre-trip hours	During trip hours	Post-trip hours	Total Hours
1. Rodney Rookey	12	204	4	20
2. Laureen Elgert	10	204	6	22

## 7.0 Project Discipline(s):

Water Supply	Structures	Agriculture
<input type="checkbox"/> Source Development	<input type="checkbox"/> Bridge	<input type="checkbox"/> Irrigation Pump
<input checked="" type="checkbox"/> Water Storage	<input type="checkbox"/> Building	<input type="checkbox"/> Irrigation Line
<input checked="" type="checkbox"/> Water Distribution	<input type="checkbox"/> Civil Works	<input type="checkbox"/> Water Storage
<input type="checkbox"/> Water Treatment	<input type="checkbox"/> Roads	<input type="checkbox"/> Soil Improvement
<input type="checkbox"/> Water Pump	<input type="checkbox"/> Drainage	<input type="checkbox"/> Fish Farm
Sanitation	<input type="checkbox"/> Dams	<input type="checkbox"/> Crop Processing
<input type="checkbox"/> Latrine	<input type="checkbox"/> Energy	<input type="checkbox"/> Equipment
<input type="checkbox"/> Gray Water System	<input type="checkbox"/> Fuel	<input type="checkbox"/> Information Systems
<input type="checkbox"/> Black Water System	<input type="checkbox"/> Electricity	<input type="checkbox"/> Computer Service

## **8.0 Project Location**

**Latitude:** -90.494921 W  
**Longitude:** 15.372468 N

## **9.0 Project Snapshot for Publicity**

### **9.1 Problem identification**

The thirty-four families in the community of Guachtuq, Guatemala, identified water poverty as their most pressing issue.

### **9.2 Project goal**

The goal of this project is to ensure that each family in Guachtuq has water security, or adequate quantity, quality, and access to water to meet human needs. Water security is achievable for Guachtuq through the implementation of individualized rainwater harvesting systems at each home. To ensure long-term success, families will be educated in constructing and maintaining the systems.

### **9.3 Project status**

On the May 2015 Implementation Trip, the EWB-USA WPI team worked with the community members of Guachtuq and El Centro Comunitario Educativo Pokomchi (CeCEP) to build 22 rainwater harvesting systems at homes in the community, completing the planned Implementation Phase for the Guachtuq, Guatemala Rainwater Harvesting Project. Upon the teams departure, 34 systems were completed in the community. Additionally the EWB-USA WPI travelers continued the monitoring and evaluation of previously implemented systems through family interviews and water quality testing. The next step is to organize a planned Project Monitoring and Evaluation Trip in May 2016, possibly followed by Program Closeout.

## Post Implementation Report Part 2 – Technical Information

### 1.0 Executive Summary

This is the post-trip report for the Engineers Without Borders-USA Worcester Polytechnic Institute (EWB-USA WPI) May 2015 Implementation Trip for the Guachtuq, Guatemala Rainwater Harvesting project, #6871.

The goal of this project is to achieve water security—defined as adequate quantity, quality, and access to water to meet human needs—for each of the thirty-four families in Guachtuq, Guatemala by constructing individualized rainwater harvesting systems. This goal was accomplished on the May 2015 Implementation Trip as the EWB-USA WPI team, the community members of Guachtuq, and El Centro Comunitario Educativo Pokomchi (CeCEP) worked together to build the final 22 rainwater harvesting systems in the community.

Guachtuq is a rural community of about 220 people, located on the outskirts of the San Cristobal Verapaz Municipality in the Alta Verapaz department of Guatemala, a mountainous region in the center of the country. Many community members exclusively speak Pokomchi, an indigenous Mayan language, though some are also proficient or fluent in Spanish. Thirty-four families live dispersed over 1 km on a dirt road that leads up a mountain; there is approximately a 500 ft elevation difference over the length of the community. During the dry season, January through April, the community historically has relied on a single communal water basin, known locally as the *finca*. This water basin is located on private land near the bottom of the community. Women and children often spend 4-6 hours collecting water each day, walking up and down the steep slope with containers of water and baskets of laundry. Socio-economic tensions frequently surround use of the finca water. The water originates on a nearby private farm and, though the basin was built in 2006 through an agreement between the farm owner and the community, members of other communities sometimes make use of the finca as well.

EWB-USA WPI partnered with Guachtuq in 2009. Assessment trips in 2010 and 2011 determined the goal of the project: achieving water security. The team worked with the community to identify individual rainwater harvesting systems as the most technologically and culturally appropriate solution due to geology, community layout, personal finances and the transient nature of community membership. EWB-USA WPI developed a relationship with El Centro Comunitario Educativo Pokomchi (CeCEP), a non-governmental and non-profit organization that provides the team with cultural information, translators, a workspace, and communication with the community when the team is not in Guatemala. All community members and organizations participating in this project have signed MOU contracts with EWB-USA WPI.

The rainwater harvesting systems have been engineered iteratively, beginning with two pilot systems constructed in January 2013. Based on feedback from the May 2013 Assessment Trip, new designs, including the “first flush,” were tested through two additional pilot systems built in January 2014. Protocols for system maintenance were established and tested when eight more systems were built during the May 2014 Implementation Trip. The scope of the project was finalized in May 2014 with assessments at each of the remaining homes. In January 2015 the team confirmed system designs, quantities and transportation of materials, community involvement, and all other logistics necessary to complete the implementation phase of this

project. The final 22 rainwater harvesting systems were built in May 2015.

The implementation of the final 22 rainwater harvesting systems was planned to take place in five phases, as outlined in the *525: Pre-Implementation Form*

- **Phase I: Preliminary Data and Preparations,**
- **Phase II: Concrete Base Construction,**
- **Phase III: Materials Transport for System,**
- **Phase IV: System Construction and Education,**
- **Phase V: Wrap-up.**

In reality, due to a variety of unforeseen obstacles, this process did not manifest exactly as intended. However, thanks to the careful planning and preparation of the travelers; the ability and willingness of the community; and teamwork and communication between EWB-USA WPI, community members, and CeCEP, the implementation was completed within the planned trip duration. **Phase I** was completed as planned. The team verified that each home was properly prepared and had representatives to assist with construction. They also conducted water quality tests on all existing EWB-USA WPI systems in the community. Due to logistical delays, **Phase II**, **Phase III**, and **Phase IV** did not follow linearly as planned. The main source of delay was due to unforeseen difficulties with the deliveries of tools and materials provided by the team's primary supplier, Construfacil, located in the nearby city of Coban. To overcome this obstacle, community members used their own tools and tools remaining from previous EWB-USA WPI trips to begin **Phase II** on time, though progress was slow until adequate supplies arrived.

**Phase III** was unexpectedly fragmented and occurred simultaneously with **Phases II** and **IV**. The EWB-USA WPI/Guachtuq/CeCEP team adjusted to this delay by completing systems in a different order than originally planned, capitalizing on the materials available each day.

Fortunately, because of the skill and flexibility of community members, the construction part of **Phase IV**, was completed a day ahead of schedule. **Phase V** occurred at the end of the trip as planned, concurrent with individualized learning sessions for each family (originally scheduled for **Phase IV**). Learning sessions were reinforced with a general explanation of system function and maintenance at the final community meeting.

Some homes in the community changed unexpectedly after the January 2015 Assessment Trip. System designs were subsequently altered in-country to maintain system functionality, and materials were distributed appropriately. However, the general system design did not change; each system will function as described in the approved *525 Pre-Implementation Form*. Section 4.3 discusses homes that had significant design alterations, and Section 4.4 contains drawings of the final systems.

When the EWB-USA WPI travel team left the community at the end of the trip, each family participating in the program had a functional individualized rainwater harvesting system. The systems were completed to the satisfaction of the families and individualized learning sessions were held at each home. With the completion of these final 22 rainwater harvesting systems, the planned implementation phase of the Guachtuq Rainwater Harvesting Project was completed. Over the course of the trip, the team discovered the possibility for minor system improvements that may be developed and introduced to the community in the future.

With the May 2015 Implementation Trip complete, EWB-USA WPI plans to submit a *530 Pre-Monitoring and Evaluation Form* in preparation for a Monitoring and Evaluation trip in May 2016.

## 2.0 Program Background

EWB-USA WPI completed two assessment trips in 2010 and 2011, when the team started to form a relationship with the community members of Guachtuq. The team conducted in-house assessments, held community meetings, and undertook water quality studies. In 2011, the team conducted a community wide survey to determine a water consumption rate for each family. Unfortunately, no trends emerged that related the number of family members to water consumption across the community, so the team has followed WHO standards to determine the amount of water a rainwater harvesting system needs to provide. The team also thoroughly assessed the two homes chosen by the community for pilot implementation. This included measurements of each home as well as in-depth discussions of the needs of each family.

Throughout the project, one of the most important tools that the team has developed is an Excel model that uses a variety of parameters, and helps the team design systems to fit the specific needs of each family. Considering average regional daily rainfall (obtained from a local university), roof area of a home, number of family members, and water consumption rate, this model can be used to determine how many additional tanks each family needs to ensure sufficient water for drinking and cooking throughout the dry season.

Using information gathered from the first two assessment trips, Excel model results, and nearly two years of research and design, the team constructed two pilot systems during the first implementation trip in January 2013. The goal of the pilot project was to ensure that the Excel model worked properly and to provide a basis for future system design. Other benefits of a small-scale implementation included developing methods for construction and beginning to establish a knowledge base about constructing rainwater harvesting systems within the community. In order to accurately determine if these pilot systems served the families appropriately, a monitoring system was also established during this implementation trip. A volunteer at CeCEP visited the community while the team was out of the country, collected preliminary information on the efficacy of the rainwater harvesting systems, and received verbal feedback on system quality from both families.

The team completed a third assessment trip in May 2013. The goal of this trip was to evaluate the success of the pilot systems and assess homes for the second implementation. In addition, a thorough census was conducted to gather demographic information about every family and to learn general information about the community. Water quality tests were also collected at various water sources throughout the community. The monitoring system established during the January 2013 Implementation Trip evolved into a bi-weekly survey that asked residents about their water consumption habits. Follow-ups were held with the two pilot families to ensure that the systems functioned properly and, most importantly, satisfied each family's daily needs for drinking and cooking.

The second implementation trip, EWB-USA WPI's fifth trip to Guachtuq, took place in January, 2014. Though not an official EWB trip since it was funded by a grant through the EPA P3 program, this trip was essential to the progress of the project. The team constructed two rainwater harvesting systems, conducted water quality tests, held in-depth, semi-structured interviews, established a connection with the mayor of the Municipality of San Cristobal, developed stronger relationships with CeCEP and community members, and further assessed the eight homes scheduled to receive systems during the May 2014 Implementation Trip.

Necessary details were also discussed with local hardware stores, water tank vendors, and the municipality to arrange availability of materials and plan for transportation.

EWB-USA WPI's sixth trip to Guachtuq, the third implementation trip, took place in May 2014. In under ten days, the team and community members built eight rainwater harvesting systems, updated systems of previous beneficiaries, conducted two rounds of water quality testing, interviewed almost every family in the community, met with the mayor of the municipality, held multiple community meetings, strengthened relationships with local NGO partner CeCEP, and assessed the homes of the remaining families.

In January 2015, the club had an additional assessment trip in order to prepare the community for the upcoming 22-home implementation in May 2015. The travel team confirmed the home designs with each family and verified the bill of materials. The team reviewed MOUs with each family to confirm agreements about the planned systems and pre-implementation preparations families needed to make. The team worked with CeCEP to identify and compare quotes from materials suppliers for the final 22 systems. They then worked to arrange materials transportation in the form of trucks donated by the Municipality of San Cristóbal, with additional transportation paid for through the selected vendors. The team tested water quality of the finca, EWB-USA WPI systems, and non-EWB-USA WPI tanks, following the precedent of monitoring and evaluation protocol from past trips. Finally, the team held learning sessions with the community children to spread knowledge of rainwater harvesting system function and maintenance to all community members. Throughout the trip, the team built trust with the community, to enable success in the May 2015 Implementation.

In May 2015, EWB-USA WPI returned for the eighth time—the last planned Implementation Trip for the Guachtuq Rainwater Harvesting Project. Over two weeks, the travelers worked with the community members and CeCEP to complete construction of the 22 final systems. They conducted a variety of water quality tests at all previously implemented EWB-USA WPI systems and many pre-existing systems from other past projects. The team held interviews with all families that received a system during this implementation trip to collect baseline data about water usage and habits. Further interviews were held with past beneficiaries to evaluate impacts and monitor system function. All systems were completed by teams of community members working alongside an EWB-USA WPI member and a translator from CeCEP.

The next step for EWB-USA WPI is to prepare for the planned May 2016 Monitoring and Evaluation Trip, where the team will ensure that all systems are providing improved water security and that families have the knowledge to maintain and repair systems as needed.

### **3.0 Trip Description**

On the May 2015 Implementation Trip, the EWB-USA WPI travel team completed construction of all 22 planned, individualized rainwater harvesting systems. The team also continued monitoring and evaluation of the 12 systems built on past implementation trips and held interviews with nearly all families in the community. With this trip, EWB-USA WPI completed the planned Implementation Phase for the Guachtuq, Guatemala Rainwater Harvesting project.

In collaboration with the community members of Guachtuq and El Centro Comunitario Educativo Pokomchi (CeCEP), the team built all 22 systems within the 17-day trip. The team originally

planned five construction “phases”, outlined in the 525: *Pre-Implementation Form*:

- **Phase I: Preliminary Data and Preparations,**
- **Phase II: Concrete Base Construction,**
- **Phase III: Materials Transport for System,**
- **Phase IV: System Construction and Education,**
- **Phase V: Wrap-up.**

While the phased plan was not able to be followed as planned, it remained the framework for the process that the travelers used when working through the trip. **Phase I** was completed as planned within the first few days. After this point, EWB-USA WPI faced a number of unexpected setbacks, but persevered by working closely and strategically with the community. Delayed deliveries of essential tools and materials from the team’s primary supplier, Construfacil, hindered progress. However, as planned, EWB-USA WPI, CeCEP, and the community members formed five construction groups who were able to use tools from past implementations and the available materials to begin **Phase II** on time, despite being at a reduced rate. Once the proper tools arrived, all concrete bases were completed in one day, putting the team ahead of the initial itinerary. **Phase III** was then unexpectedly fragmented as materials were delivered over the course of the next week. Consequently, some construction groups had to begin building without the proper gutters, tubing, and connectors (the position of downspouts defines size and placement of pipes and connectors needed for the path to tank). With the help of community members, groups were reorganized to optimize the amount of work that could be completed with the materials and tools available each day. The community members worked tirelessly and patiently through these delays without reservation. Through teamwork and flexibility, the pipes that connect gutters to tanks were arranged and assembled for all the systems within two and a half days (**Phase IV**). The remaining connections and tubing were then completed on an individual basis as the materials were delivered. This led to the general systems at each home being completed a full day ahead of schedule, with final pieces and tank patches being completed on the final Friday and Saturday of the trip. **Phase V** was then completed as planned, involving a community-wide learning session at the end of the trip.

The team continued monitoring systems from past implementations and gathered additional baseline data at the 22 homes to be able to measure project impacts on the next monitoring trip. Existing EWB-USA WPI systems were tested for *E. coli* and *coliform* bacteria. Different parts of the systems were tested to identify possible sources of contamination. Additional water quality tests were conducted at existing systems (from past projects), the *finca* (which was also tested for inorganic contaminants), and a seasonal waterhole located behind the community building. This baseline data will enable the team to identify changes in water quality for the beneficiary families. The results are located in Appendix B – Water Quality Data and Appendix C – Inorganic Water Quality Data. Analysis of and conclusions drawn from these data are reported in Section 8.5 Additional Information.

The team held semi-structured interviews with each of the 22 May 2015 beneficiary families to learn about the current state of water access in the community, the family’s water-use habits, and the time spent retrieving water from the *finca*. Information from these interviews (baseline data) will be compared with information gathered on the planned May 2016 Monitoring and Evaluation Trip. The interview instrument and results from these interviews can be found in Appendix D – Interview Questions and Appendix E – Interview Results respectively.

## 4.0 Project Summary

### 4.1 Project Description

The Engineers Without Borders-USA chapter at Worcester Polytechnic Institute (EWB-USA WPI) aims to provide the community of Guachtuq, Guatemala with water security. The community of Guachtuq is located in the Alta Verapaz region of Guatemala and is home to about 220 Pokomchi people (of Mayan descent), among 34 families. Of the many challenges they face daily, water poverty—lack of water security—was identified as their greatest concern. Water security can be described as having adequate quantity, quality, and access to water to meet basic human needs. Currently, many families obtain the majority of their water from a polluted, spring-fed water basin, locally known as the *finca*. The *finca* is located a half-hour walk downhill from most families in the community and is sometimes enshrouded by socio-political tensions regarding water rights. During the dry season, which lasts from February to May, the *finca* often dries up, forcing families to obtain water from other, more distant, and sometimes costly sources of water.

While the value of a rainwater harvesting system is often locally perceived as the size or number of storage tanks, this project optimizes and individualizes each system to provide families with sufficient, good-quality water through the rainy and dry seasons. EWB-USA WPI has worked with the community members to develop and implement individual rainwater harvesting systems at each home in the community. In the Guachtuq Rainwater Harvesting project, systems are designed to collect rain that falls on the roof of a family's home and store the water in 2500 L HDPE tanks, providing water for cooking and drinking needs year round. With a specially designed first flush, which prevents contamination from the roof, a filter, and maintenance guidelines provided to each family, EWB-USA WPI rainwater harvesting systems are designed to maintain water quality and maximize rainwater collection. The systems aim to improve all three dimensions of water security: quantity, quality, and access. Water quality testing and interviews will be used to measure impacts as the project enters the Monitoring and Evaluation phase.

### 4.2 Summary

The Systems were designed and built specifically for each family, using the general system shown in Figure 1. (Home-specific designs used are explained in Section 4.4 Drawings). To complete the construction of the 22 systems, community members were divided into five groups, each led by at least one EWB-USA WPI traveler and a translator from CeCEP. These groups were able to finish the construction of all systems a full day earlier than expected in the original itinerary. While each system was home specific, the same components existed in all of them. These main components included a concrete base, gutters, a first flush, PVC tubing, an overflow, and storage tanks as described in the *525 Pre-Implementation Form*. Materials for all components of the systems were bought from local suppliers so that replacement parts would be accessible to the community in the future.

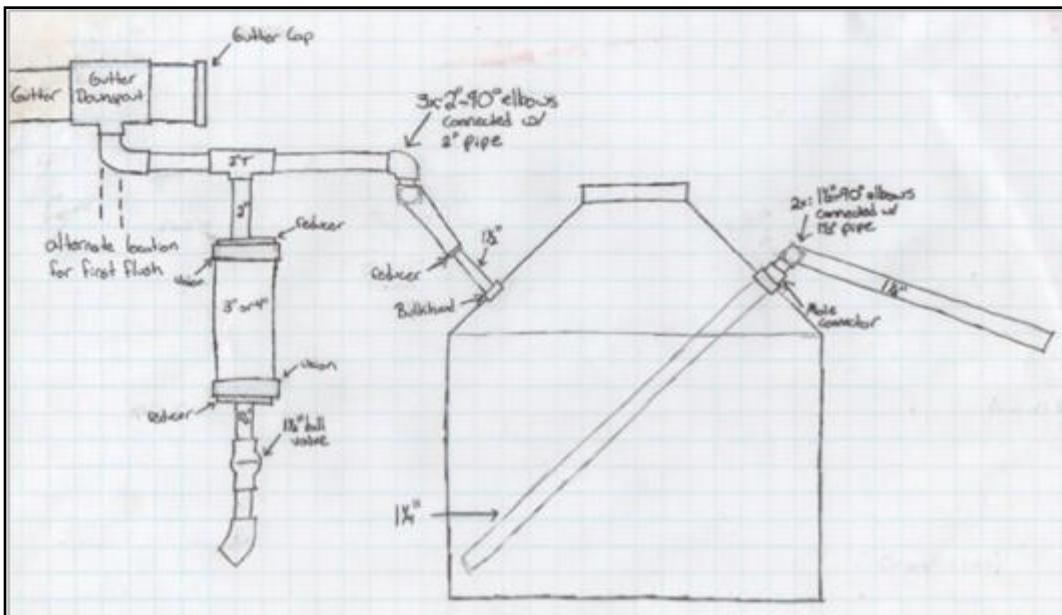


Figure 1: General schematic of an EWB-USA WPI Rainwater Harvesting System.

The concrete bases provide stable support for the 2500 L HDPE water-storage tanks. First, a wooden frame was constructed as a mold for the base. The size was determined by the number of tanks needed in the individual system. The space underneath the wooden frame was covered in crushed stone in order to provide level ground and help prevent erosion. Then, by layering larger rocks as aggregate and rebar for support within the wooden frame, the base was completed by pouring in ready-mix concrete. Once the base had dried, cinder blocks were placed on top for added height and the storage tanks were placed on top. The added height is necessary in order to enable the community members to be able to place buckets under the spigot.

The next step was for gutters to be hung on the homes. Wooden gutter clips were attached to each home to ensure that the gutter would sit directly underneath the edge of the roof. Gutter clips were hand-crafted from 1 x 6 wooden boards, cut and hung specifically for each home. The team cut a notch at the end of each board to secure the gutter in place and then nailed the boards to wooden rafters, studs, or other available supports. At some houses, existing metal clips were used after it was determined that they were the most secure option available at that home. A string and level were used to ensure that gutters were hung with a slight slope towards the tanks. Gutter caps, unions, and downspouts were used in each individual system as required.

After rain falls from the roof and is caught in the gutters, it flows through the downspout and into the first flush, a mechanism that collects the first volume of water that comes off the roof, containing most roof contamination. The amount of water collected is determined from calculations in the team's Excel model, which are based on the roof area directly feeding the first flush. This first volume of water effectively washes the roof clean and reduces roof-sourced contamination in the drinking water collected in the storage tanks. The first flush was comprised primarily of a large piece of 3" or 4" PVC pipe, the length of which is directly correlated to the volume of water needed to be collected from the roof. An empty water bottle was placed inside the first flush; it floats to the top as the first flush fills and creates a seal to prevent the dirty

water from mixing with the cleaner water that flows over the top of the bottle into the storage tanks. Every first flush has a ball valve at the bottom so that the water can be captured after every storm and used for non-consumption needs. The first flush was vertically supported by a stick or cinder block as desired by the family.

PVC tubing and connectors varied for each home since designs were individualized based on each family's needs. The necessary PVC tubes and connectors for each home were estimated during the Assessment Trip in January 2015. The team used large burlap sacks to sort and distribute the connectors and small parts for each home. Tubes were distributed at each house upon delivery. During construction, the sacks make it easy to redistribute parts as needed and keep track of any excess connectors.

The storage tanks used were 2500L, high density polyethylene (HDPE) Rotoplas tanks, the same type used in previous implementations. For families that already owned 2500L Rotoplas tanks, 1700L Rotoplas tanks, or 5000 L concrete tanks from previous projects, these existing tanks were incorporated into the EWB-USA WPI systems. This existing storage capacity was considered when designing systems and was a factor in calculating the number of additional tanks needed to supply sufficient quantity of water for drinking and cooking year round. If homes were deemed to have adequate storage already, then no additional tanks were added with the implementation of their system.

Each system contained at least one overflow, a mechanism designed to divert excess water once the tanks are full. The overflow ideally removes the dirtiest, oldest water in the system first, keeping the cleanest water for consumption. The overflow is comprised of two pipes, one inside the tank and one outside, connected through the side of the tank by a Rotoplas bulkhead adaptor. The inner pipe reaches to the bottom of the tank so that when the tank overflows, the water from the bottom is removed first. The pipe on the outside diverts the excess water away from the tank, preventing erosion around the base and allowing a family to capture the discarded water. Finally, a small hole is drilled in the elbow on the outside of the tank in order to prevent the overflow from becoming a siphon.

To create a "closed system" and prevent contamination from insects and debris, mosquito netting was used to cover all gutter downspouts and overflows. Teflon tape was used to seal all threaded connections, especially at the tank interfaces. The majority of PVC flush interfaces were sealed with PVC glue. Some were left unglued so the system can be cleaned.

Thanks to cooperation, patience, and teamwork between the community members of Guachtuq, CeCEP, and EWB-USA WPI, the construction groups were able to effectively finish the construction of all the systems a full day earlier than planned in the original itinerary. Friday and Saturday of the second week were able to be used to distribute any materials delivered late, and to patch holes in existing tanks that were incorporated into the EWB-USA WPI systems. Drawings that illustrate the proper construction method for each part of the system can be found in Appendix F – Construction Diagrams.

### **4.3 Difference Between Planned and Actual Implementation**

There were many aspects of the implementation trip that did not go exactly as planned. However, the team and the community worked through the changes efficiently finishing the implementation earlier than expected.

#### **4.3.1 Logistical Complications**

The main logistical issue was delayed deliveries of tools and materials from the primary supplier, Construfacil. First, Construfacil failed to deliver tools needed for the construction of concrete bases on time. At the beginning, the team was able to make progress by using existing resources from past trips and community members' personal tools. The second, larger delivery of PVC materials and gutters was also significantly late. Originally scheduled to arrive on Saturday, May 16<sup>th</sup>, the materials arrived incrementally through midday on Tuesday the 19<sup>th</sup>. Consequently, the majority of the system construction and assembly was delayed until Tuesday afternoon, nearly two days later than anticipated. This delay also caused the team to be short one student and translator for multiple days as they went to resolve the issues in person.

Due to the material delivery delays, some construction teams began working earlier than others since there was only sufficient materials to start a few systems. As a result, community involvement became somewhat disorganized. Communication was crucial. Sometimes, community members heard conflicting information from different team members, as meeting times and locations changed daily. Groups were sometimes rearranged, adding to the confusion and difficulty of keeping community members focused on the construction. Despite these challenges, the travelers, community members, and translators were flexible. They adapted and worked day by day, instead of just by the previously planned Phases, succeeding despite the unpredictable situations.

Independent of these complications, EWB-USA WPI members were repeatedly approached by community members who reported that some houses were not represented on the construction teams. The travelers advised the community members to remind their neighbors that participation in construction was required in order to receive a system, as stated in the MOU. While the travelers did have a list of representatives from each home, without personally knowing each of the 34 representatives or having a means of enforcement, it was difficult for the team to offer any other solution.

#### **4.3.2 Design Alterations:**

There were multiple systems that were not implemented exactly as originally planned by the club. Six of the twenty-two systems were altered more significantly and these changes are described below. Due to circumstances such as home rebuilding and family requests, the team worked to adapt designs to best fit each family. These changes are illustrated for each home in Section 4.4 in detail.

- The family of House 2 elected not to use the roof over the kitchen, as the original plan stated, because of soot from their open-fire cookstove, which collects on the roof and contaminates the rainwater. The orientation of the tanks was also changed at the request of the family, which can be seen more clearly in **Error! Reference source not**

**found..** Both sides of the main roof were connected to feed into the same tank, and the system overflowed into an existing concrete tank that had not been originally included as part of the EWB system due to changes in ownership of the tank.

- The system for House 3 did not use the roof above the kitchen as was originally included in the design. After the team carefully analyzed the new system with a smaller roof area, it was determined that the family would still have sufficient water, therefore the team excluded this roof from the family's system as requested.
- The family of House 6 expanded the size of their roof before the team arrived in country. As this change would only give the family more water and not limit their access to water, the designs were changed slightly to include more gutters.
- The system for House 10 was altered because the family changed the configuration of their roof panels. They still received the same number of tanks, as the overall roof area was similar to before; however, the piping and route to tanks changed.
- The family of House 25 elected to not receive an overflow for their system. They would not accept a system with an overflow and wished instead to use their first flush as an overflow if necessary. After a discussion with multiple mentors on the feasibility of this changed design, it was determined that this was an acceptable change that would not harm the integrity or functionality of the system when coupled with proper education.
- The system for House 40 was designed to have all the gutters combined and feed into the first set of two tanks, these tanks would then overflow into a lower set of two more tanks. However, due to an unexpected inequality in gutter elevation, the plans changed. The smaller roof fed directly into the lower two tanks and the larger, higher roof feed into the upper tanks. The upper tanks still overflowed into the lower ones, maintaining one closed system.

#### 4.4 Drawings

Technical drawings were created to plan the system at each home. These drawings illustrate how the general form of the system is adapted to each individual home to best meet the needs of each family. These drawings were then edited to reflect any changes made during the Implementation. In the drawings, red circles represent a first flush, blue lines represent PVC piping, blue rectangles represent gutters, and the black arrows represent the slope of the roof. During construction, each system was tested with water to ensure all gutters and pipes maintained enough slope to prevent any stagnation in the system. This flow is illustrated by black arrows over the piping. These schemata were used during implementation to ensure that systems built according to plan and to explain the plans to the construction teams. The technical drawing for House 2 is included here. Technical drawings for the other twenty-one systems are provided in Appendix G – System Drawings.

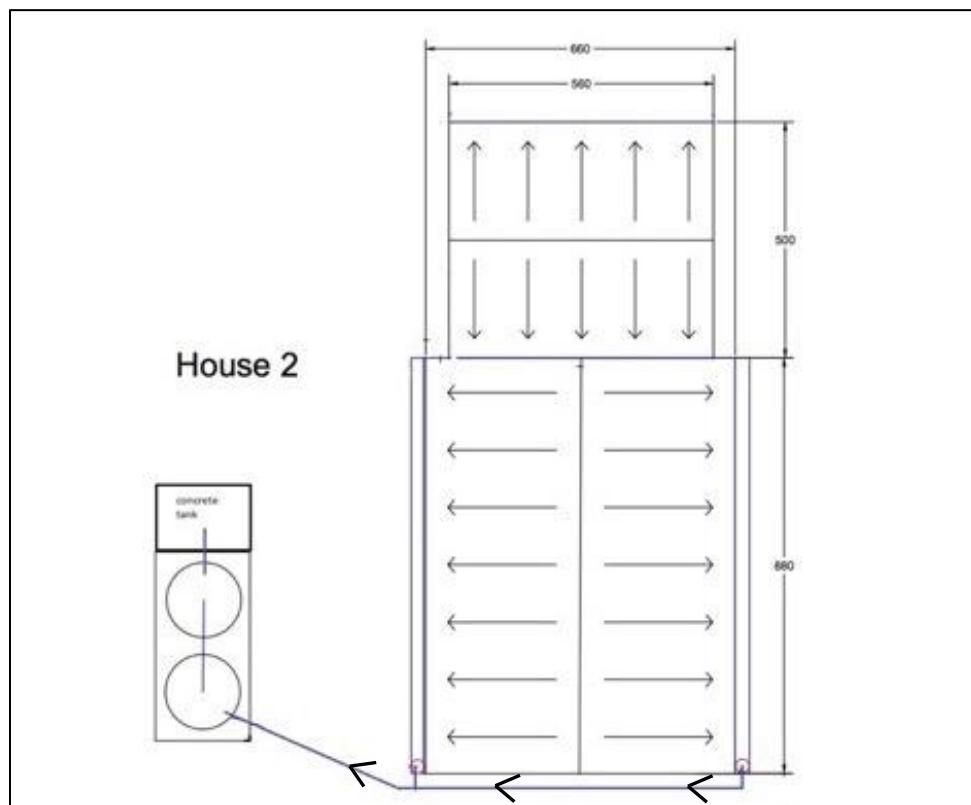


Figure 2: This the modified home design for House 2.

#### 4.5 Operation and Maintenance

Each family is responsible for the continued operation and maintenance of their systems. As stated in the MOU signed by the head of every family receiving a system, the family is responsible for maintaining the system, purchasing replacement parts, and making repairs as needed. A representative from the home was usually present during construction of their system and assisted with construction of their neighbors' systems as well. Actively participating in

construction ensured that there was at least one family member who was knowledgeable about the system and would be able to maintain it independent of EWB-USA WPI.

Members of each family also participated in individualized learning sessions about their system after construction was completed. An EWB-USA WPI member and translator spent sufficient time at each home carefully explaining the use and maintenance of the system. Learning sessions taught best practices for using, cleaning, and repairing the first flush, gutters, tubing, storage tanks, and mosquito netting. Many community members are familiar with working with PVC and concrete, the main material components of the system, and will compound with these sessions to help them be able to efficiently repair and properly maintain the systems.

The team also emphasized the importance of water conservation and “separation of containers” to prevent cross-contamination between water sources. Because of the learning sessions, families who were unrepresented during construction were still knowledgeable about their specific system. In addition, women and children who may not have been part of construction also had the opportunity to learn. All families were given an education booklet, presented in Appendix H – Education Booklets, which depicts reminders about best practices. As a result of the learning sessions, EWB-USA WPI hopes that more community members will become experts on rainwater harvesting systems and help each other as problems arise.

To enable each family to pay for their system, payment plans have been arranged through CeCEP. The community members know that they are required to pay 5% of the total cost of the system. The specific amount that is owed by each family can be found in the MOU's shown in Appendix A – Final Implementation Agreements (MOUs). EWB-USA WPI and CeCEP both have the payment records for everyone who has begun paying from previous implementations, which can be seen in Appendix I – Completed Community Payments.

#### **4.6 Sustainability**

Prior trips have shown that the community has the organizational, financial, and technical skills to ensure the longevity and sustainability of the rainwater harvesting systems. The May 2015 Implementation Trip confirmed those observations, and a summary is provided here. Upon critical analysis of the community through the Planning, Monitoring, Evaluation, and Learning framework, EWB-USA WPI has also identified possible future concerns.

Organizationally, the COCODE, the local community government, has not played a role in the project. Issues with corruption and community distrust made the group unable to participate in the leadership of the project. Instead, the project has received governmental support from the Municipality of San Cristobal Verapaz through donations of invaluable time, energy, and resources to transport water and materials to Guachtuq. The Mayor of San Cristobal was present at the final community meeting and presented EWB-USA WPI with a locally-made, traditional banner in order to thank the team for their work over the years. Though municipal support may not continue after the completion of the construction due to the variable political climate in Guatemala, their involvement to this point has attributed credibility and authority to the Guachtuq Rainwater Harvesting Project and the EWB-USA WPI team.

Organizationally, the Water Committee of Guachtuq is the body that will have the most impact on the sustainability of the project. The Water Committee formed independently of EWB-USA WPI in 2013. In the past, the Water Committee has helped EWB-USA WPI design systems and

has facilitated project planning. The Water Committee has also repeatedly defaulted to EWB-USA WPI to make decisions about sensitive topics, including the order in which families received systems and setting the final scope of the project. However, the Water Committee has been involved with each step of the process, and the members include representatives who received systems early in the project, leading to greater knowledge of the system construction and maintenance. While EWB-USA WPI is not in-country, Roberto Chocoj (House 26), the Vice President of the Water Committee, has provided local expertise when families have questions about system maintenance and repairs.

Financially, families have been making payments on systems implemented in the past, indicating that they will likely also be able to afford to make small repairs as needed. On the May 2015 Implementation Trip, many men took nearly two weeks off of work, demonstrating the importance of the system in their life and that, financially, the systems are worth several days' pay for them and their family. In addition, at the end of the trip, EWB-USA WPI decided to sell all tools purchased for the implementation. Tools are being sold at CeCEP for 70% of their original cost. The funds generated from these sales will be put towards the planned May 2016 Monitoring and Evaluation trip. A large number of community members expressed interest in purchasing the tools, and hopefully will be able to use them for needed repairs and maintenance. The community was given a 2-week window to purchase the tools before the sale was opened up to the San Cristobal community.

On the technical side, EWB-USA WPI took careful steps to ensure that community members had the technical knowledge needed to build the rainwater harvesting systems. Before construction of concrete bases began, the EWB-USA WPI team conducted a group demonstration at House 34, the house of Maria Magdalena. Travelers and experienced community members worked through the entire process of building a concrete base, thoroughly explaining each step to the rest of the community members. Afterwards, the construction teams dispersed and, in spite of a delay in the delivery of tools, correctly finish every base a day early. This was a clear exhibit of the community members' skill and attention to the design. Likewise, before the gutters were raised, the team held a separate demonstration at House 19. To demonstrate the proper assembly of gutter-to-tank, tank-to-tank, and tank to faucet piping, the team held a third training, using the completed system at House 27 as a visual aid. The EWB-USA WPI team was impressed to see that, during the demonstrations, community members relied on the explanations of their neighbors in addition to the explanation of the EWB-USA WPI representative. This indicated that a deeper understanding already existed in the community. As a confirmation that, without a doubt, the community members were capable and understood what they were doing, gutters, tubing and connections were completed in two and a half days—twice as fast as expected.

After the completion of each new system, EWB-USA WPI members performed a learning session on water quality management, system maintenance, and system design at each house with as many members of the family present as possible. During the learning sessions, the travelers used an education booklet designed to intuitively convey guidelines for best practices and proper maintenance, shown in Appendix H – Education Booklet. In some learning sessions, family members, most often children, acted as translators, which reinforced their own understanding about the functionality and maintenance of the system. During the final community meeting, these maintenance practices were explained once more in front of the entire community as reinforcement. These sessions allowed for more widespread and consistent knowledge on the sustainable use and maintenance of the systems.

EWB-USA WPI has ample reason to believe that the community of Guachtuq is well-equipped to make this project sustainable. However, the team has also identified three technical concerns that require attention: protocol for care of the filters, accessibility of replacement parts, and separation of tanks for maintenance.

#### **4.6.1      Filters**

This trip revealed three issues with the sediment filters attached to the spigots on the Rotoplas tanks. First, to clean the filters, most families scrub them with rags or a brush; it became apparent that scrubbing the delicate filters tears their filaments, ruining the filter and leading to decreased water quality. Roberto Chocoj (House 26), the owner of one of the January 2013 pilot systems, has been able to preserve his filter by soaking it in chlorine and removing dirt with his fingers instead of scrubbing it harshly. Most families reported filters lasting between three and six months, but Roberto's is still working after four years. Families were encouraged to follow Roberto's method and soak the filters instead of scrub them. The team hopes this will allow for increased longevity of the filter, reducing the cost of system maintenance, and less likely to jeopardize water quality.

It was additionally found that, while many community members were willing to purchase new filters when needed, they did not know how to order them through Rotoplas. The team will be working with CeCEP in the coming year to set up a program where the filters are more easily accessible as is discussed in Section 9.0 Next Phase of the Program.

The third concern regarding the filters is that if they are not cleaned regularly, they may harbor bacteria and actually contaminate the water as it exits the tanks. The team did not bring enough water quality tests to draw conclusions about whether the filters are contaminating tank water, but data indicated that some tanks had higher counts of bacteria than expected. On the anticipated May 2016 Monitoring and Evaluation Trip, this will be a poignant area of study to ensure that filters are improving—not degrading—water quality.

#### **4.6.2      Repair/Replacement Parts**

All of the parts to build the system were purchased locally, making it feasible for community members to obtain replacements as needed. However, the true sustainability relies on every member of the family knowing they can obtain the pieces that easily. In the case of House 5, the house of Filomena Gualim, she was not fully aware of the process for getting these parts or installing them. In order to enable a separation of two EWB-USA WPI tanks, she cut the connecting pipe, and then attempted to reseal it with packing tape. The way the system was cut, the elbow and associated male threaded adaptor needed replacing. It was discovered that while Filomena was willing to buy a new elbow and adaptor at their full price, she was not aware how to repair it herself. As a result, how to acquire and attach replacement parts in each section of the system was addressed during the demonstration completed with the construction teams before the PVC tubing was installed. The reparation of essential components is imperative to the system's sustainability without the constant monitoring of EWB-USA WPI. This was also addressed by insuring that members of the family were present for the technical education so that the man assisting with construction was not the only family member with complete knowledge of the construction of the system.

#### **4.6.3 Separation of Tanks**

Through interviews with past beneficiaries, an unforeseen and recurring problem emerged: families are unable to separate their tanks to clean them one at a time. While the system was originally designed this way to ensure that the community members were cleaning the entire system, it was discovered that this was often not feasible for the families to do. Most often, the tanks were connected together at the bottom to ensure that water is used from both tanks at the same rate. However, in order to clean one tank, all the tanks must be emptied and, for some systems (like Filomena's mentioned above in Section 4.6.2) this involves losing all of the storage capacity they own.

Unless families have other vessels to temporarily hold water, they must discard all their water in order to clean tanks. The EWB-USA WPI excel model, used to design the systems, estimates the amount of water that should be in the tanks each day based on daily rainfall data, roof area, water consumption rate, and number of family members. However, the model does not account for times the tanks will be voluntarily emptied for maintenance. With no mechanism to store at least some of the water, some families are left completely without water until it rains again. It is equally possible that a family could harbor contaminants in the tanks because they are unwilling to empty and clean the system when water levels are low. While the community members currently clean the tanks at the same time, conserving as much water as they can, the system design would benefit greatly from the added flexibility and the families would not have to lose water security in order to properly maintain their system.

The team will spend the next year thoroughly analyzing possible designs using information and knowledge of locally available parts, then will consult mentors and EWB-USA to determine what will best fit the families needs. This solution could then be introduced to the community on the planned May 2016 Monitoring Trip.

## 5.0 Photo Documentation

*Figure 3: Water Quality Testing*



EWB-USA WPI students process the first round of water quality tests to identify bacterial contamination from *E. coli* and coliform bacteria.

*Figure 4: Concrete Base Demonstration.*



The first demonstration completed with the construction teams explaining the process of constructing the concrete base.

*Figure 5: Sorting Existing Materials.*



Leftover materials from past implementations were sorted for use on the May 2015 Trip.

*Figure 6: Construction team building a concrete base.*



Shown are an EWB-USA WPI member, CeCEP and community members working together in a construction team to complete the construction of a concrete base.

*Figure 7: Gutter clip demonstration*



Community members taught each other after a brief explanation by an EWB-USA WPI member.

*Figure 8: Delivery of concrete bags.*



Concrete bags were delivered from the nearby city of Coban and transferred to another truck to be transported up to the community.

*Figure 9: Delivery of Rotoplas Tanks.*



Two trucks drove up the community in order to deliver the 26 tanks needed for the implementation.

05/10/2015 12:17

*Figure 10: Piping and PVC demonstration.*



The community gathered in front of a completed system at House 27 to go over the process for constructing the path to tank for each system.

*Figure 11: Completed System.*



A family with their completed system at House 17, the house of Edgar Efrain Yuja Cal and Catarina Macz Calel.

*Figure 12: The community of Guachtuq.*



The community gathered for a picture after the final community meeting. The mayor of the local municipality, San Cristobal, was also present with his wife.

## 6.0 Lessons Learned

### ***Implementation Strategy: Always be flexible and ready to change plans if necessary***

Even though the team spent hours making a schedule that would allow the trip to run effortlessly, circumstances changed the itinerary. Team members were missing to deal with unexpected issues, materials were late, and various other logistical changes occurred. However, the team was flexible and willing to change plans when necessary, allowing the trip to continue to move forward. Plans rarely go exactly as a team hopes and therefore it is important to remain flexible and to continue working towards reaching the original goals even when the schedule changes.

### ***Transportation: Have access to a vehicle to reduce travel time to and from the community when necessary***

Due to the amount of systems constructed, the team had very little free time. The access to a vehicle, provided by a member of CeCEP, was vital many days to starting on time in the community and transporting heavy tools and equipment from the local construction stores. Some days the extra half an hour saved walking each way to the community was significant to finishing all of the plans for the day.

***Troubleshooting: Sometimes there is no alternative but to go meet in person***

Through multiple materials delays, the team found that often meeting in person to resolve any issues was the most efficient use of a team member or two. With the language barrier and different work culture, it was sometimes difficult to get the proper urgency communicated over the phone. Although this may seem time consuming, as a member is lost working in the community, it keeps the project moving forward.

***Implementation Strategy: Have a way to track your workforce***

As community participation was vital to this project, it was imperative that the team had the community involvement that was expected each day. However, keeping track of each representative involved in construction was more difficult than expected. There were also cases of community members who live in one home working as the volunteer of a different home, making it challenging to track which home each person was representing. Therefore there was no effective way prepared to track when and if people were working from each home. This was not a problem for this implementation as the team had enough community involvement to finish the systems, however in future implementations this is an important lesson to keep in mind.

***Outside Funding: Know monetary laws in the country/Organizational financial policies***

Different countries handle money and receipts differently. If you are dealing with money that is not in your own bank account, make sure to know all the laws about accessing it ahead of time. This was not properly researched for the trip and therefore the team spent more time than was planned for trying to get the proper receipts to access the Rotary grant money. The team was able to access all of the money needed in order to fund the construction of the systems in the community.

## 7.0 Project Status

Project Type	Implementation Continues	Monitoring & Evaluation	Complete
Rainwater Harvesting		X	

## 8.0 Completed Project Monitoring

### 8.1 Completed Project Status Table

Project Type	Project Discipline	Date of Completion (mm/dd/yy)	Functionality (enter one range per project)			Periodic Maintenance (yes or no)	Demonstration of Community Capacity (yes or no)
			0-50 %	50-75 %	75-100 %		
Water Supply	Water Supply	05/25/15	75-100%			Yes	Yes

### 8.2 Project Functionality Indicators

Project Type	Project Functionality Indicator	Monitoring Result
Water Supply	Number (or percentage) of community members satisfied with the project	Of the community members who have received an EWB-USA WPI system, the majority are very satisfied with their system's functionality. Some complaints were raised about the ability to clean the tanks separately. In a multiple tank system with a bottom connection, there is no way to detach the tanks to clean them separately. This means that when families want to clean their tanks they are losing all of their water. There was continued negative feedback regarding the Rotoplas filters that come with the tanks. Many were torn and dirty. The majority of families however were satisfied with the systems, especially the improved water storage.
	Quantity of water available to each household during dry and wet seasons	Interviews with families who had received systems in previous implementations reported that the majority of the time they did not need to use any water source besides the EWB-USA WPI systems for drinking or cooking. During the rainy season, families used the system's water for all purposes including laundry, bathing and cleaning corn as well.
	Quality of the water at the water point	Water quality tests were done on previously implemented EWB-USA WPI systems as part of ongoing monitoring. Some concerns were raised about the impact of the filters on the cleanliness of the water. It was found that most families were properly cleaning and maintaining tanks, gutters, and the first flushes, which were improving the ultimate quality of the water in the tanks.

### 8.3 Periodic Maintenance Indicators

Project Type	Periodic Maintenance Indicator	Monitoring Result
Water Supply	Level of cleanliness of gutters feeding a rainwater harvesting system	During a visual inspection at each of the homes, it was found that the gutters were generally clean and free of debris. The degree of cleanliness varied by home but all appeared to have been cleaned at least once since implementation. Some families informed the team that they clean the gutters when they clean the first flush and tanks.
	Level of cleanliness of water storage tanks	Through interviews, the team learned that tanks implemented on May 2014 have been cleaned at least once since the implementation. Some tanks had small amounts of debris/dirt gathering at the base of the tank. Other tanks appeared to be recently cleaned.
	Observed evidence of routine maintenance on the system done accurately without EWB-USA WPI	Families informed travelers that they were routinely cleaning systems, however, some systems appeared cleaner than others. Chlorine could be smelt on some of the filters. This was an indicator of certain families performing proper maintenance. The team also observed a child cleaning a tank with soap and chlorine during the trip. One family had difficulty cleaning the tanks and had to cut the tube connecting them at the bottom to get them apart. All other systems seemed to be maintained accurately.

### 8.4 Demonstration of Community Capacity Indicators

Project Type	Community Capacity Indicator (list indicators identified in the 522 for each project)	Monitoring Result
Water Supply	Community completed major repairs to the system accurately without EWB-USA WPI	House 31 had a leak at the second waterfall connection. The family couldn't fix it so they went to Roberto to ask for help. He was able to properly glue it.
	Chapter observed community members training others	Many men who had already implemented systems were involved in the construction of the new systems. These men were very active and vocal during the construction process and were able to teach the other men working on construction.
	Existence of broken components	At House 5 the family was unable to detach the system at the bottom to turn the tanks to clean inside. They cut the PVC close to a fitting and then were unable to glue it back together.

### 8.5 Additional Information

### 8.5.1 Water Quality Testing Results

Water Quality tests were completed in duplicate at all of the previously implemented systems and at multiple other systems that were pre-existing in the community. Unlike in previous trips where the tests were completed in triplicate, the team chose to complete them only in duplicate upon being advised to do so by a professional mentor. Detailed methodology for the tests completed can be seen in the following Section 8.5.2 as well as in the *525 – Pre-Implementation Report*. The tests that were completed on the May 2015 trip were completed in three rounds, as shown in Appendix B – Water Quality Data. The focus of each round of water quality testing is described below.

1. The first round was completed on existing tanks at homes that would be receiving systems on the May 2015 Implementation Trip so that accurate baseline data was collected before the tanks were integrated into the EWB-USA WPI systems. Each of these tests were carried out in duplicate and the results are shown in **Error! Reference source not found.**. The first round also included tests on existing EWB-USA WPI implemented tanks in triplicate in order to be comparable to the data collected on previous trips. This data is shown in **Error! Reference source not found.**.
2. The second round of tests were completed on the remaining EWB-USA WPI systems as well as the *finca* and a water hole discovered by the team on the previous January 2015 Assessment Trip. This data was collected in duplicate, as the team wished to preserve tests to be able to investigate the possible contamination caused by filters seen from the tests of the EWB-USA WPI system at House 31. This in-depth testing was planned to be completed in a third round of testing.
3. The third round of tests focused mainly on identifying the possibility of dirty Rotoplas filters contaminating the water coming from the systems. This round also included tests on two remaining concrete tanks in the community. These tests were completed in triplicate for increased accuracy due to the lack of data EWB-USA WPI currently has regarding the existing concrete tanks in the community. The remaining tests were completed in duplicate in order to be able to separate as many systems from their filters as possible. More extensive testing to look into this potential issue will be done on the planned May 2016 Monitoring Trip.

The major conclusions that were drawn from the three rounds of testing are listed below:

- *The first flushes were properly separating harmful bacteria out from the drinking water system:* The second round of testing showed two homes (House 9 and House 16) that had blue colonies signifying the presence of *E Coli* in the system's first flush, but not in the tank. These data points led the travelers to believe that the first flush was indeed pulling out potentially harmful contaminants from the system before reaching the drinking water tanks. This conclusion was further supported from other tests completed on existing EWB-USA WPI systems showing higher counts of red colonies, or bacteria in the first flushes than in the associated tanks.

- *Existing concrete tanks showed similar levels of bacteria as the EWB-USA WPI tanks, making them suitable to incorporate into the new systems:* The team took data concerning the cleanliness of existing concrete tanks in the community in order to establish a baseline before they were incorporated into the EWB-USA WPI systems. This is important to note because there were multiple tanks included in systems, but the club had not taken significant data to analyze their cleanliness before.
- *There is a possibility filters that are not cleaned properly have an adverse effect on water quality:* Due to the discovery that some filters were not being cleaned properly, there was concern that filters were becoming dirty enough that they decreased the water quality of the system. Focused water quality tests were completed as can be seen in Appendix B – Water Quality Data. Results indicated that the filters did not appear to be having adverse effects on the water quality of the systems. However, the team did not have enough tests with them to draw any definitive conclusions. Further testing on the planned May 2016 Monitoring Trip will be able to shed more light on the situation. Examples of filters seen on the May 2015 trip are below in Figures 14 and 15.



Figure 13: Intact Filter.



Figure 14: Torn Filter.

- *Proper cleaning and maintenance methods needed to be further emphasized within the community:* On the trip, it was observed that many of the systems were coming back with more bacteria than expected. While the systems still had improved results when compared to the *finca*, this data showed the need for some change. This was the first time the club had seen a significant number of systems after the rainy season, and therefore greater measures to emphasize cleaning the system were taken at the end of the trip. Additional testing on the planned May 2016 Monitoring trip will be able to show more specific trends.

### 8.5.2 Water Quality Methodology

Each test requires a small sample of water. Ten milliliters are added to clear glass Colilert tubes, which are pre-filled with a chemical powder. For the Petrifilms, one milliliter is dropped onto a flat, circular test paper that has a small amount of agar and resembles a Petri dish. Once assembled, both types of tests are incubated on the body for about 22 hours. To make the time more comfortable, the team designed shirts with pockets that are made to accommodate the different dimensions of the two tests.

The Colilert tubes will turn yellow with the presence of bacteria and will fluoresce under a black light with the presence of harmful *E. coli*. If the fluid in Colilert tests remains clear, the water is potable. The Petrifilm tests offer a better sense of how much bacteria is in each water sample. Red and blue colonies, general bacteria and *E. coli* respectively, can be counted per unit area on the flat test surface.

The inorganic test results are immediate. The color of the tabs, after being dipped in water, determines the presence and quantity of the respective contaminant.



Figure 15: EWB-USA WPI traveler preparing petrifilm tests.

### 8.5.3 Monitoring Interviews

Semi-structured interviews were conducted with at least one member of each of the 22 families that received a system on this trip and with many of the families that received EWB-USA WPI systems in the past. The team developed an interview instrument to guide conversations around

the themes of quantity, quality, and access to water, education, and public health. The interviews were used to gain information about social change in the community. Results from these interviews will reveal important information about the current state of water in the community and will provide baseline data for the homes which received systems on this trip. Raw information from these interviews can be seen in Appendix E – Interview Results. Interview information will be used to prepare for the May 2016 Monitoring and Evaluation Trip and to measure the social impact that the systems have on the families of Guachtuq.

## 9.0 Next Phase of the Program

The next phase of the Guachtuq, Guatemala program is to monitor and evaluate the impacts of systems implemented through the Rainwater Harvesting project. Over the next year, Alvaro, the in country community contact, will continue to visit the members of Guachtuq two to three times a month and report any issues to EWB-USA WPI. The team will maintain contact with CeCEP throughout the year.

In May 2016, a travel team plans to return to Guachtuq to conduct a thorough evaluation of program impacts. The team hopes to find that all families have improved water security and improved access to adequate quantity and quality of water to meet drinking and cooking needs year round. The 901 Project Planning and Baseline Study, filed in July, 2014, and the 901B Program Impact Monitoring Report submitted with this document outline the plans for monitoring and evaluation in more detail.

EWB-USA WPI will be working over the course of the next year to explore design options to offer the ability to separate individual tanks in the systems upon numerous request from families in the community. This would allow the families to clean each tank separately, making it easier to maintain their systems. The team will also be working closely with CeCEP in order to increase the availability of the Rotoplas filters to the community. Since Rotoplas is the only vendor what will sell the filters used in the systems, setting up a program to buy them is crucial to the long-term sustainability and success of this project.

The Monitoring and Evaluation trip planned for May 2016, will be led by incoming project lead Evelyn Grainger. The team hopes that the project will conclude with this monitoring trip and that no future implementations will be needed. Due to increasing safety concerns, EWB-USA WPI will also be working with CeCEP and Guachtuq to establish a plan for long-term sustainability and program closeout.

## 10.0 Professional Mentor Assessment

### 10.1 Professional Mentor Name and Role

Rodney Rookey, Responsible Engineer in Charge

### 10.2 Professional Mentor Assessment

This report is being written upon successful completion of rainwater harvesting systems in the community of Guachtuq. All of the goals of the May, 2015 Implementation Trip were achieved. They included procurement of materials,

actual building of each system, water quality tests, training on how to best use the system, and assessment of all prior implementations.

Once in country, it was apparent that there was going to be a delay in the delivery of the material to the project site. The team used their flexibility and critical thinking skills to adjust the work schedule. The water quality tests and the majority of the assessments were completed first. When the materials finally arrived, there was no problem in getting the twenty-two systems built.

The community was split into 4-5 work teams of 4-5 men each, depending on the day. Each team was supported by at least one EWB-USA WPI member and/or mentor. Each team included the homeowners of the systems that were to be built by that team. This assured some quality control. The teams were extremely efficient, diligent, and hard-working.

Again, the NGO, CeCEP, was instrumental in getting the project completed. Their translators and knowledge of the community and the country was invaluable. After having completed the implementation, the team then arranged the training sessions and finished the assessments.

I would consider this project a complete success. I would also add that, this being my first EWB-USA project, I would find it hard to believe that other EWB teams are as professional, critically thinking, and dedicated as the two I have worked with from WPI (January, 2015 and May, 2015). It would be my honor to work with EWB-USA WPI in the future.

### **10.3 Professional Mentor Affirmation**

I was the lead mentor for this trip and I take responsibility for the work presented in this document

## Appendices

### 1.0 Appendix A – Final Implementation Agreements (MOUs)

2

**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchhu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 6,464.00, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

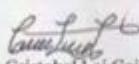
Base	<u>Q 1,649<sup>00</sup></u>
Rebalse	<u>Q 68<sup>00</sup></u>
Primera lluvia	<u>Q 652<sup>00</sup></u>
Tinacos	<u>Q 2,100<sup>00</sup></u>
Misceláneo	<u>Q 1,695<sup>00</sup></u>

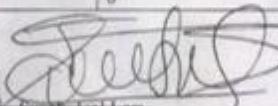
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 326<sup>00</sup>. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 27.<sup>00</sup> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchhu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

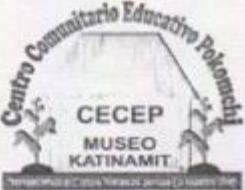
  
Maleo Cical Lem  
Beneficiario

  
Centro Comunitario Educativo Poloncho  
CECEP  
SAN CRISTOBAL  
ADMINISTRACION

Susy Ical Lem  
CECEP

Figure 16: Final page of the MOU with House 2.

3



**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 6,099.°°, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

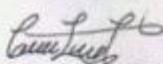
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Rebalse	<u>Q 199.°°</u>
Primera lluvia	<u>Q 329.°°</u>
Tinacos	<u>Q 2100.°°</u>
Misceláneo	<u>Q 1522.°°</u>

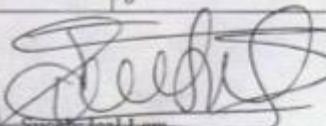
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 305.°°. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 25.°° que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Susy Ical Lem

  
Centro Comunitario Educativo Polonchit  
CECEP  
ADMINISTRACIÓN  
SAN CRISTÓBAL  
Beneficiario

Figure 17: Final page of the MOU with House 3.

4

**Museo Katinamit**  
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Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchtu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 7239<sup>00</sup>, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

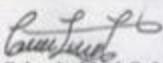
Base	<u>Q 1997.<sup>00</sup></u>
Rebalse	<u>Q 101.<sup>00</sup></u>
Primera lluvia	<u>Q 644.<sup>00</sup></u>
Tinacos	<u>Q 2400.<sup>00</sup></u>
Misceláneo	<u>Q 2091.<sup>00</sup></u>

Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 362<sup>00</sup>. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 30<sup>00</sup> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchtu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Beneficiario

  
Centro Comunitario Educativo Polonense  
CECEP  
ADMINISTRACIÓN  
SAN CRISTÓBAL

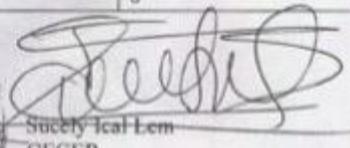
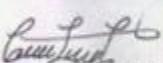
  
Susely Ical Lem  
CECEP

Figure 18: Final page of the MOU with House 4.

6

	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.	
Se instaló un sistema de agua, de valor total de <u>Q 7296.00</u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:	
Base	<u>Q 1997.00</u>
Rebalse	<u>Q 2100.00</u> 102.00
Primera lluvia	<u>Q 666.00</u>
Tinacos	<u>Q 2400.00</u>
Misceláneo	<u>Q 2131.00</u>
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:	
1. Yo pagaré un 5% de este costo, que es de <u>Q 365.00</u> Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 30.42</u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.	
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.	
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.	
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0	2400
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Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Beneficiario

  
Centro Comunitario Educativo Petén Maya  
CECEP  
ADMINISTRACIÓN  
SAN CRISTOBAL A.C.

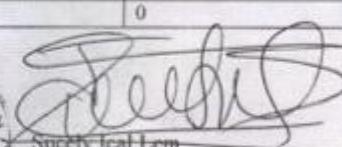
  
Susely Ical Lem  
CECEP

Figure 19: Final page of the MOU with House 6.



**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 5202<sup>00</sup>, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

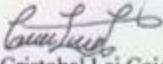
Base	<u>Q 100<sup>00</sup></u>
Rebalse	<u>Q 67<sup>00</sup></u>
Primera lluvia	<u>Q 337<sup>00</sup></u>
Tinacos	<u>Q 2400<sup>00</sup></u>
Misceláneo	<u>Q 2297<sup>00</sup></u>

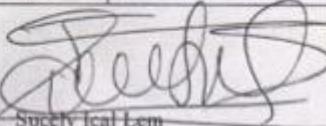
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 260<sup>00</sup>. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 27<sup>00</sup> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Suselly Ical Lem  
CECEP

  
Beneficiario

Figure 20: Final page of the MOU with House 7.

10

	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt
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Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 11196<sup>00</sup>, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

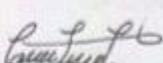
Base	<u>Q 1997<sup>00</sup></u>
Rebalse	<u>Q 135<sup>00</sup></u>
Primera lluvia	<u>Q 679<sup>00</sup></u>
Tinacos	<u>Q 4800<sup>00</sup></u>
Misceláneo	<u>Q 3585</u>

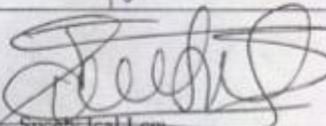
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 560<sup>00</sup>. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 46.65 que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

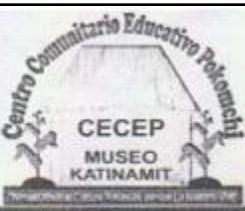
  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Susely Ical Lem

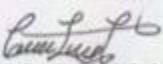
  
Beneficiario

Figure 21: Final page of the MOU with House 10.

12

	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.	
Se instaló un sistema de agua, de valor total de <u>Q 1472<sup>00</sup></u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:	
Base	<u>Q —</u>
Rebalse	<u>Q —</u>
Primera lluvia	<u>Q 335<sup>00</sup></u>
Tinacos	<u>Q —</u>
Misceláneo	<u>Q 1137<sup>00</sup></u>
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:	
1. Yo pagaré un 5% de este costo, que es de <u>Q 73<sup>60</sup></u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 6.<sup>15</sup></u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.	
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.	
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.	
Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Beneficiario

  
Centro Comunitario Educativo Potomotí  
CECEP  
ADMINISTRACIÓN  
SAN CRISTÓBAL A.C.

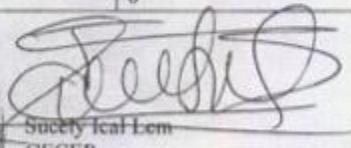
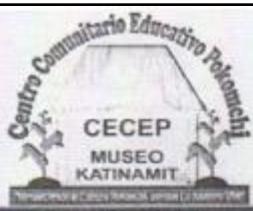
  
Susely Ical Lem  
CECEP

Figure 22: Final page of the MOU with House 12.

17

**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 7998.00, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

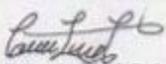
Base	<u>Q 1649.00</u>
Rebalse	<u>Q 192.00</u>
Primera lluvia	<u>Q 325.00</u>
Tinacos	<u>Q 4800.00</u>
Misceláneo	<u>Q 1032.00</u>

Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 400.00. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 33.33 que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Beneficiario

  
CECEP  
SAN CRISTOBAL A.C.

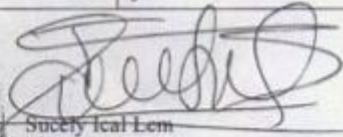
  
Susely Ical Lem  
CECEP

Figure 23: Final page of the MOU with House 17.

19

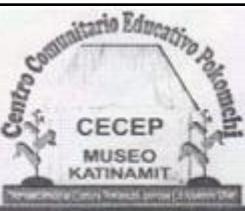
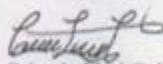
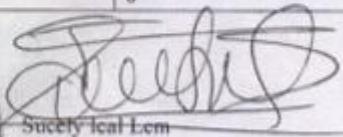
	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt																								
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.																									
Se instaló un sistema de agua, de valor total de <u>Q 7852.00</u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:																									
Base	<u>Q 1649.00</u>																								
Rebalse	<u>Q 68.00</u>																								
Primera lluvia	<u>Q 325.00</u>																								
Tinacos	<u>Q 4800.00</u>																								
Misceláneo	<u>Q 1010.00</u>																								
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:																									
1. Yo pagaré un 5% de este costo, que es de <u>Q 393.00</u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 32.75</u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.																									
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.																									
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.																									
	<table border="1"><thead><tr><th>Años después de la instalación</th><th>Precio del tinaco (quetzales)</th></tr></thead><tbody><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>2160</td></tr><tr><td>2</td><td>1920</td></tr><tr><td>3</td><td>1680</td></tr><tr><td>4</td><td>1440</td></tr><tr><td>5</td><td>1200</td></tr><tr><td>6</td><td>960</td></tr><tr><td>7</td><td>720</td></tr><tr><td>8</td><td>480</td></tr><tr><td>9</td><td>240</td></tr><tr><td>10</td><td>0</td></tr></tbody></table>	Años después de la instalación	Precio del tinaco (quetzales)	0	2400	1	2160	2	1920	3	1680	4	1440	5	1200	6	960	7	720	8	480	9	240	10	0
Años después de la instalación	Precio del tinaco (quetzales)																								
0	2400																								
1	2160																								
2	1920																								
3	1680																								
4	1440																								
5	1200																								
6	960																								
7	720																								
8	480																								
9	240																								
10	0																								
Este contrato es firmado por los siguientes colaboradores:																									
 Cristobal Laj Cojoc Presidente Comité de Agua	 Beneficiario  Sucely Ical Lem CECEP																								

Figure 24: Final page of the MOU with House 19.

70 30

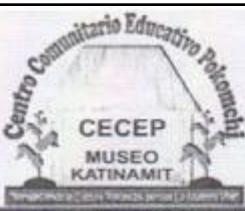
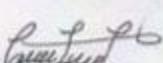
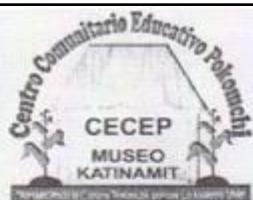
	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt																								
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.																									
Se instaló un sistema de agua, de valor total de <u>Q 5459<sup>00</sup></u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:																									
Base	<u>Q 848.<sup>00</sup></u>																								
Rebalse	<u>Q 68.<sup>00</sup></u>																								
Primera lluvia	<u>Q 336.<sup>00</sup></u>																								
Tinacos	<u>Q 2400.<sup>00</sup></u>																								
Misceláneo	<u>Q 1807.<sup>00</sup></u>																								
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:																									
1. Yo pagaré un 5% de este costo, que es de <u>Q 273<sup>00</sup></u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 22.<sup>75</sup></u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.																									
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.																									
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.																									
<table border="1"><thead><tr><th>Años después de la instalación</th><th>Precio del tinaco (quetzales)</th></tr></thead><tbody><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>2160</td></tr><tr><td>2</td><td>1920</td></tr><tr><td>3</td><td>1680</td></tr><tr><td>4</td><td>1440</td></tr><tr><td>5</td><td>1200</td></tr><tr><td>6</td><td>960</td></tr><tr><td>7</td><td>720</td></tr><tr><td>8</td><td>480</td></tr><tr><td>9</td><td>240</td></tr><tr><td>10</td><td>0</td></tr></tbody></table>	Años después de la instalación	Precio del tinaco (quetzales)	0	2400	1	2160	2	1920	3	1680	4	1440	5	1200	6	960	7	720	8	480	9	240	10	0	 Cristobal Laj Cojoc Presidente Comité de Agua
Años después de la instalación	Precio del tinaco (quetzales)																								
0	2400																								
1	2160																								
2	1920																								
3	1680																								
4	1440																								
5	1200																								
6	960																								
7	720																								
8	480																								
9	240																								
10	0																								
 Beneficiario	 Suceley Ical Lem CECEP																								

Figure 25: Final page of the MOU with House 20.

22

  
**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 8719<sup>00</sup>, el (fecha) 25/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

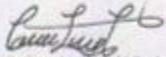
Base	<u>Q 1825<sup>00</sup></u>
Rebalse	<u>Q 4800<sup>00</sup> 68.<sup>00</sup></u>
Primera lluvia	<u>Q 330<sup>00</sup></u>
Tinacos	<u>Q 4800<sup>00</sup></u>
Misceláneo	<u>Q 1696<sup>00</sup></u>

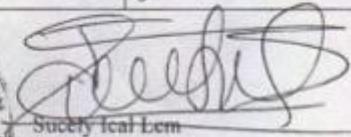
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 436<sup>00</sup>. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 36.<sup>30</sup> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Susely Ical Lem  
CECEP

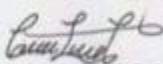
  
Beneficiario

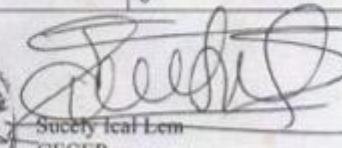
Figure 26: Final page of the MOU with House 22.

23a

	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.	
Se instaló un sistema de agua, de valor total de <u>Q 5597<sup>00</sup></u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:	
Base	<u>Q 1649<sup>00</sup></u>
Rebalse	<u>Q 67<sup>00</sup></u>
Primera lluvia	<u>Q 668<sup>00</sup></u>
Tinacos	<u>Q —</u>
Misceláneo	<u>Q 3213<sup>00</sup></u>
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:	
1. Yo pagaré un 5% de este costo, que es de <u>Q 280<sup>00</sup></u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 25.<sup>00</sup></u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.	
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.	
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.	
Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Susely Ical Lem

  
Beneficiario

Figure 27: Final page of the MOU with House 23a.

23b

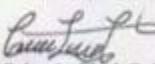
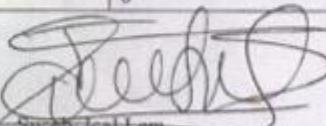
	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt																								
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.																									
Se instaló un sistema de agua, de valor total de <u>Q 4942.00</u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:																									
Base	<u>Q 848.00</u>																								
Rebalse	<u>Q 67.90</u>																								
Primera lluvia	<u>Q 332.00</u>																								
Tinacos	<u>Q 2400.00</u>																								
Misceláneo	<u>Q 1295.00</u>																								
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:																									
1. Yo pagaré un 5% de este costo, que es de <u>Q 217.00</u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 20.34</u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.																									
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.																									
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.																									
	<table border="1"><thead><tr><th>Años después de la instalación</th><th>Precio del tinaco (quetzales)</th></tr></thead><tbody><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>2160</td></tr><tr><td>2</td><td>1920</td></tr><tr><td>3</td><td>1680</td></tr><tr><td>4</td><td>1440</td></tr><tr><td>5</td><td>1200</td></tr><tr><td>6</td><td>960</td></tr><tr><td>7</td><td>720</td></tr><tr><td>8</td><td>480</td></tr><tr><td>9</td><td>240</td></tr><tr><td>10</td><td>0</td></tr></tbody></table>	Años después de la instalación	Precio del tinaco (quetzales)	0	2400	1	2160	2	1920	3	1680	4	1440	5	1200	6	960	7	720	8	480	9	240	10	0
Años después de la instalación	Precio del tinaco (quetzales)																								
0	2400																								
1	2160																								
2	1920																								
3	1680																								
4	1440																								
5	1200																								
6	960																								
7	720																								
8	480																								
9	240																								
10	0																								
Este contrato es firmado por los siguientes colaboradores:																									
 Cristobal Laj Cojoc Presidente Comité de Agua	 Beneficiario  Susely Ical Lem CECEP																								

Figure 28: Final page of the MOU with House 23b.

24

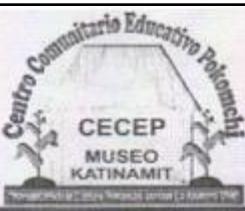
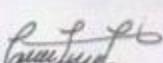
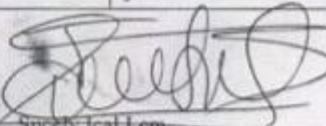
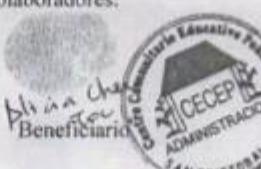
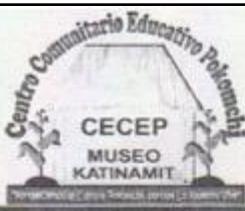
	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt																																		
<p>Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.</p> <p>Se instaló un sistema de agua, de valor total de <u>Q 4690.00</u>, el (fecha) <u>23/05/2015</u>. La siguiente lista muestra un desglose del valor total del sistema:</p> <table><tbody><tr><td>Base</td><td><u>Q 848.00</u></td></tr><tr><td>Rebalse</td><td><u>Q 68.00</u></td></tr><tr><td>Primera lluvia</td><td><u>Q 326.00</u></td></tr><tr><td>Tinacos</td><td><u>Q 2400.00</u></td></tr><tr><td>Misceláneo</td><td><u>Q 1048.00</u></td></tr></tbody></table> <p>Este contrato implica 3 compromisos más allá que los que están indicados en el acta:</p> <ol style="list-style-type: none"><li>1. Yo pagaré un 5% de este costo, que es de <u>Q 234.50</u>. Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 19.50</u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.</li><li>2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.</li><li>3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.</li></ol> <table><thead><tr><th>Años después de la instalación</th><th>Precio del tinaco (quetzales)</th></tr></thead><tbody><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>2160</td></tr><tr><td>2</td><td>1920</td></tr><tr><td>3</td><td>1680</td></tr><tr><td>4</td><td>1440</td></tr><tr><td>5</td><td>1200</td></tr><tr><td>6</td><td>960</td></tr><tr><td>7</td><td>720</td></tr><tr><td>8</td><td>480</td></tr><tr><td>9</td><td>240</td></tr><tr><td>10</td><td>0</td></tr></tbody></table> <p>Este contrato es firmado por los siguientes colaboradores:</p> <p> Cristobal Laj Cojoc Presidente Comité de Agua</p> <p> Susely Ical Lem</p> <p> Centro Comunitario Educativo Potomchi CECEP ADMINISTRACIÓN SAN CRISTOBAL A.C.</p>		Base	<u>Q 848.00</u>	Rebalse	<u>Q 68.00</u>	Primera lluvia	<u>Q 326.00</u>	Tinacos	<u>Q 2400.00</u>	Misceláneo	<u>Q 1048.00</u>	Años después de la instalación	Precio del tinaco (quetzales)	0	2400	1	2160	2	1920	3	1680	4	1440	5	1200	6	960	7	720	8	480	9	240	10	0
Base	<u>Q 848.00</u>																																		
Rebalse	<u>Q 68.00</u>																																		
Primera lluvia	<u>Q 326.00</u>																																		
Tinacos	<u>Q 2400.00</u>																																		
Misceláneo	<u>Q 1048.00</u>																																		
Años después de la instalación	Precio del tinaco (quetzales)																																		
0	2400																																		
1	2160																																		
2	1920																																		
3	1680																																		
4	1440																																		
5	1200																																		
6	960																																		
7	720																																		
8	480																																		
9	240																																		
10	0																																		

Figure 29: Final page of the MOU with House 24.

25

**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

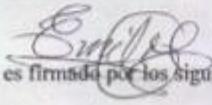
Se instaló un sistema de agua, de valor total de Q 5142.00, el (fecha) 25/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

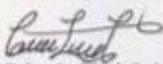
Base	<u>Q 848.00</u>
Rebalse	<u>Q 67.00</u>
Primera lluvia	<u>Q 653.00</u>
Tinacos	<u>Q 2400.00</u>
Misceláneo	<u>Q 1174.00</u>

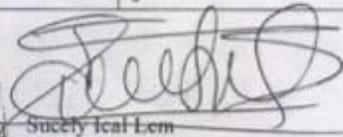
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 257.00. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 21.42 que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

  
Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Susely Ical Lem  
CECEP

Beneficiario 

Figure 30: Final page of the MOU with House 25.

30

**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 8200.00, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

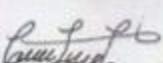
Base	<u>Q 848.00</u>
Rebalse	<u>Q 102.00</u>
Primera lluvia	<u>Q 1005.00</u>
Tinacos	<u>Q 2400.00</u>
Misceláneo	<u>Q 3845.00</u>

Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 410.00. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 34.17 que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Beneficiario

  
Centro Comunitario Educativo Potomchi  
CECEP  
ADMINISTRACIÓN  
SAN CRISTÓBAL A.V.

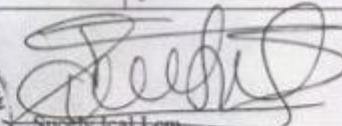
  
Susely Ical Lem  
CECEP

Figure 31: Final page of the MOU with House 30.

32

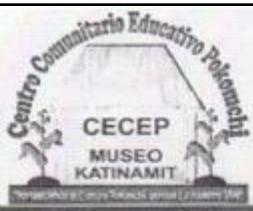
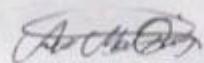
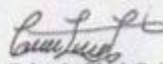
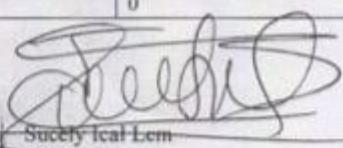
	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.	
Se instaló un sistema de agua, de valor total de <u>Q 1529.00</u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:	
Base	<u>Q —</u>
Rebalse	<u>Q 67.00</u>
Primera lluvia	<u>Q 338.00</u>
Tinacos	<u>Q —</u>
Misceláneo	<u>Q 1124.00</u>
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:	
1. Yo pagaré un 5% de este costo, que es de <u>Q 76.00</u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 6.00</u> que entregaré a CECEP, a Susely Ical Lem el primero de cada mes.	
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.	
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.	
	
Este contrato es firmado por los siguientes colaboradores:	
 Cristobal Laj Cojoc Presidente Comité de Agua	 Susely Ical Lem CECEP
Beneficiario	

Figure 32: Final page of the MOU with House 32.

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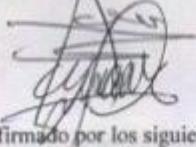
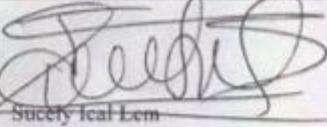
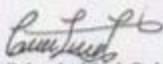
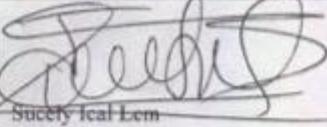
	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt																																		
<p>Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.</p> <p>Se instaló un sistema de agua, de valor total de <u>Q 8193.<sup>00</sup></u>, el (fecha) <u>23/05/2015</u>. La siguiente lista muestra un desglose del valor total del sistema:</p> <table><tbody><tr><td>Base</td><td><u>Q 1649.<sup>00</sup></u></td></tr><tr><td>Rebalse</td><td><u>Q 68.<sup>00</sup></u></td></tr><tr><td>Primera lluvia</td><td><u>Q 336.<sup>00</sup></u></td></tr><tr><td>Tinacos</td><td><u>Q 4800.<sup>00</sup></u></td></tr><tr><td>Misceláneo</td><td><u>Q 1340.<sup>00</sup></u></td></tr></tbody></table> <p>Este contrato implica 3 compromisos más allá que los que están indicados en el acta:</p> <ol style="list-style-type: none"><li>1. Yo pagaré un 5% de este costo, que es de <u>Q 410.<sup>00</sup></u> Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 341.<sup>66</sup></u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.</li><li>2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.</li><li>3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.</li></ol> <p> </p> <table border="1"><thead><tr><th>Años después de la instalación</th><th>Precio del tinaco (quetzales)</th></tr></thead><tbody><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>2160</td></tr><tr><td>2</td><td>1920</td></tr><tr><td>3</td><td>1680</td></tr><tr><td>4</td><td>1440</td></tr><tr><td>5</td><td>1200</td></tr><tr><td>6</td><td>960</td></tr><tr><td>7</td><td>720</td></tr><tr><td>8</td><td>480</td></tr><tr><td>9</td><td>240</td></tr><tr><td>10</td><td>0</td></tr></tbody></table> <p>Este contrato es firmado por los siguientes colaboradores:</p> <p> Cristobal Laj Cojoc Presidente Comité de Agua</p> <p> Susy Ical Lem CECEP</p> <p> Beneficiario Centro Comunitario Educativo Potomchi CECEP ADMINISTRACIÓN SAN CRISTÓBAL A.</p>		Base	<u>Q 1649.<sup>00</sup></u>	Rebalse	<u>Q 68.<sup>00</sup></u>	Primera lluvia	<u>Q 336.<sup>00</sup></u>	Tinacos	<u>Q 4800.<sup>00</sup></u>	Misceláneo	<u>Q 1340.<sup>00</sup></u>	Años después de la instalación	Precio del tinaco (quetzales)	0	2400	1	2160	2	1920	3	1680	4	1440	5	1200	6	960	7	720	8	480	9	240	10	0
Base	<u>Q 1649.<sup>00</sup></u>																																		
Rebalse	<u>Q 68.<sup>00</sup></u>																																		
Primera lluvia	<u>Q 336.<sup>00</sup></u>																																		
Tinacos	<u>Q 4800.<sup>00</sup></u>																																		
Misceláneo	<u>Q 1340.<sup>00</sup></u>																																		
Años después de la instalación	Precio del tinaco (quetzales)																																		
0	2400																																		
1	2160																																		
2	1920																																		
3	1680																																		
4	1440																																		
5	1200																																		
6	960																																		
7	720																																		
8	480																																		
9	240																																		
10	0																																		

Figure 33: Final page of the MOU with House 33.

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	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt
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Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 6894<sup>00</sup>, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

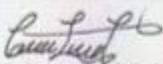
Base	<u>Q 1997<sup>00</sup></u>
Rebalse	<u>Q 32135.<sup>00</sup></u>
Primera lluvia	<u>Q 342<sup>00</sup></u>
Tinacos	<u>Q 2400.<sup>00</sup></u>
Misceláneo	<u>Q 2020<sup>00</sup></u>

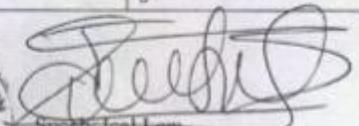
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

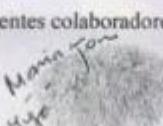
1. Yo pagaré un 5% de este costo, que es de Q 345<sup>00</sup>. Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 28.75 que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Susely Ical Lem  
CECEP

  
Beneficiario

  
Centro Comunitario Educativo Potomchi  
CECEP  
ADMINISTRACIÓN  
SAN CRISTÓBAL

Figure 34: Final page of the MOU with House 34.

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**Museo Katinamit**  
San Cristóbal Verapaz  
Tel. (502) 7950-4896  
cecep@intelnet.net.gt

Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchtu'Uq, Ingenieros sin Fronteras y CECEP.

Se instaló un sistema de agua, de valor total de Q 7891.00, el (fecha) 23/05/2015. La siguiente lista muestra un desglose del valor total del sistema:

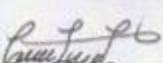
Base	<u>Q 1649.00</u>
Rebalse	<u>Q 68.00</u>
Primera lluvia	<u>Q 327.00</u>
Tinacos	<u>Q 4800.00</u>
Misceláneo	<u>Q 1051.00</u>

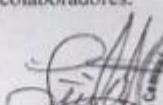
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:

1. Yo pagaré un 5% de este costo, que es de Q 395.00 Lo pagaré: en un plazo o en 12 cuotas mensuales de Q 32.92 que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchtu'Uq.
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.

Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Beneficiario

  
Centro Comunitario Educativo Potomchi  
CECEP  
SAN CRISTOBAL A.C.  
ADMINISTRACIÓN

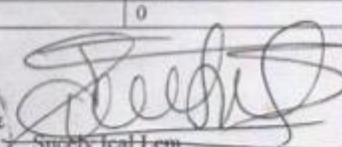
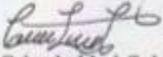
  
Susely Ical Lem  
CECEP

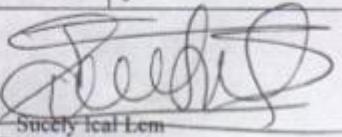
Figure 35: Final page of the MOU with House 36.

40

	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.	
Se instaló un sistema de agua, de valor total de <u>Q 11700<sup>00</sup></u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:	
Base	<u>Q 3256<sup>00</sup></u>
Rebalse	<u>Q 202<sup>00</sup></u>
Primera lluvia	<u>Q 657<sup>00</sup></u>
Tinacos	<u>Q 4800<sup>00</sup></u>
Misceláneo	<u>Q 2784.<sup>00</sup></u>
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:	
1. Yo pagaré un 5% de este costo, que es de <u>Q 585<sup>00</sup></u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 48.75</u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.	
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.	
3. Yo me comprometo a no vender el tinaco por el mínimo establecido de 10 años. Si decido venderlo o si salgo de la comunidad, tendré que comprar el tanque de CECEP a un monto que disminuye cada año. La siguiente tabla incluye el precio el tinaco en el periodo de diez años.	
Años después de la instalación	Precio del tinaco (quetzales)
0	2400
1	2160
2	1920
3	1680
4	1440
5	1200
6	960
7	720
8	480
9	240
10	0

Este contrato es firmado por los siguientes colaboradores:

  
Cristobal Laj Cojoc  
Presidente Comité de Agua

  
Susely Ical Lem  
CECEP

  
Beneficiario

Figure 36: Final page of the MOU with House 40.

43

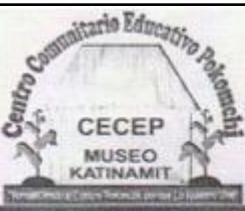
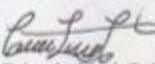
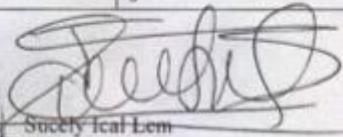
	<b>Museo Katinamit</b> San Cristóbal Verapaz Tel. (502) 7950-4896 cecep@intelnet.net.gt																								
Este contrato representa un acuerdo entre: el beneficiario de la comunidad de Guatchthu'Uq, Ingenieros sin Fronteras y CECEP.																									
Se instaló un sistema de agua, de valor total de <u>Q 8647<sup>00</sup></u> , el (fecha) <u>23/05/2015</u> . La siguiente lista muestra un desglose del valor total del sistema:																									
Base	<u>Q 1649.<sup>00</sup></u>																								
Rebalse	<u>Q 124.<sup>00</sup></u>																								
Primera lluvia	<u>Q 329<sup>00</sup></u>																								
Tinacos	<u>Q 480<sup>00</sup></u>																								
Misceláneo	<u>Q 1745<sup>00</sup></u>																								
Este contrato implica 3 compromisos más allá que los que están indicados en el acta:																									
1. Yo pagaré un 5% de este costo, que es de <u>Q 432.<sup>00</sup></u> . Lo pagaré: en un plazo o en 12 cuotas mensuales de <u>Q 36.<sup>00</sup></u> que entregaré a CECEP, a Susy Ical Lem el primero de cada mes.																									
2. Yo me comprometo a apoyar las instalaciones futuras que hacen Ingenieros sin Fronteras en otras casas de la comunidad de Guatchthu'Uq.																									
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	<table border="1"><thead><tr><th>Años después de la instalación</th><th>Precio del tinaco (quetzales)</th></tr></thead><tbody><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>2160</td></tr><tr><td>2</td><td>1920</td></tr><tr><td>3</td><td>1680</td></tr><tr><td>4</td><td>1440</td></tr><tr><td>5</td><td>1200</td></tr><tr><td>6</td><td>960</td></tr><tr><td>7</td><td>720</td></tr><tr><td>8</td><td>480</td></tr><tr><td>9</td><td>240</td></tr><tr><td>10</td><td>0</td></tr></tbody></table>	Años después de la instalación	Precio del tinaco (quetzales)	0	2400	1	2160	2	1920	3	1680	4	1440	5	1200	6	960	7	720	8	480	9	240	10	0
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7	720																								
8	480																								
9	240																								
10	0																								
Este contrato es firmado por los siguientes colaboradores:																									
 Cristobal Laj Cojoc Presidente Comité de Agua	 Beneficiario  Susely Ical Lem CECEP																								

Figure 37: Final page of the MOU with House 43.

## 2.0 Appendix B – Water Quality Data

*Table 1: Instructions for reading the water quality data organized in the tables below.*

Tube number	House number	Source	Tube color	Fluoresce?	Blue count	Red count
Refers to the number written on the tubes and petrifilm tests for reference in country	Refers to the number of each house which can be referenced to the community map on this sheet, or list of community names below	GT - government implemented tank EWB - EWB-USA WPI implemented tank 1 or 2 - references different tanks in the same system FF - First flushes on the system, may be distinguished by number	Clear, Mild Yellow, or yellow indicating presence of bacteria	Yes or No indicating presence of E Coli Bacteria	Amount of blue colonies present on the petrifilm signifying E Coli colonies	Amount of red colonies present on the petrifilm signifying bacterial colonies

*Table 2: First half of water quality data completed in the first round of tests.*

Tube number	House number	Source	Tube color	Fluoresce?	Blue count	Red count
1	40	GT1	Yellow	No	0	21
1	40	GT1	Yellow	No	0	97
2	40	GT2	Yellow	No	0	14
2	40	GT2	Yellow	No	0	14
3	32	GT1	Yellow	Yes	0	33
3	32	GT1	Yellow	Yes	0	42
4	32	GT2	Yellow	Yes	0	85
4	32	GT2	Yellow	No	0	102
6	23a	GT1	Yellow	No	0	0
6	23a	GT1	Yellow	No	0	6
7	23a	GT2	Yellow	No	0	39
7	23a	GT2	Yellow	No	0	40
8	10	GT2	Yellow	Yes	0	170
8	10	GT2	Yellow	Yes	0	178
9	7	GT	Yellow	No	0	0
9	7	GT	Clear	No	0	4

10	6	GT	Clear	No	0	0
10	6	GT	Clear	No	0	5
11	4	GT	Clear	No	0	0
11	4	GT	Clear	No	0	0
12	3	GT	Mild Yellow	No	0	153
12	3	GT	Mild Yellow	No	0	143
13	2	GT	Yellow	No	0	43
13	2	GT	Yellow	No	0	57

Table 3: Second half of water quality data completed in the first round of tests.

Tube number	House number	Source	Tube color	Fluoresce ?	Blue count	Red count
1	1	EWB	Yellow	No		18
1a	1	FF2	Yellow	No		11
2	1	FF1	Clear	No		2
2	1	FF1	Clear	No		2
3	5	EWB	Light yellow	No		0
3	5	EWB	Clear	No		1
4	5	FF1	Yellow	No		32
4	5	FF1	Yellow	No		23
5	9	EWB	Yellow	No		33
5	9	EWB	Yellow	No		52
7	9	FF1	Yellow	No	1	102
7	9	FF1	Yellow	Yes	1	74
8	9	FF2	Light yellow	No		TNTC
8	9	FF2	Light yellow	Yes		TNTC
9	8	EWB	Yellow	No		2
9	8	EWB	Yellow	No		0
11	8	FF1	Clear	No		0
11	8	FF1	Clear	No		37
12	8	FF2	Yellow	No		3

12	8	FF2	Clear	No		1
14	16	EWB	Clear	No		0
14	16	EWB	Yellow	Yes		TNTC
15	16	FF1	Clear	Yes		5
15	16	FF1	Clear	Yes	3	35
16	18	EWB	Yellow	No		1
16	18	EWB	Yellow	No		4
17	18	FF1	Yellow	Yes		2
19	21	EWB	Clear	No		0
19	21	EWB	Light yellow	No		0
20	21	FF1	Light yellow	No		1
20	21	FF1	Light yellow	No		3
21	26	EWB	Yellow	No		0
21	26	EWB	Yellow	No		3
23	27	EWB	Yellow	No		2
23	27	EWB	Yellow	No		3
24	27	FF1	Clear	No		0
24	27	FF1	Clear	No		4
25	29	EWB	Yellow	Yes		78
25	29	EWB	Yellow	Yes		115
26	29	FF1	Yellow	No		74
26	29	FF1	Yellow	Yes		112
A		Water hole	Yellow	Yes	2	68
29		Water hole	Yellow	Yes		72
30		Finca tap	Yellow	Yes		52
31		Finca basin	Yellow	Yes	4	TNTC
32	8	GT1	Light yellow	No		1
33	8	GT2	Light yellow	No		0

*Table 4: Water Quality data from the second round of testing.*

Tube number	House number	Source	Tube color	Fluoresce?	Blue count	Red count
1	31	GT2	Yellow	No	0	2
1	31	GT2	Yellow	No	0	2
1	31	GT2	Yellow	No	0	1
2	31	EWB1	Yellow	Yes	0	1
2	31	EWB1	Yellow	Yes	0	0
2	31	EWB1	Mild Yellow	Yes	0	2
3	31	FF1	Yellow	No	0	TNTC
3	31	FF1	Yellow	No	0	TNTC
3	31	FF1	Yellow	No	0	TNTC
4	31	FF2	Clear	No	0	0
4	31	FF2	Clear	No	0	0
4	31	FF2	Clear	No	0	0
5	28	EWB1	Yellow	No	0	38
5	28	EWB1	Yellow	No	0	31
5	28	EWB1	Yellow	No	0	35
6	28	FF1	Clear	No	0	18
6	28	FF1	Clear	No	0	5
6	28	FF1	Clear	No	0	13
7	27	EWB1	Yellow	No	0	0
7	27	EWB1	Yellow	No	0	2
7	27	EWB1	Yellow	No	0	5
8	27	FF1	Clear	No	0	2
8	27	FF1	Clear	No	0	1
8	27	FF1	Clear	No	0	2

*Table 5: Water Quality Data from the third round of testing.*

Tube number	House number	Source	Tube color	Fluoresce ?	Blue count	Red count
1	12	Concrete tank	Yellow	No		1
1	12	Concrete tank	Yellow	No		5
1	12	Concrete tank	Yellow	No		2
2	6	Concrete tank	Clear	No		1
2	6	Concrete tank	Yellow	No		1
2	6	Concrete tank	Yellow	No		0
3	31	EWB Tank w/ Filter	Yellow	No		4
3	31	EWB Tank w/ Filter	Yellow	No		7
4	31	EWB Tank w/o Filter	Yellow	No		17
4	31	EWB Tank w/o Filter	Yellow	No		17
5	16	EWB Tank w/ Filter	Yellow	No		TNTC
5	16	EWB Tank w/ Filter	Yellow	No		TNTC
12	16	EWB Tank w/o Filter	Yellow	No		1
12	16	EWB Tank w/o Filter	Yellow	No		1
6	29	EWB Tank w/ Filter	Yellow	Yes	3	TNTC
6	29	EWB Tank w/ Filter	Yellow	Yes	5	TNTC
7	29	EWB Tank w/o Filter	Yellow	Yes	12	TNTC
7	29	EWB Tank w/o Filter	Yellow	Yes	10	TNTC
8	26	EWB Tank w/ Filter	Yellow	Yes		5
8	26	EWB Tank w/ Filter	Yellow	Yes		25
9	26	EWB Tank w/o Filter	Yellow	Yes	5	TNTC

9	26	EWB Tank w/o Filter	Yellow	Yes		N/A
10	8	EWB Tank w/ Filter	Yellow	No		2
10	8	EWB Tank w/ Filter	Yellow	No		19
11	8	EWB Tank w/o Filter	Yellow	No		3
11	8	EWB Tank w/o Filter	Yellow	No		7
13	32	Government Tank	Yellow	No		13
13	32	Government Tank	Yellow	No		46

### 3.0 Appendix C – Inorganic Water Quality Data

*Table 6: Results of the inorganic test completed on the finca, and an EWB implemented tank.*

	Sample - EWB Tank 14	Sample - Finca
Parameter	Test 1	Test 1
Total Chlorine (mg/L)	0	0
Free Chlorine (mg/L)	0	0
Chloride (mg/L)	0	0
pH (standard units)	4.0	6.5
Total Alkalinity (mg/L)	0	246
Total Hardness (mg/L)	0	50
Nitrates/Nitrites (mg/L)	0	0
Iron (mg/L)	0	0
Sulfates (mg/L)	not tested	0
Copper (mg/L)	0	0
Lead (mg/L)	not tested	positive
Pestacides (mg/L)	not tested	invalid

## 4.0 Appendix D – Interview Questions

### 4.1 Questions for Previously implemented Homes

#### Visually Inspect:

**Mosquito Netting:** [Broken, not broken] [good condition, poor condition, missing] [worn,torn]

**Filters:** Darkness(1-10)[through pictures], Dirty(1), cleaned regularly(2), cleaned recently(3)

**First Flush:** [Empty, Full] [water clear, water turbid] [bucket, divet, no divet]

**Tank Cleanliness:** Dirty, cleaned regularly, cleaned recently

**Gutters:** Debris, Dirt, Clean

**Roofs:** Debris, Dirt, Clean

**Presence of Orange Bucket:** out, not out

**Connections:** Sealed, Not Sealed

**Base:** Intact, Cracked, Broken

**Conversation:** *use picture options when possible*

#### Tank Cleanliness:

How often have they been cleaning the tanks?

Do you clean both at the same time?

Describe how you clean it?

Who cleaned it?

#### Repairs:

Have you needed to repair any parts?

If so, what did you replace/repair?

If so, who replaced/repaired it?

If you didn't repair it how come?

How much did the repair cost?

#### First Flush:

How often do you empty your first flush?

What do you use first flush water for if you use it?

#### Health:

How often have your family members had an upset stomach since the new year?

What do you think the cause of the stomach ache was? Was it reoccurring?

How impairing was the illness? [school, work]

Have there been any community wide illnesses?

Do you feel like the system has improved your health?

Have you noticed any difference in your family's health since we implemented?

#### Water Use and Source Quality:

How many times did you go to the finca yesterday?

How many times per day did you go in the past week?

How many times have you gone in the last month?

How many times have you gone since you received the system?

Show what buckets you use for what purposes

What were you using that water for when you got it?

Do you notice an increase in trips to the finca during the dry season?

Do you notice a difference between water from the system and the water from the finca?

[cleanliness, taste]

Who collects water from the finca? (how much)

How much time does the system save you?

**Behavior:**

How often (days) do your kids go to school per week?

How long are your kids at school per day? [full day, half day, quarter day]

Why don't your kids go to school if they don't?

Has anyone been able to pick up a job or new activity that was previously unemployed?

Have there been any tensions relating to water access?

## 4.2 Questions for homes receiving a system

**Visual Inspection:**

**Tops on Existing Tanks:** Yes, No

**Roofs:** Debris, Dirt, Clean

**Gutters:** Debris, Dirt, Clean

**Conversation:** *use picture options when possible*

**Tank Cleanliness:**

How often have they been cleaning the tanks?

Do you clean both at the same time?

Describe how you clean it?

Who cleaned it?

**First Flush:**

How often do you empty your first flush?

What do you use first flush water for if you use it?

**Finca:**

How often do you go to the finca?

Yesterday, Last week, Last month

**Behavior:**

How often (days) do your kids go to school per week?

How long are your kids at school per day? [full day, half day, quarter day]

What do you think about your system? (if they have one)

**Health:**

How often have your family members had an upset stomach since the new year?

What do you think the cause of the stomach ache was? Was it reoccurring?

How impairing was the illness? [school, work]

Have there been any community wide illnesses?

Why don't your kids go to school if they don't?

Have there been any changes in community leadership?

Have there been any tensions relating to water access?

**Water Use and Supply:**

Where do you get your water from? (anywhere else but the finca)

What were you using that water for when you got it? (per location)

Do you notice an increase in trips to the finca during the dry season?

Do you notice a difference between water from other places and water from the finca?  
[cleanliness, taste]  
Who gets water from the finca? (how much)  
Show what buckets you use for what purposes

## 5.0 Appendix E – Interview Results

### House 2

#### Technical

Receiving one tank

Asked about disconnecting the two tanks to clean

Wants to save the water in the existing system when we need to empty it

200 cm and 180 cm are distances from roof to ground (not high enough for system)

Height issue with existing design

New plan is to put all three tanks low against the wall

He will level the land there for the three tanks

One tank will be sitting ontop of the existing concrete tank

One new tank will be raised on a double high base to be above the old tank that will sit on the concrete tank

This high new tank will overflow into both the old and other new tank

Height of government tank = 50 inches, diameter = 53 inches

Height of concrete tank/base = 24 inches

#### Finca

Watch water level of government tank and when it starts getting low 4 people go to finca 2x per day

Wash laundry at finca when water level is low

Don't use water hole, not good quality water

Only drink finca water when run out of tank water

Hour round trip to get water from finca

#### Existing Tank

13 years ago got black tanks through government project

5-6 years ago the tank broke

Government Tank 1 (tank in front of house)

Broken

Top is on tank and a stick is in the tank outlet

Government Tank 2 (tank beside house)

Top is off of tank with a gutter leading into top

Clean tanks with chlorine using a child inside the tank, child washes feet first

Don't turn the tanks over to clean because they use towels to wipe the debris out

#### Finca vs. Tank

Prefer water in tanks because it falls straight from the sky and sometimes things fall into the finca water, unlike the tanks  
Boil both finca and tank water

## School

Kids of school age go to school every day

# House 3

## Technical

There is a tank here that was not marked in the home folders  
Home folder is now up to date  
Only need one tank  
210 cm is the low roof and they will be digging out the ground there for the tanks  
The need more stone and will collect more

## Finca

Go to finca 3x per day, twice in morning, once in afternoon  
When tank is empty, make 4 trips with 2 people but when half empty only goes 3 times  
When water gets to  $\frac{1}{2}$  a tank she goes to bring water to stretch out the water, shares the work between the days  
End of march/beginning of April had to start going to finca  
Always boils water

## Existing Tank

Initially weren't part of the government project but someone dropped out so they got a government tank  
Pay 300Q for the tank to someone in Guachtuq but is not sure if the money was actually paid to the government or if the person kept the money  
Not currently connected to the roof  
Top is on tank  
Cleaned government tank yesterday when asked to  
Clean tank upright using a kid inside the tank

## Finca vs. Tank

Drinks only the government tank water unless it goes empty  
Uses finca water for all other non drinking purposes  
Thinks tank water is more trustworthy and tastes better because it falls from the sky

Finca and tank water don't have a big difference in health impacts, difference is boiling

## **School**

6 yr old girl don't go to school  
11yr old boy goes to school in morning and bible study in the afternoon  
9 yr old goes to school in morning

## **Sickness**

Believes if you drink water from either tank or finca without boiling, you will get sick

## **Other**

Does spinning, her and her sisters spin  
Was given seeds at one point to plant but it was too dry for them to grow  
Lives next to her father, and sister lives in house 1

# **House 4**

## **Technical**

Land appears leveled  
Has two tanks and needs one  
Has two 1700 tanks  
He will save the water for mixing concrete  
Roofs  
Houser roof is clean  
Workshop roof is mainly clean, has a little debris  
Roof on far side (opposite side of workshop) is very dirty with lots of leaves and debris

## **Finca**

Finca used occasionally, used in the dry season to wash and two times a week to bathe  
Save the tank water for drinking  
There aren't other water sources besides the finca and the tanks

## **Existing Tank**

Clean tanks 2 times per year using soap, chlorine and brush  
Father pours water and kids clean the tanks

## **Finca vs. Tank**

The quality of the two sources is variable  
Roof water sometimes looks dirty and has a bad taste  
Finca looks clear but the tank is yellow  
There aren't community wide water problems

## **School**

Don't miss school much for water  
They are at school even though it is mothers day when the interview was conducted  
They only miss school when they are sick , for one or two days

## **Sickness**

Fever is most common  
Get stomach aches as well  
He thought it was caused by the water sitting in the sun in the tanks too long  
Doesn't know how often they are sick  
Fever is the only thing that is community wide

## **House 5**

### **Broken Tanks**

Tanks broke and has to go to the finca  
Tanks broke 20 days ago, no water since tanks broke  
Wanted to clean the tanks so paid a kid to go in the tank but he was not tall enough to get the water so she wanted to  
She said she knows now not to cut any of the tubes  
Tried to put a sealer on the cut tube but it didn't work (was too close to the fitting)  
Went to Roberto for help and he didn't have the unions to fix the tanks  
Used the water hole and borrowed water from her sister's tanks to drink when tanks were broken  
Rodney fixed the tanks during the last week of the trip

### **Before Broken Tanks**

Saved a lot of time not having to go to the finca  
Saves about a whole day every week not having to walk to the finca  
Gives her more time to collect firewood

### **Maintenance**

First Flush: when it begins to rain, open first flush and let it run until the first flush water is clear

## **Health**

Doesn't have any stomach aches

## **School**

All of her children of school age are in school

## **Other**

Husband works in Guatemala city

# **House 6**

## **Technical**

### **Finca**

Tiring to bring water from finca

Goes to finca 2x a day with the children

Time that it takes to get water could be used for things like planting and growing corn, shelling corn

People throw trash in the communal water source, an individual system people can care for more

Water hole water is warmer and water in concrete tank is cooler

## **Existing Tank**

Tank water being shared with House 5 (relatives) and the water ran out faster

## **School**

Children go to school for half day

## **Sickness**

No stomach problems because they always boil their water

## **Other**

They have one concrete tank and three plastic tanks  
Land is ready

### **Existing Tanks**

Government Tank 1 (out front)

Lid on tank

Tank is empty

Concrete Tank

Has water

Government Tank 2 (out back)

No lid

Tank has some water

Government Tank 3 (out back)

No lid

Empty

## **House 7**

### **Technical**

Move old tank to the lower location

Doesn't need a full base

Cinderblocks at the lower location to raise up the tank

Two spigots are needed

### **Existing Tanks**

Send the kids into the tank to wash in with a towel

They use chlorine as well to wash it and dry with a towel

They clean it once a year but can't clean it when it's full

Use two or three drops of chlorine in a small bin and scrub with a towel

Clean the system (tubing) with a towel and pull it through the tubes with a strong

Have a first flush like system

A gutter that sits under the system where the PVC can be disconnected

The gutters feeds to a separate bucket that is used for washing

The Finca is used to wash when there isn't rain

### **School**

The children go to school

They go to school because they are finally old enough

When they are sick they don't go to school

### **Sickness**

They get the flu or cold or a cough most often  
Sometimes stomach aches too  
They feel sick from the sun and when the season changes  
Only the children have been sick this year  
Sometimes there is a cold in the whole community

### **Existing Tanks**

Government Tank  
Lid on tank

## **House 10**

### **Technical**

There are 2 existing tanks, not 1

### **Finca**

They go 2 times a day  
And 2-3 people go to the finca when they go  
The rain water is cleaner but there's dirt and debris in it sometimes  
Children go early to get water so they don't miss school

### **Existing Tanks**

They are cleaned every 2-3 months  
When they are full they wait until they are empty to clean them  
They use one tank to drink and one tank to wash  
They go to the finca when the tanks aren't sufficiently  
Use the finca for everything when it's needed

### **Finca vs. Tank**

The rainwater is cleaner but there's dirt and debris in it sometimes  
Always boil the water

### **School**

Children go to school

The kids also help with the water  
§ They go early to get water and don't miss school

### **Sickness**

They are sick but it's because of the changing weather  
They don't think it comes from the water  
They always boil the water

### **Existing Tanks**

Government Tank 1  
Dirty  
Lid not on tank (have elsewhere on property)  
No tap on tank  
Must siphon water out through a hose  
Gutter feeding into tank is uncovered had full of dirt and debris  
Tank only has a little water  
Government Tank 2  
No lid (have elsewhere on property)  
Gutter runs directly into top of tank  
§ Gutter has debris  
This tank is used for potable water  
Water from tank was very cool, tank is in the shade

## **House 12**

Unable to get an interview because woman works from 7am-6pm every day  
The woman of the house works in a tortillaria, has 2 children and her sister (House 43) babysits the children  
Her husband was involved in 1 day of construction

## **House 17**

### **Finca**

2 people go to finca 6 times per day

### **School**

There are 5 kids and 3 are in school

### **Sickness**

Had stomach aches 2 times for everyone

## **House 19**

### **Technical**

Pitched roof, larger roof panel on left

Left panel

18ft x 12 ft

Height of roof is 6.25 ft

Right panel

10ft x 12ft

### **Finca**

All there water is from the finca

She goes 6 times a day

20 min for a trip

Children don't help because they are too young

### **School**

Girls go during the morning and the others are too young

### **Sickness**

Since January the kids have been sick 3 times

§ Mostly stomach sickness

### **Existing Tanks**

Family has no existing tanks.

## **House 20**

### **Technical**

Bottom of gutter to ground is 2.5 meters

### **Existing Tanks**

Family has no existing tanks.

## House 22

### Technical

#### Finca

Goes to the finca 10 times per day with five people

#### School

There are 5 children and only 1 goes to school (18, 13, 11, 10, 4 yr old)  
One child works at the saw mill and one child works at the slaughter house

#### Sickness

No sickness in the family

## House 23

### Finca

8 trips to finca, five people go (2 adults)  
Wash corn at the finca  
Only drink finca water when tanks run out  
For 1 month had to drink water from finca

### Existing Tanks

Turn tanks on side and clean them every 2-3 months

### Finca vs. Tank

Prefer water from tanks  
Boil water from tanks and finca  
Tanks for drinking water and use finca water for other purposes

## House 24

### Education

3 children, 2 go to school

## House 25

Has five kids, youngest is 16

### Finca

6 people go to the finca 2 times per day

Thinks that the finca water and tank water are the same quality

### Existing Tank

Wash their concrete tank every month

### Sickness

Every week someone has a stomach ache and they don't know why

They don't take medicine to treat because it costs too much and doesn't make them feel better

## House 27

### Maintenance

No netting on overflow and netting not broken and in good condition on top of downspout  
Base is just concrete blocks in a circle, no base

First flush has a cap on it

Both tanks are very clean with dirt only on bottom

All connections are good

Gutter has some debris

No orange bucket

**First flush:** clear water but full, no divet under first flush but there is a concrete block

No chlorine

### School

3 kids in school, go every day

## House 28

### Maintenance

Bottom of the tank was dirty  
Neting was broken and in poor condition with a small tear  
Gutters were clean  
No orange bucket  
**First flush:** emptied, small quantity of remaining water was turbid  
**Filter:** didn't smell of chlorine, wasn't being used because dirty and didn't know how to get a new one  
All connections were sealed  
Base cracked on back corner

## House 30

### Finca

3 daughters go 6 times per day, during rainy season go 4 times  
Only drink water from the finca even though they have a government tank  
Government tank used for cleaning and other purposes because the lid on the tank isn't kept on because it is too heavy to lift back and forth and the pump is broken  
Woman of the house says that she has chronic bronchitis and drinking rainwater makes it worse

### Existing Tanks

1 concrete tank, 1 government tank  
The tanks are cleaned when they are emptied. The tanks are cleaned by the children using chlorine and then soap  
Concrete lid is too heavy so they leave it off  
The pump to get water out of the tank is broken

### School

1 kid(14yr) goes to school  
5 other children are older and do not go to school

### Sickness

Woman of house has chronic bronchitis  
Woman of family had stomach ache 4 times but doesn't know

## House 31

### Maintenance

**First flush:** on right side of home (when facing the house) was not maintained regularly, full with turbid water and the mosquito netting on top was torn and full of debris. No divet below first flush.

The first flush located closer to the tanks had the netting intact but there was a small tear. The first flush was emptied and the little water that was in the system was clear. Uses first flush for toilet and flowers  
There was mosquito netting over the overflow.

The inside of the new tank it was dirty but the second tank that was a government tank was fairly clean.

The filter smelt slightly of chlorine. The filter was very ripped.

The second waterfall connection was leaking so they went to Roberto to ask for help fixing the system. Roberto came and glued it.

**Cleaning Tank:** man of house cleans the tanks, only been cleaned once when given in May 2014, tanks have been full since

cleaned with rag, chlorine and hot water

**Filter:** broke filter while cleaning it, still broken because has to be ordered through Rotoplas and she has no idea how to do that, would cost 120-150Q

2<sup>nd</sup> waterfall connection has leaked and asked Roberto for help fixing it

## **Finca**

Washes clothes at the finca 2 times per week and uses tank for drinking  
In July and August use the tank water to wash at home

## **Health**

No sickness in the family

## **School**

Has five grandkids in House 33 and they all go to school every day

## **Changes**

She is less tired

Saves 3 hours a day from not having to collect water

Spends time sewing extra cloth for sale and cleaning the house

Has sewed for 6 years but now does it for longer periods of time

# **House 32**

## **Technical**

Not changing roof

Will replace the old gutter inside the house instead

New gutter length 57" outside plus 7" wall, 12' 30" inside kitchen, 7" wall, 10" outside in total: 21' 3" across

## **Finca**

goes to finca 3x per week for clothes

## **Existing Tanks**

tanks used only for kitchen

Cleans tank every 4 months when empty

Uses chlorine and brushes

## **School**

4 kids, 3 go to school

2 in morning, 1 in evening

## **Sickness**

No observed health issues in house or community wide sickness

# **House 33**

## **Finca**

Go to finca 406 times per day, with Marcela's house 8 times per day  
Use both finca and tank water for all purposes

## **School**

3 kids at school from 2-6:30pm

## House 34

### Finca

Use finca after the tank is used  
Use both finca and tank water for all purposes  
When tank is empty, go to finca 11 times per day  
Don't pay anyone to go to finca for them

### Existing Tank

2 existing tanks  
Cleans tanks when empty, 2-3 times per year  
A child uses a broom and chlorine to clean the tank

### Finca vs. Tank

Believe tank water is cleaner than finca when boiled  
Dust in finca water but not in the tank

### School

5 children  
3 go to school (7:30-1pm) and 2 go to high school in evening  
All go to school every weekday

### Sickness

Mild sickness that lasted  $\frac{1}{2}$  day this year  
Once for the mother and 2x for both kids  
They sometimes get fevers when the weather changes

## House 36

### Finca

Goes to finca 10-15x per day  
Not always her. She pays someone 10 Q when she is too tired  
The finca is her only water source  
In the winter, they sometimes collect rainwater outside of their house with buckets  
They use all the water they collect for bathing, washing, and consuming.  
Boils water  
There is a noticeable difference between the water in the wet and dry seasons

## School

4 children; 7 yrs, 5, 2, and 6 months old  
The older two go to school every weekday, 1-7 pm

## Sickness

The two year old was sick 2 times this year with an unknown infection  
Fever spread throughout many nearby towns

## Other

Put covering on the new tanks so people wouldn't touch the tanks when going to the finca

# House 40

## Finca

Go to the finca every day, once in morning before it is hot and once in the afternoon when it is cool  
One woman goes with her child  
During rainy season goes less often

## Existing Tanks

Tanks cleaned four times a year with soap, chlorine and brush  
The kids go in the tanks to clean the tanks  
They clean the tanks one at a time  
They drink finca water and use tanks to wash  
It's easier to wash at the tanks  
The water is the same here and at the Finca  
There is not a lot of water right now  
Government Tank 1  
Lid is on tank  
Can see things floating in the tank water  
Government Tank 2  
Lid is on tank

## Finca vs. Tank

The water is the same in the tank and the finca

### **School**

Only two kids go to school  
There are only two kids who are school age  
They go to school between getting water early and late

### **Sickness**

Don't go to school when they are sick  
Doesn't think water is a factor in the sickness  
The seasons are more of a factor  
They boil the water always

## **House 43**

### **Technical**

Roof is 2.5 meters tall  
Moving tanks to the side of house near road  
Must keep within property line which is 1.6 meters from the fence running besides their home

### **Finca**

All water used comes from finca  
Go ten times a day and use finca water for everything, including washing the corn  
50 minute round trip to finca  
Boils water before drinking  
Husband goes to the finca to  
Goes to finca in the morning when it is cooler

### **School**

No children school aged, 5 month old son and 3 year old daughter (Glenda)

### **Sickness**

Hasn't been sick since she moved from her mothers house  
No sickness this year but last year the daughter got sick three times  
Didn't know if the cause was water or weather  
They often boil their water but not always  
If there isn't time and she is making a drink for a visitor or her husband she might not

**Other**

Plans to sleep in once system is implemented because she won't have to go to the finca, normally wakes up at 3:30 am  
She will be able to do her chores whenever she wants

## 6.0 Appendix F – Construction Diagrams

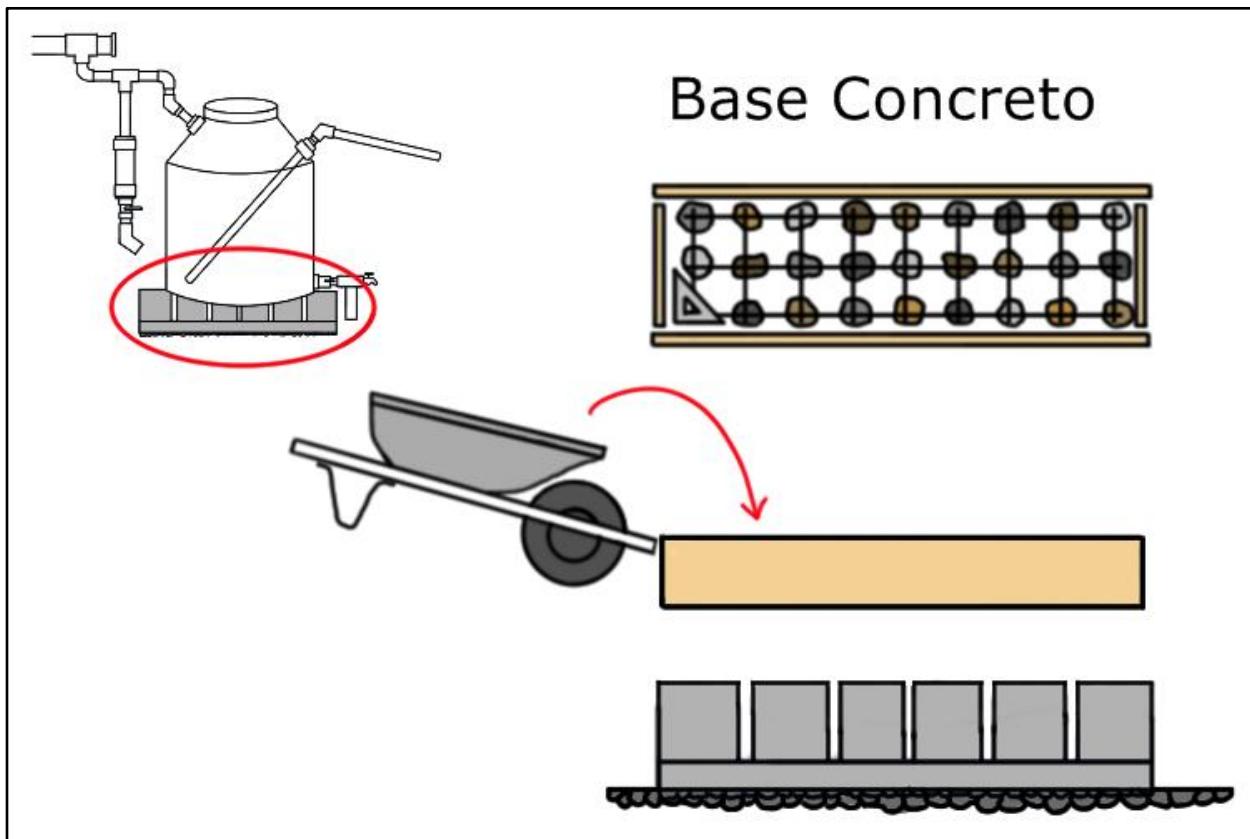


Figure 38: Visual education for the construction of a concrete base.

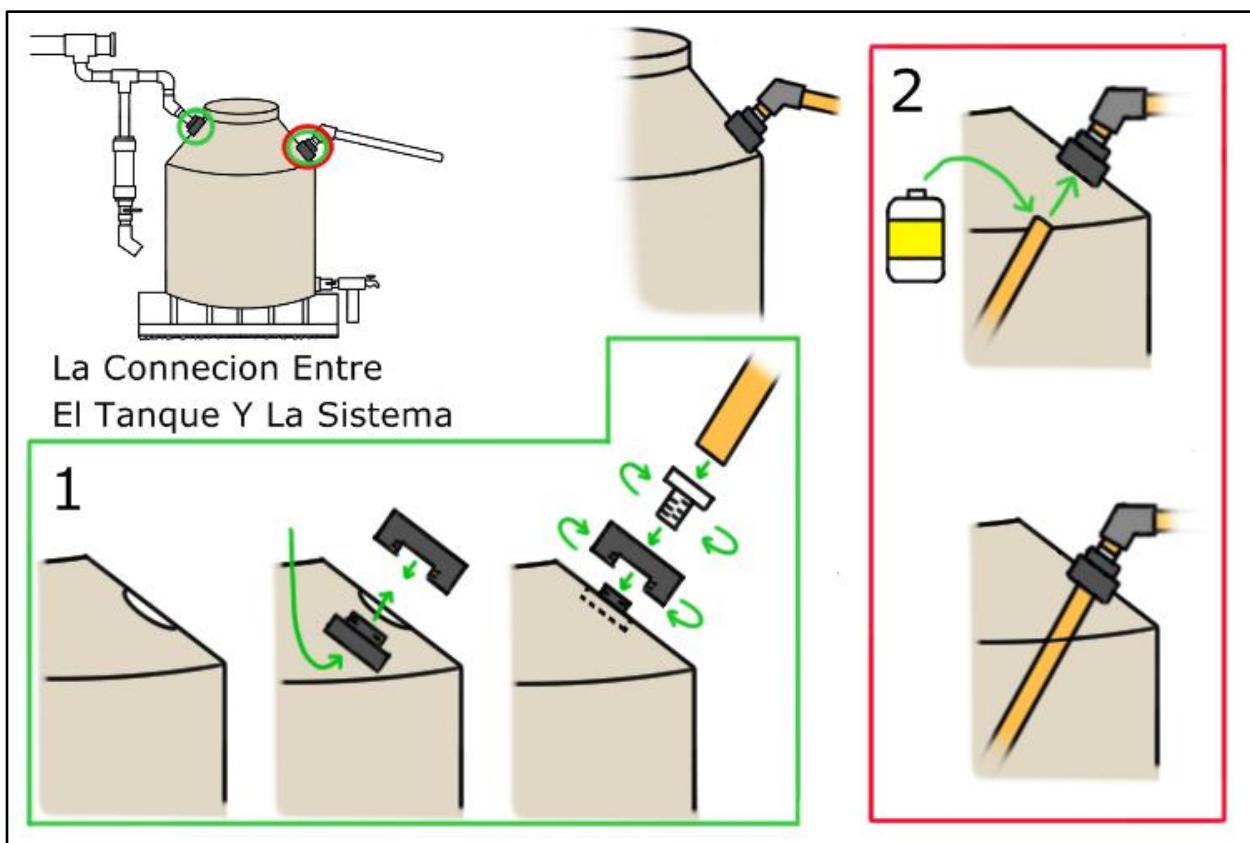


Figure 39: Visual Education for the use of Rotoplas bulkheads.

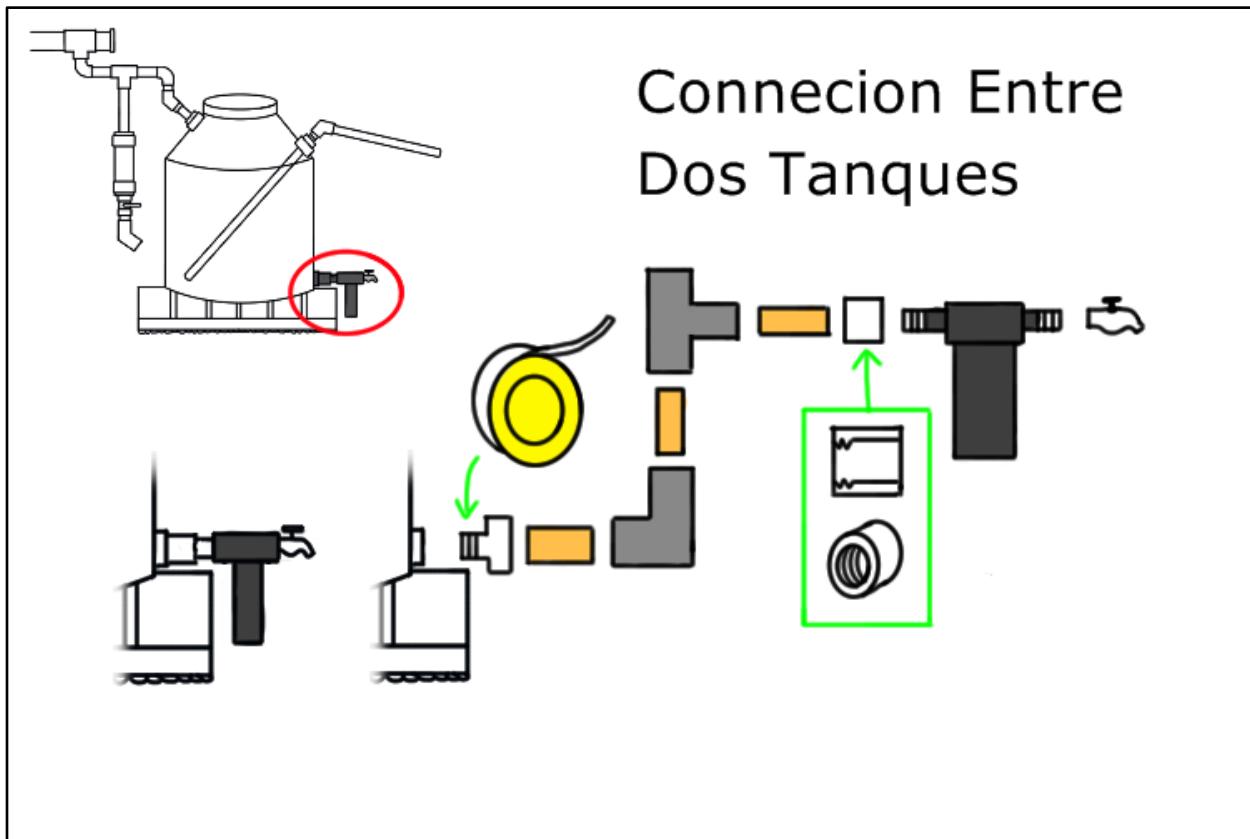


Figure 40: Visual education about the connection between two tanks joined at the bottom.

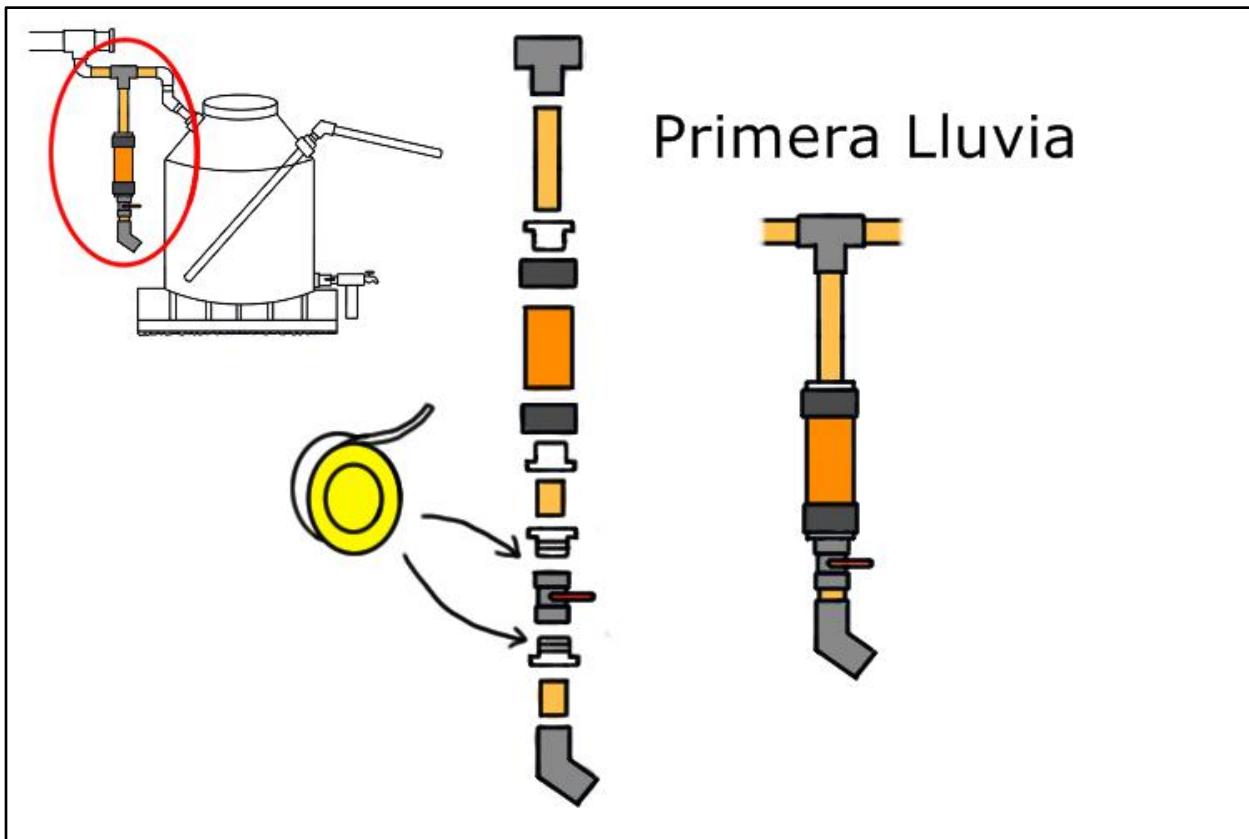


Figure 41: Visual education showing the proper construction of a first flush.

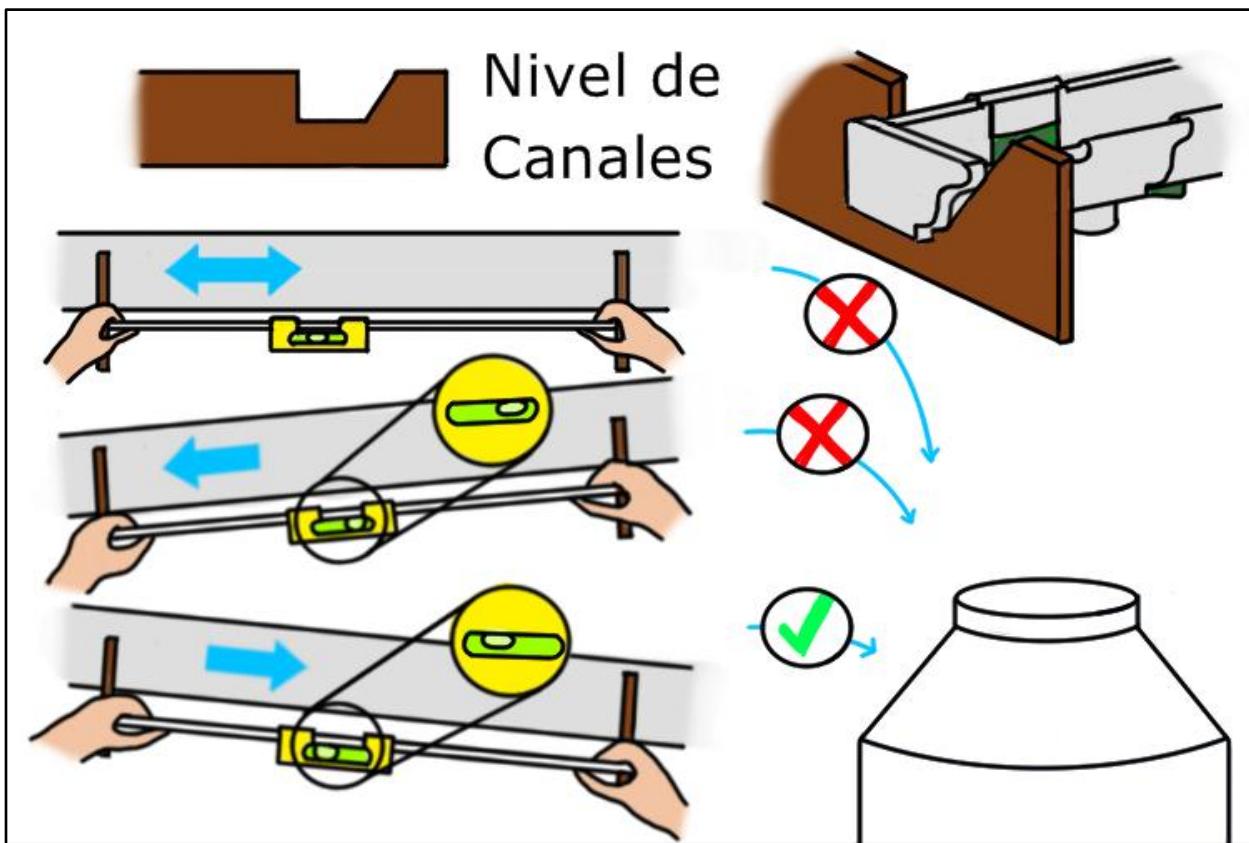


Figure 42: Visual education showing the proper orientation for gutters leading to the tanks.

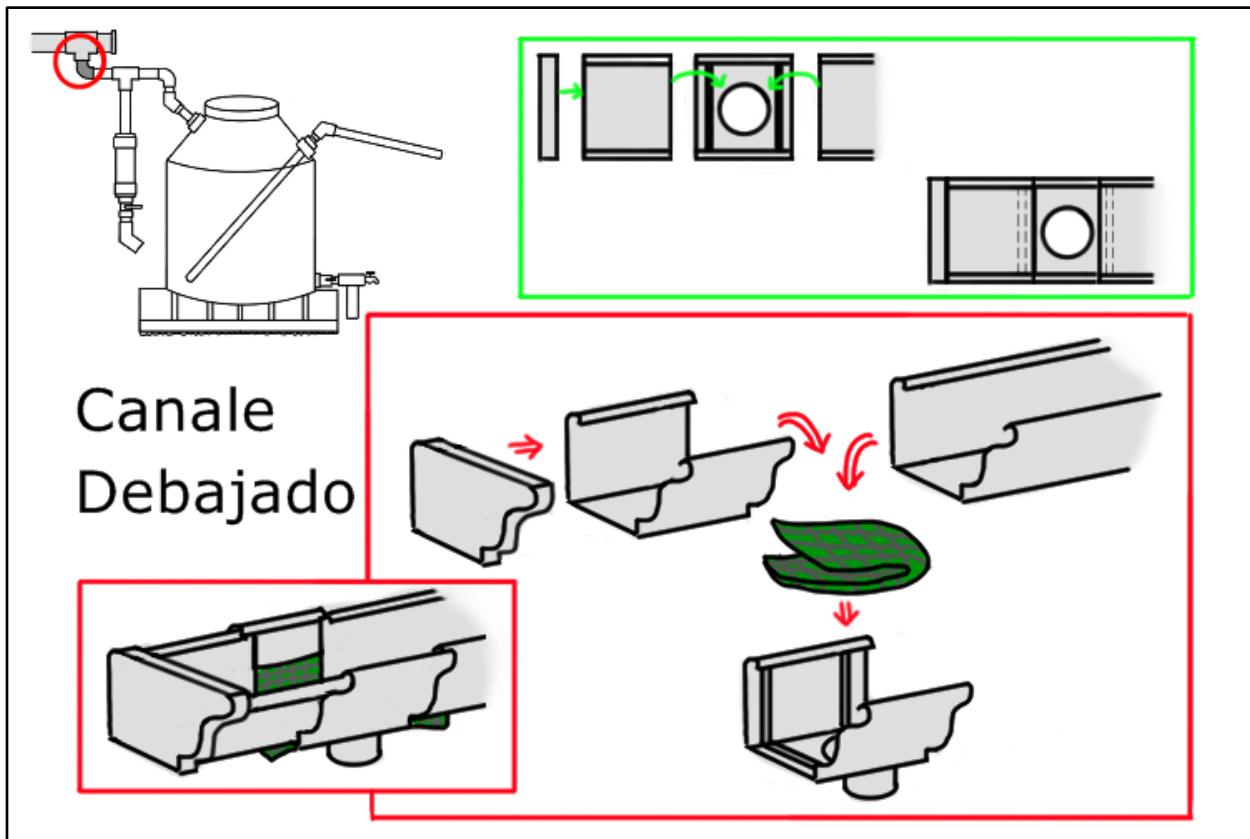


Figure 43: Visual education showing the proper construction of a gutter downspout.

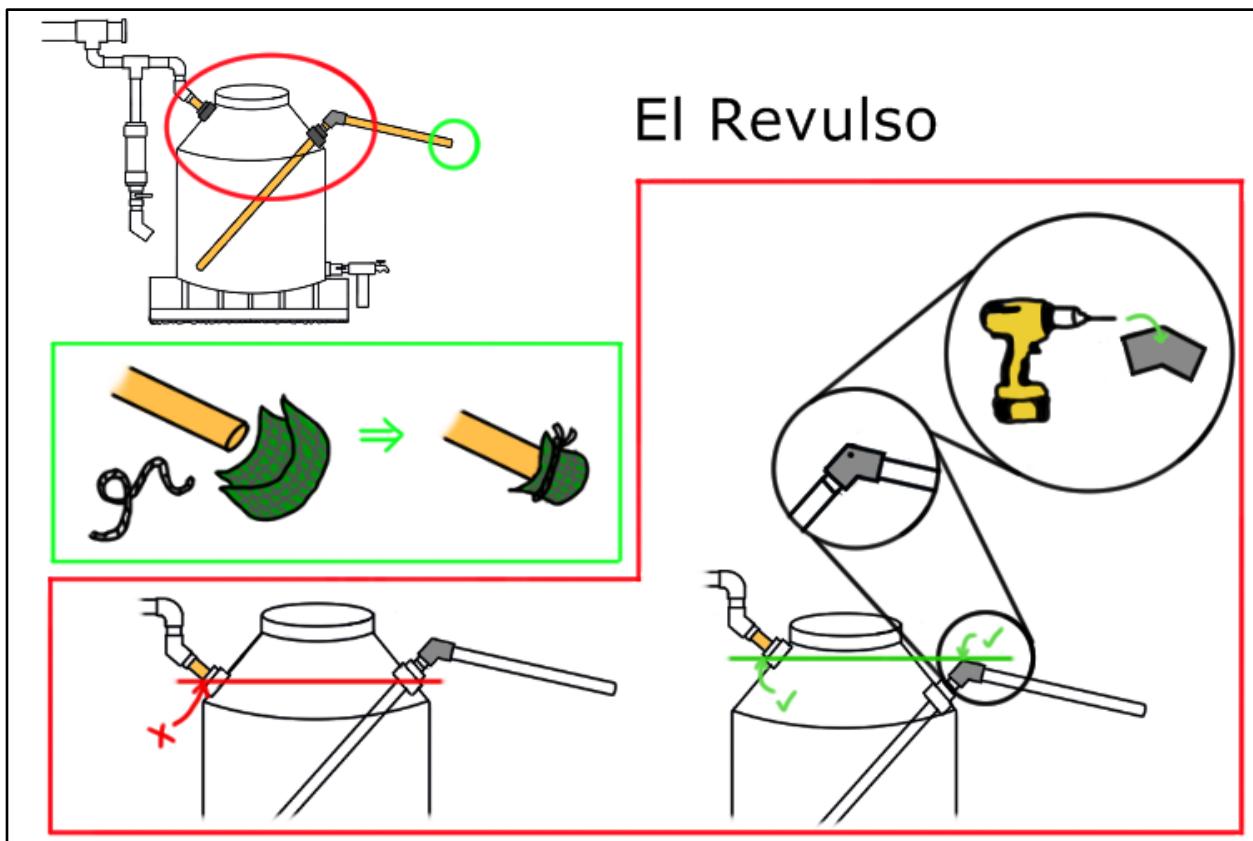


Figure 44: Visual education showing the proper construction of a system overflow.

## 7.0 Appendix G – System Drawings

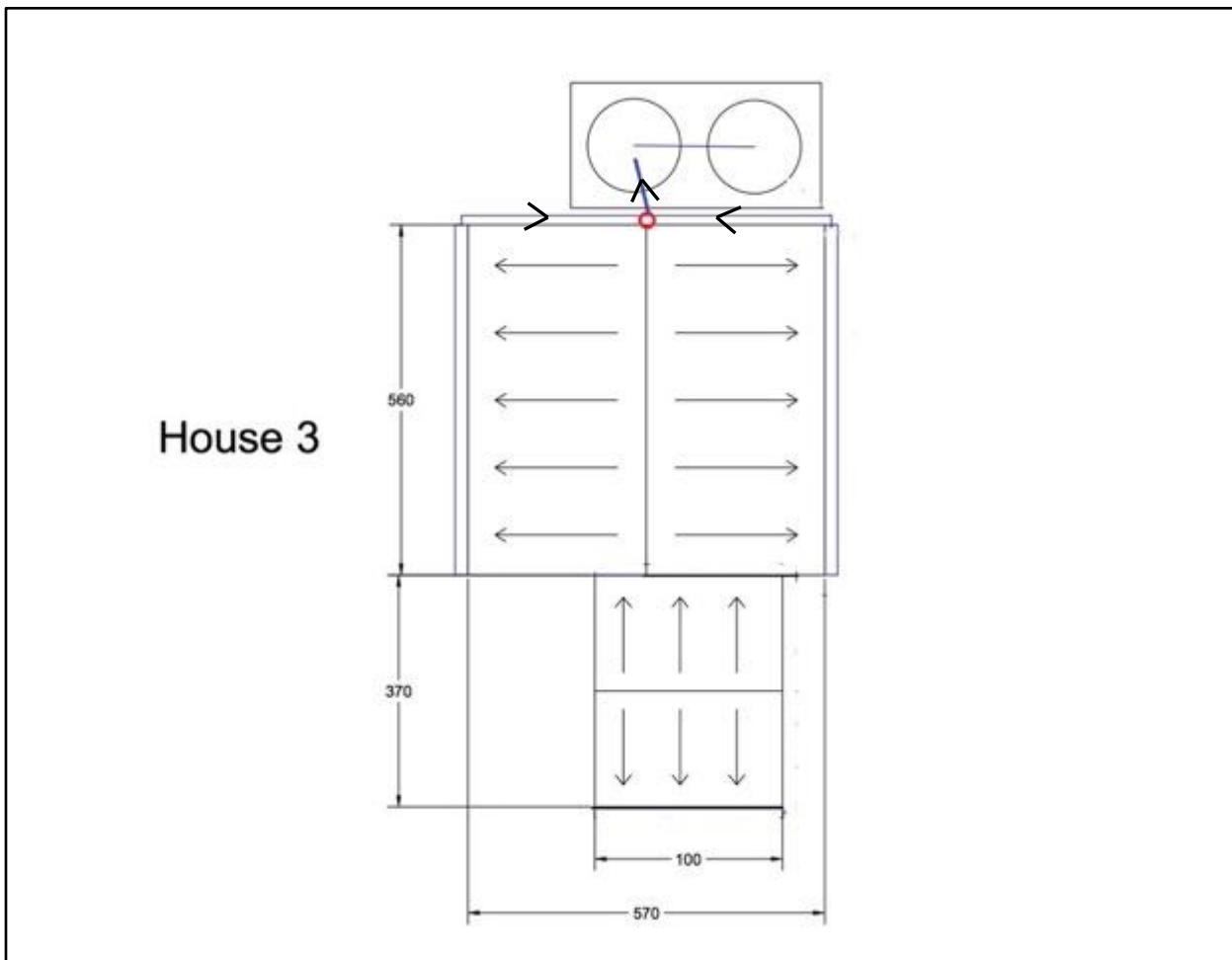


Figure 45: Modified drawing for House 3.

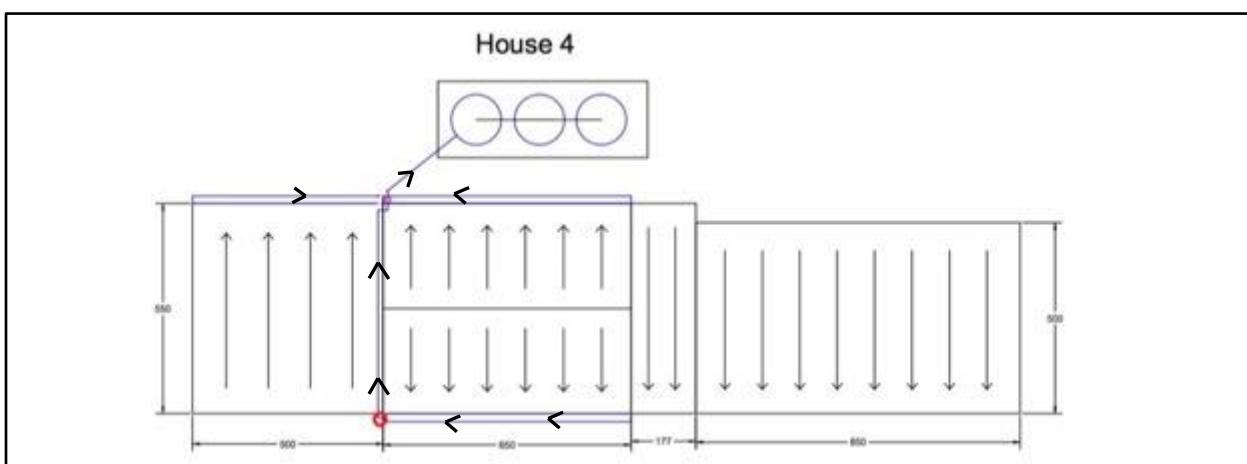


Figure 46: Modified drawing for House 4.

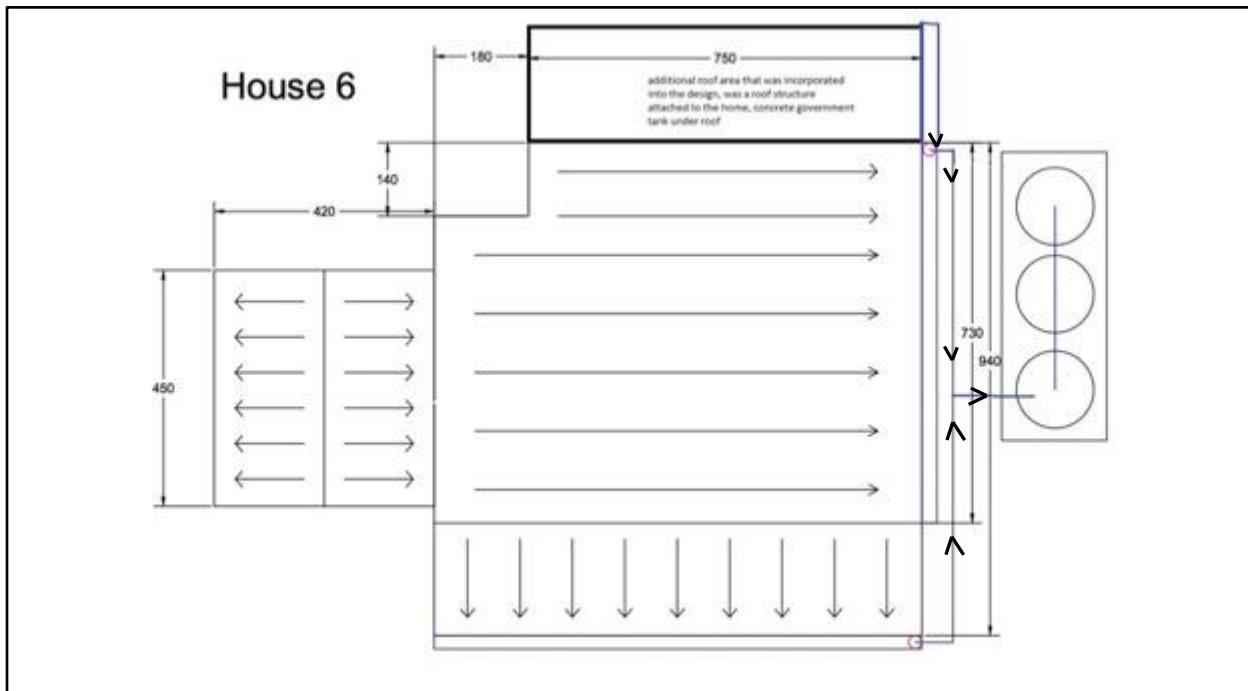


Figure 47: Modified drawing for House 6.

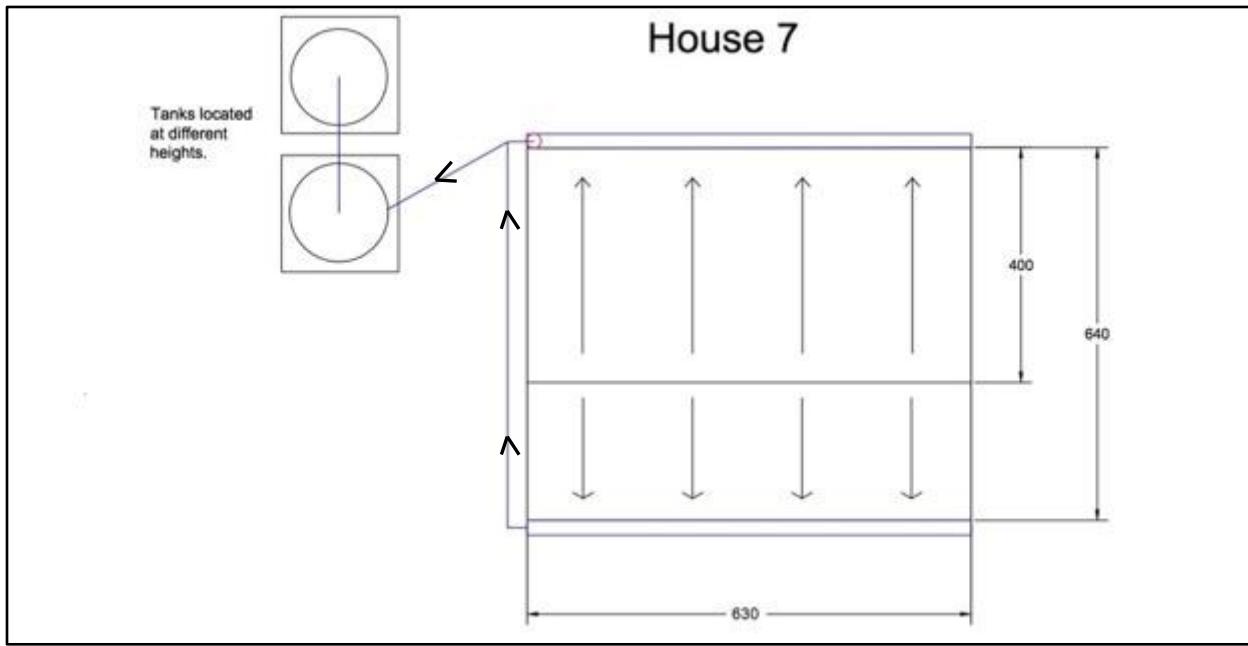


Figure 48: Modified drawing for House 7.

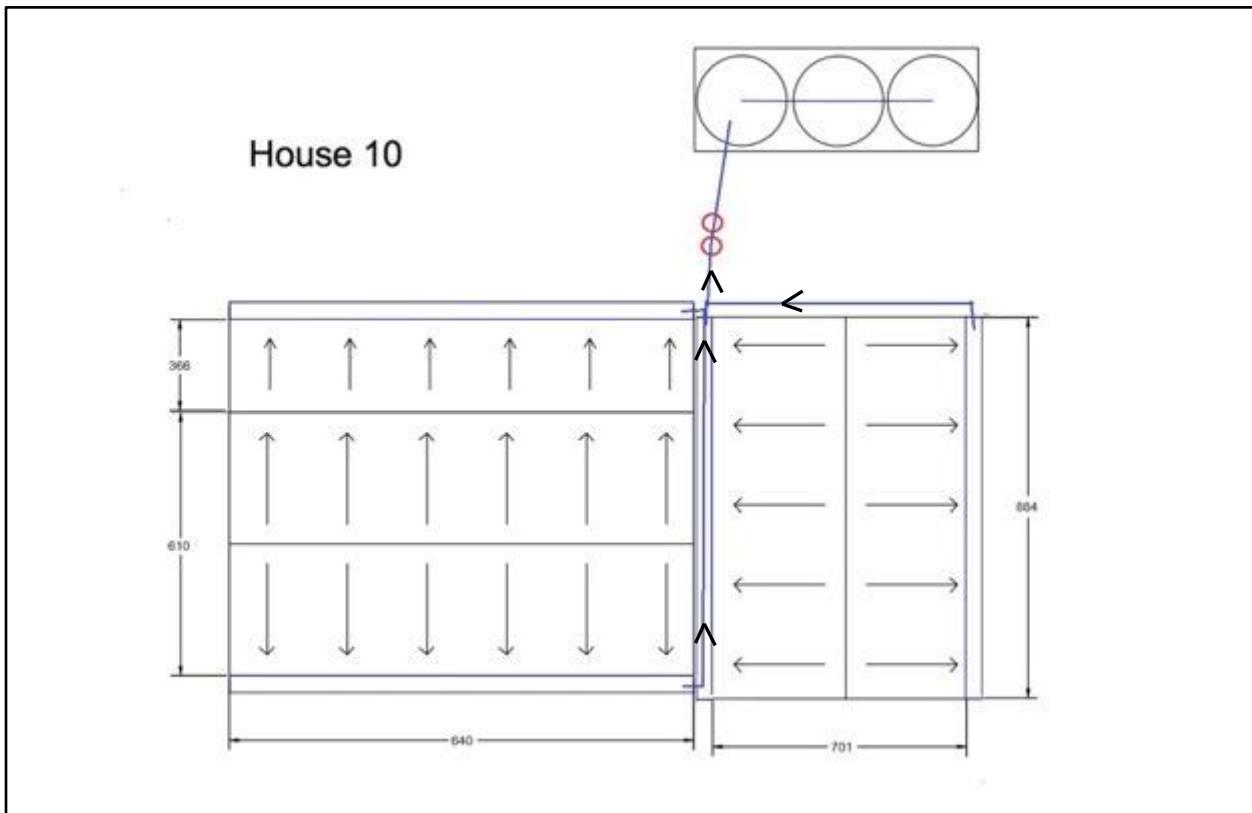


Figure 49: Modified drawing for House 10.

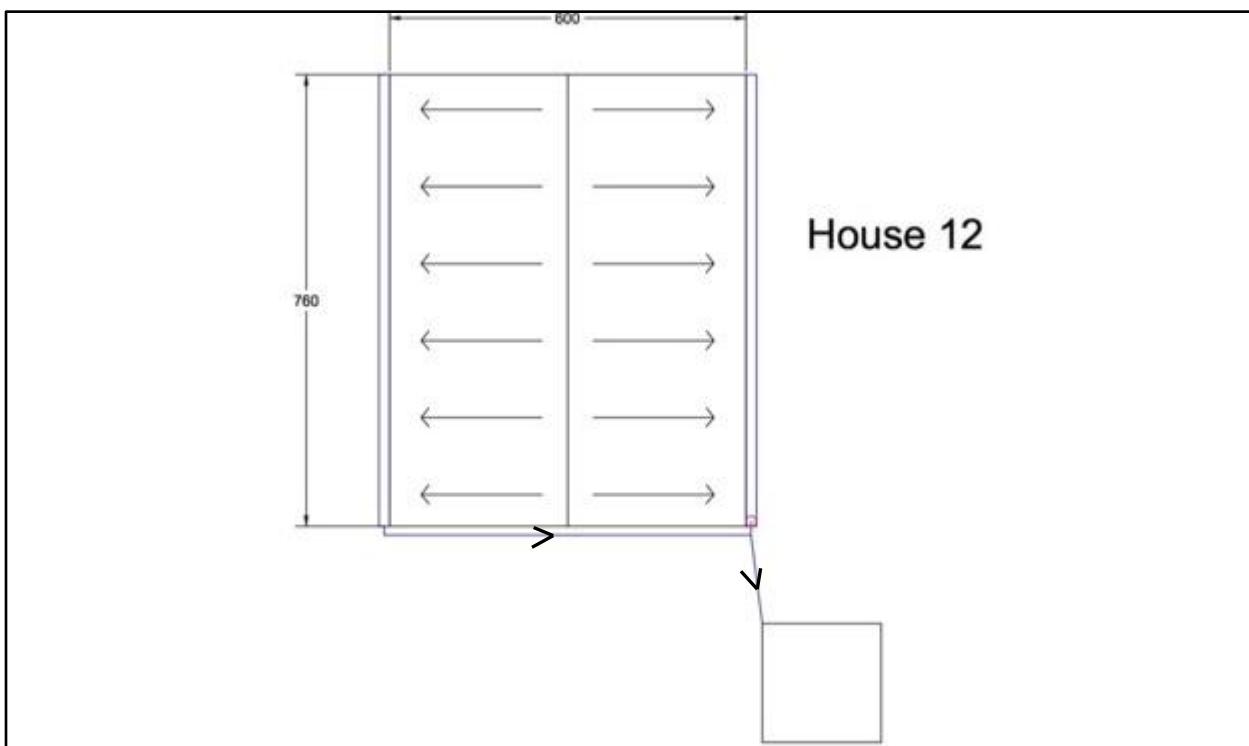


Figure 50: Modified drawing for House 12.

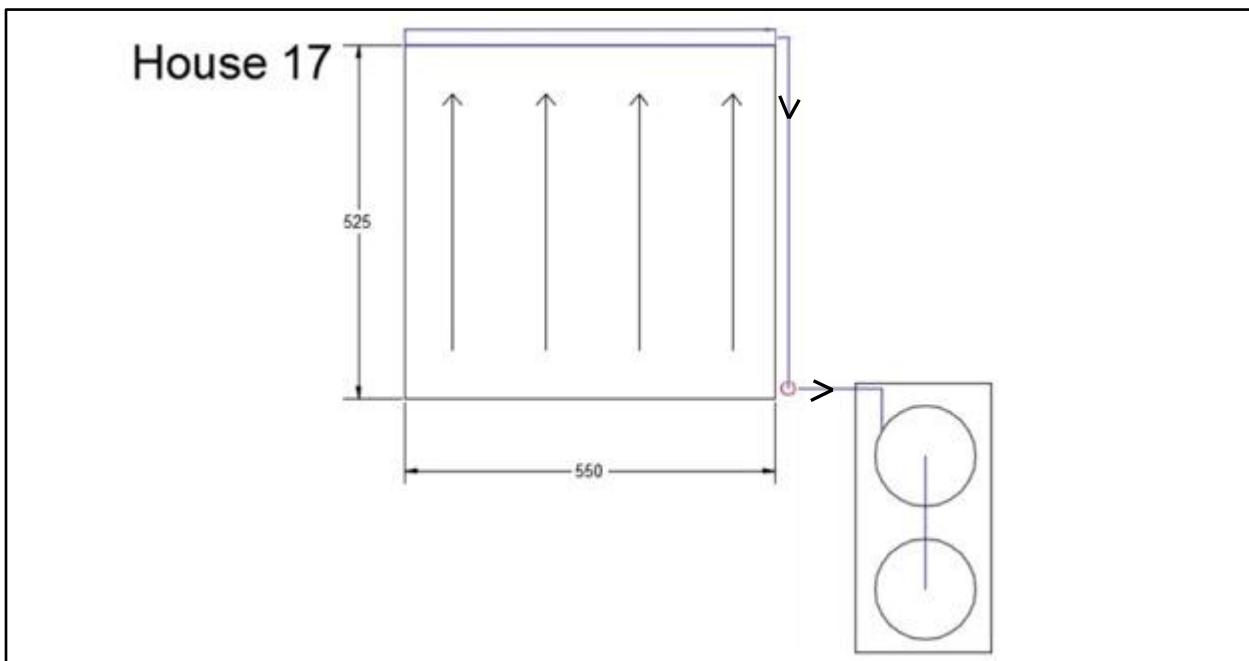


Figure 51: Modified drawing for House 17.

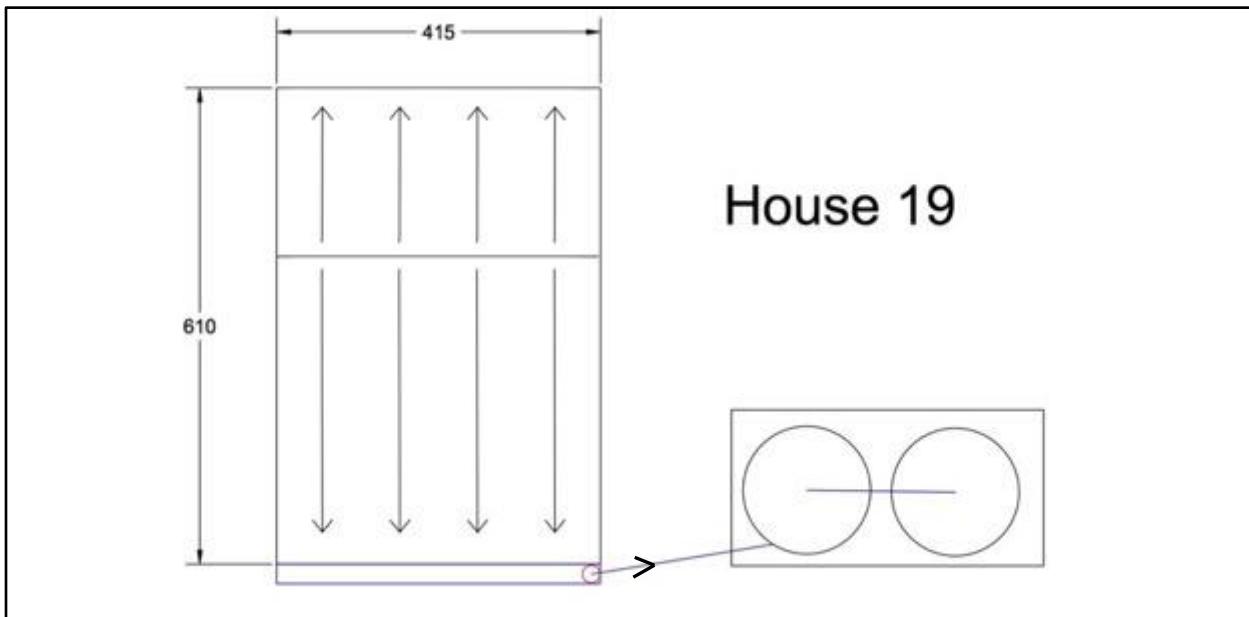


Figure 52: Modified drawing for House 19.

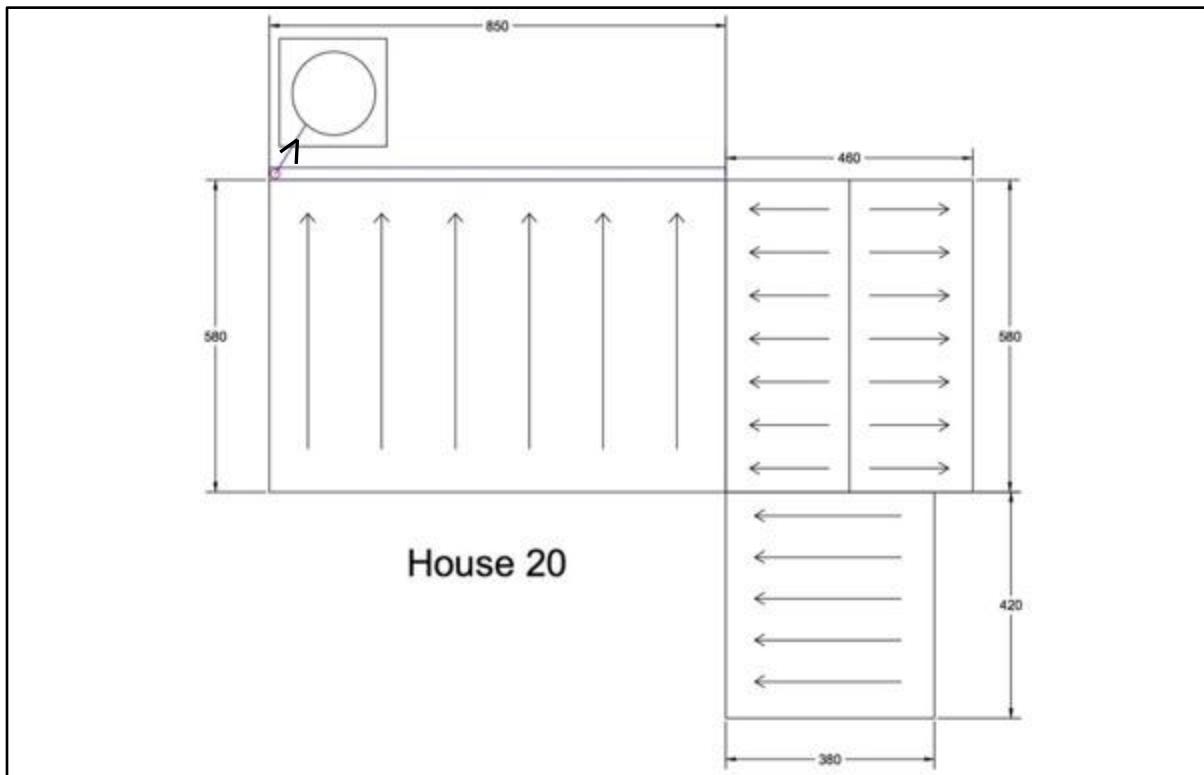


Figure 53: Modified drawing for House 20.

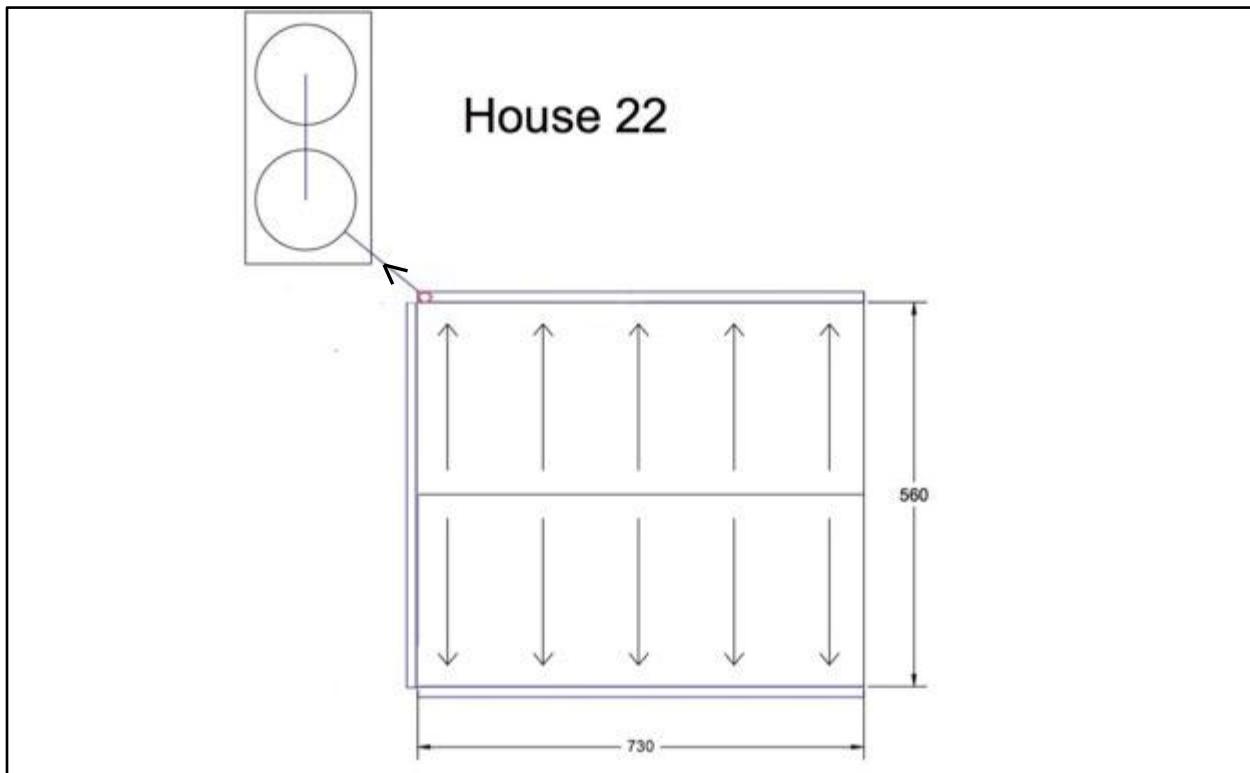


Figure 54: Modified drawing for House 22.

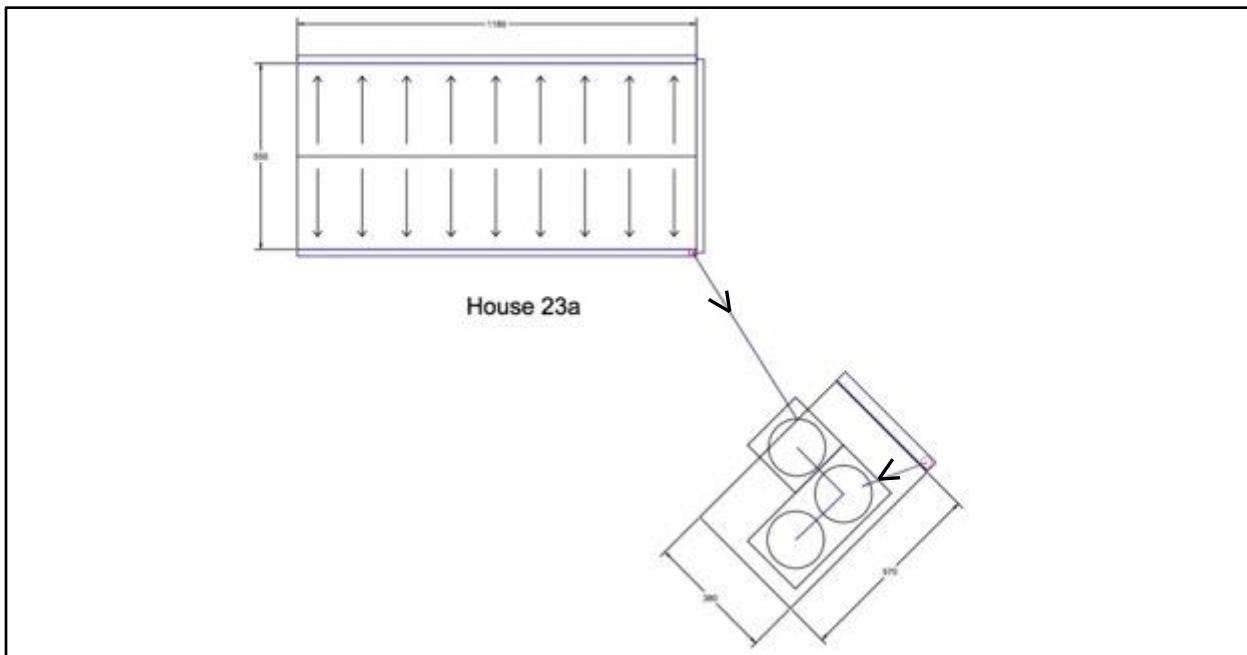


Figure 55: Modified drawing for House 23a.

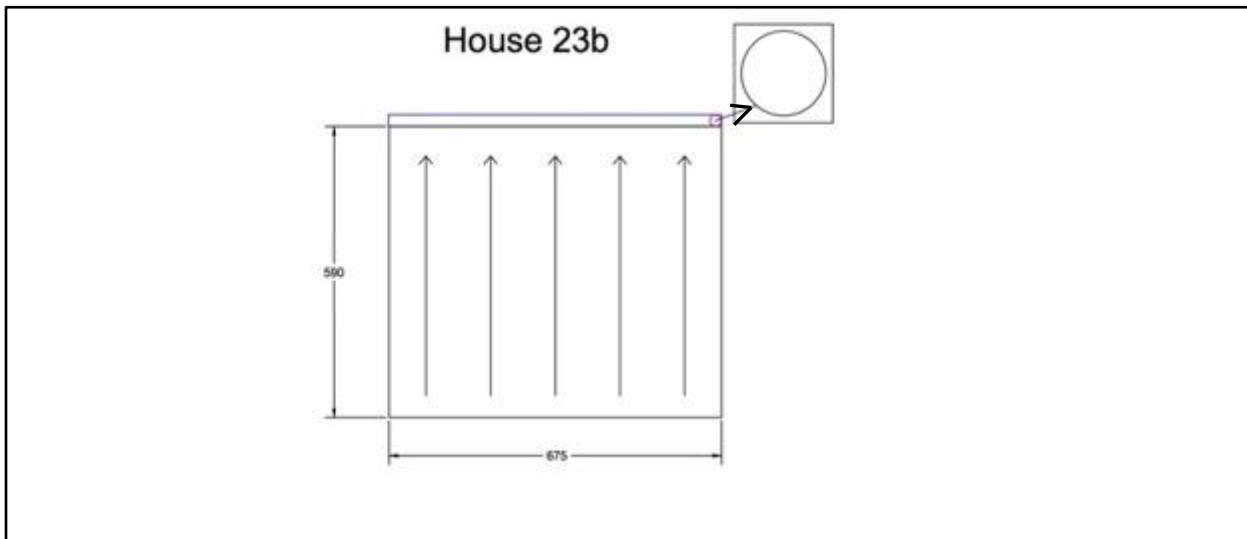


Figure 56: Modified drawing for House 23b.

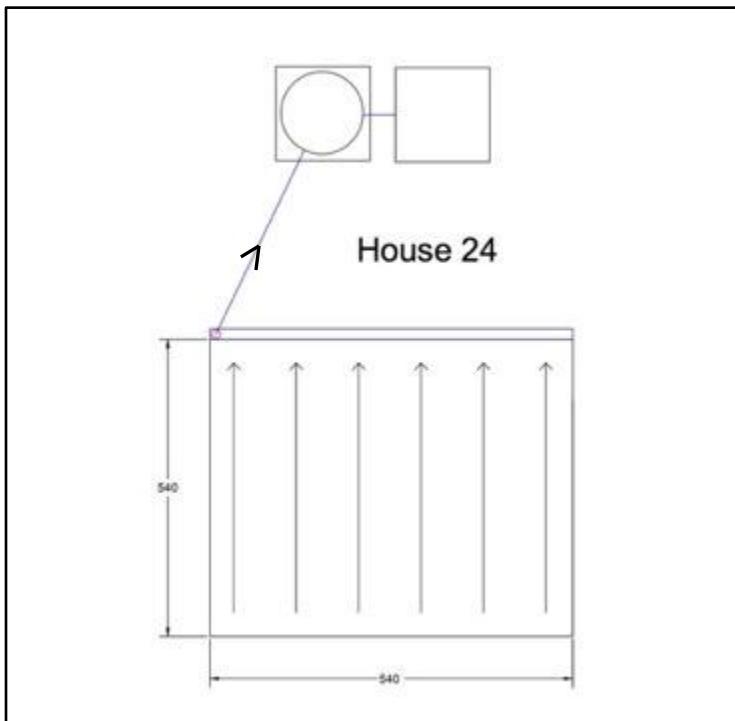


Figure 57: Modified drawing for House 24.

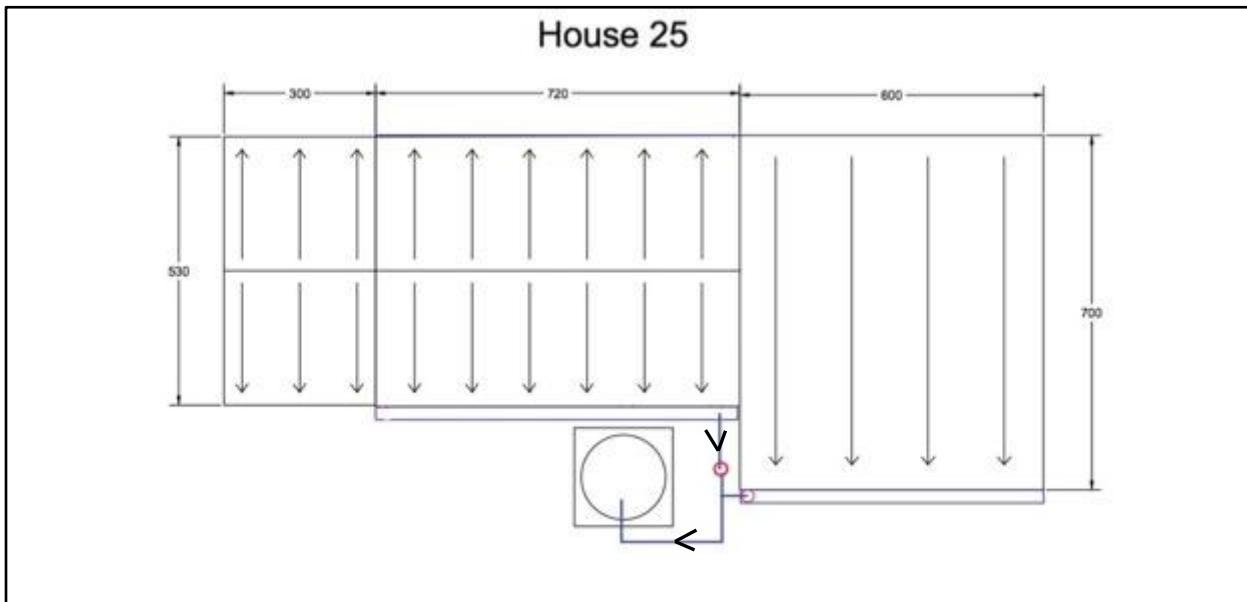


Figure 58: Modified drawing for House 25.

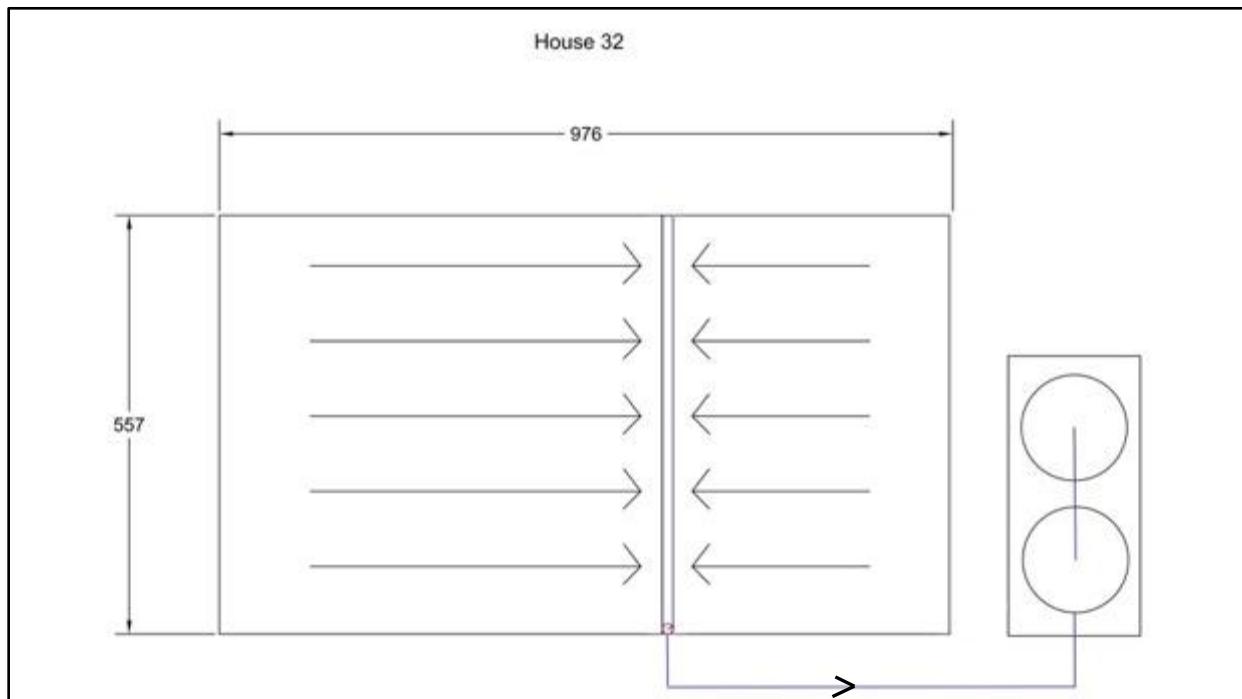
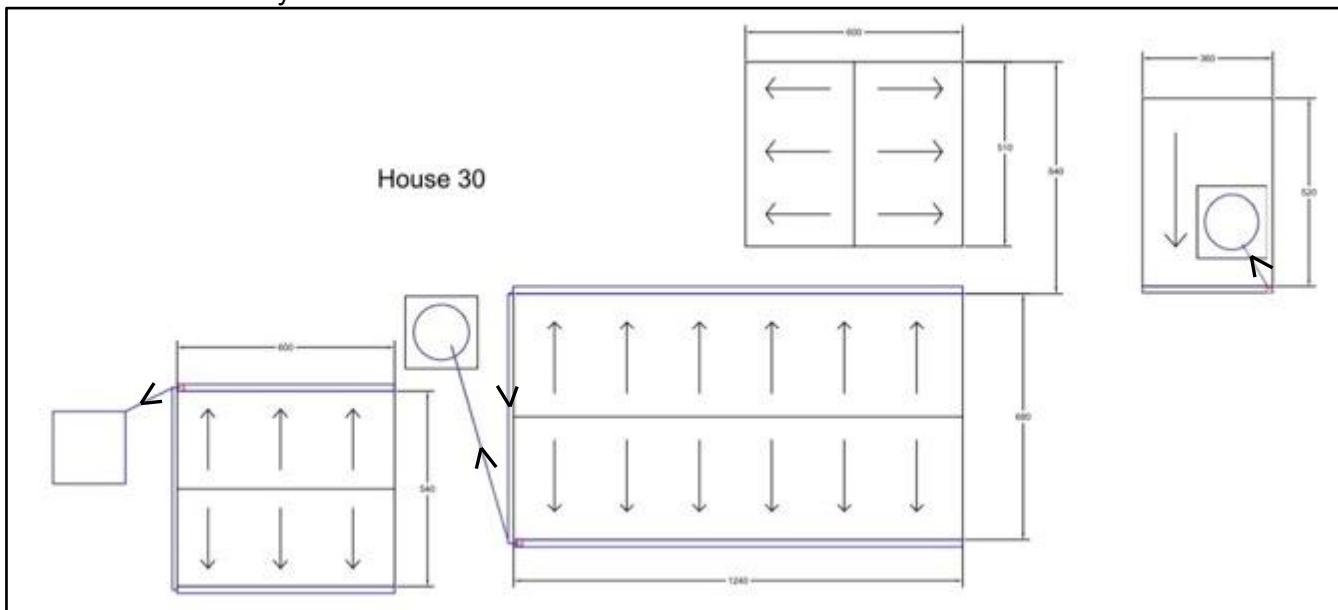


Figure 59: Modified drawing for House 30.

Figure 60: Modified drawing for House 32.

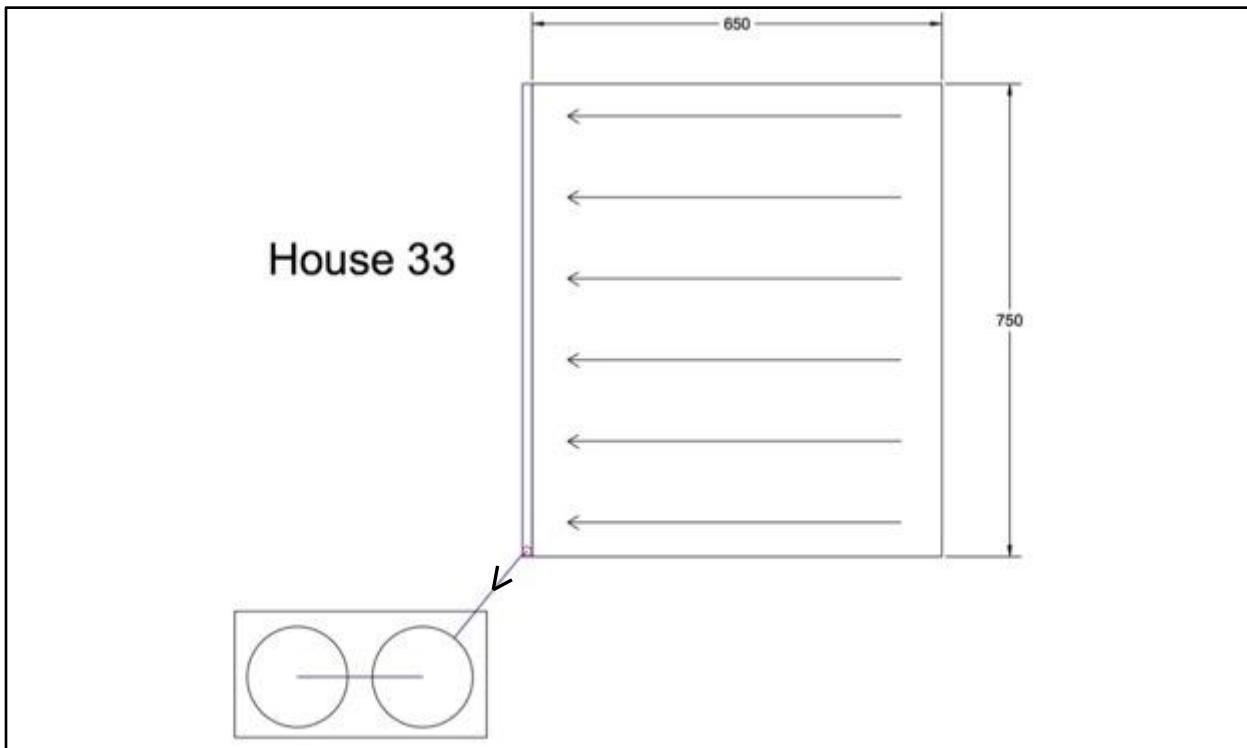


Figure 61: Modified drawing for House 33.

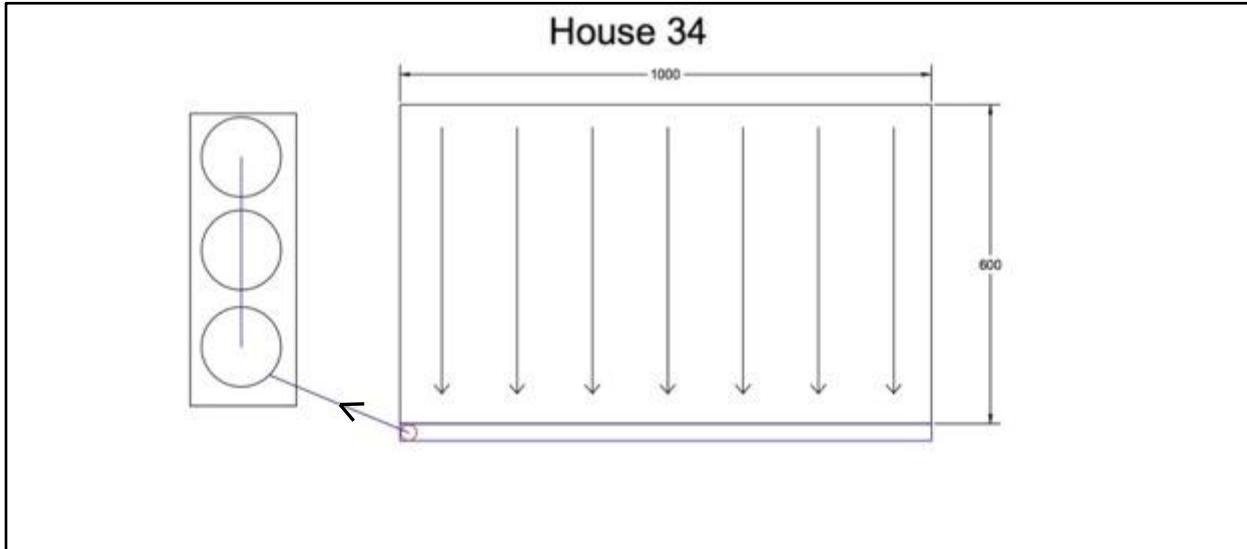


Figure 62: Modified drawing for House 34.

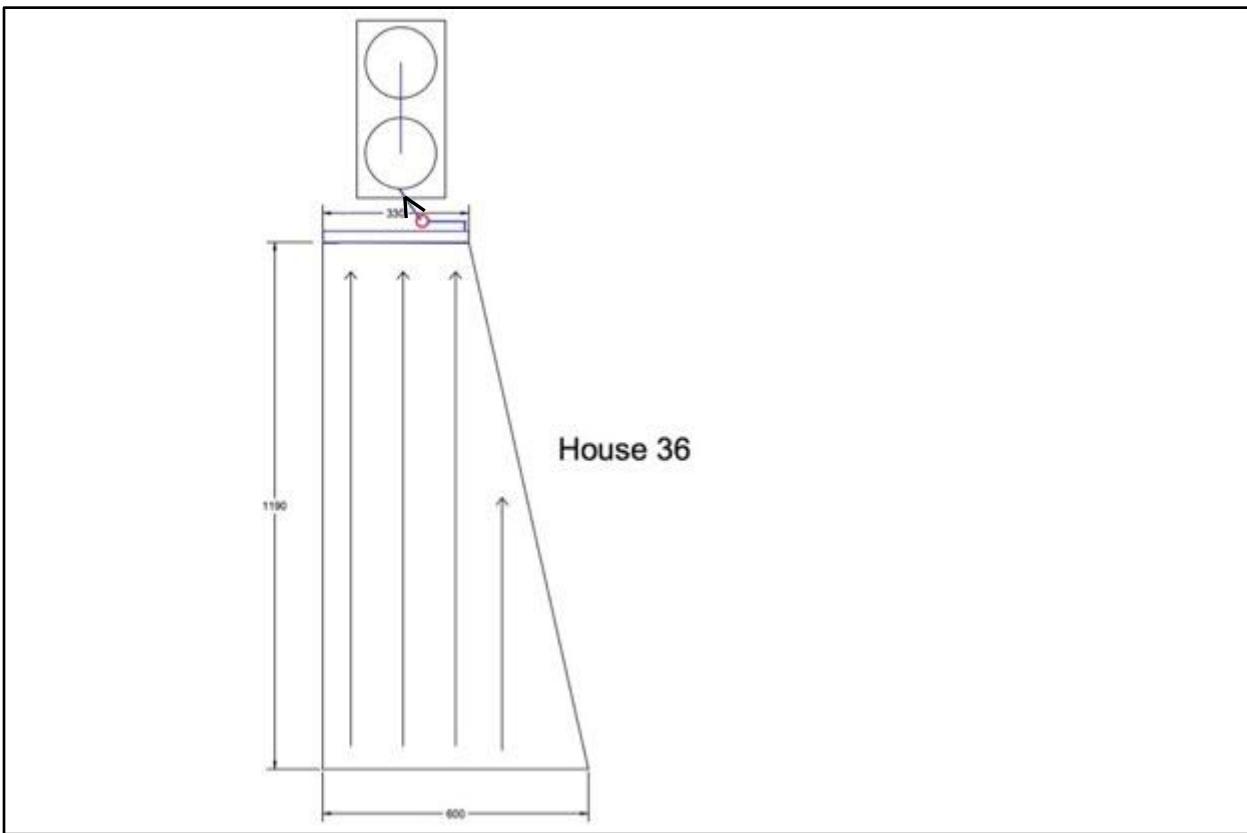


Figure 63: Modified drawing for House 36.

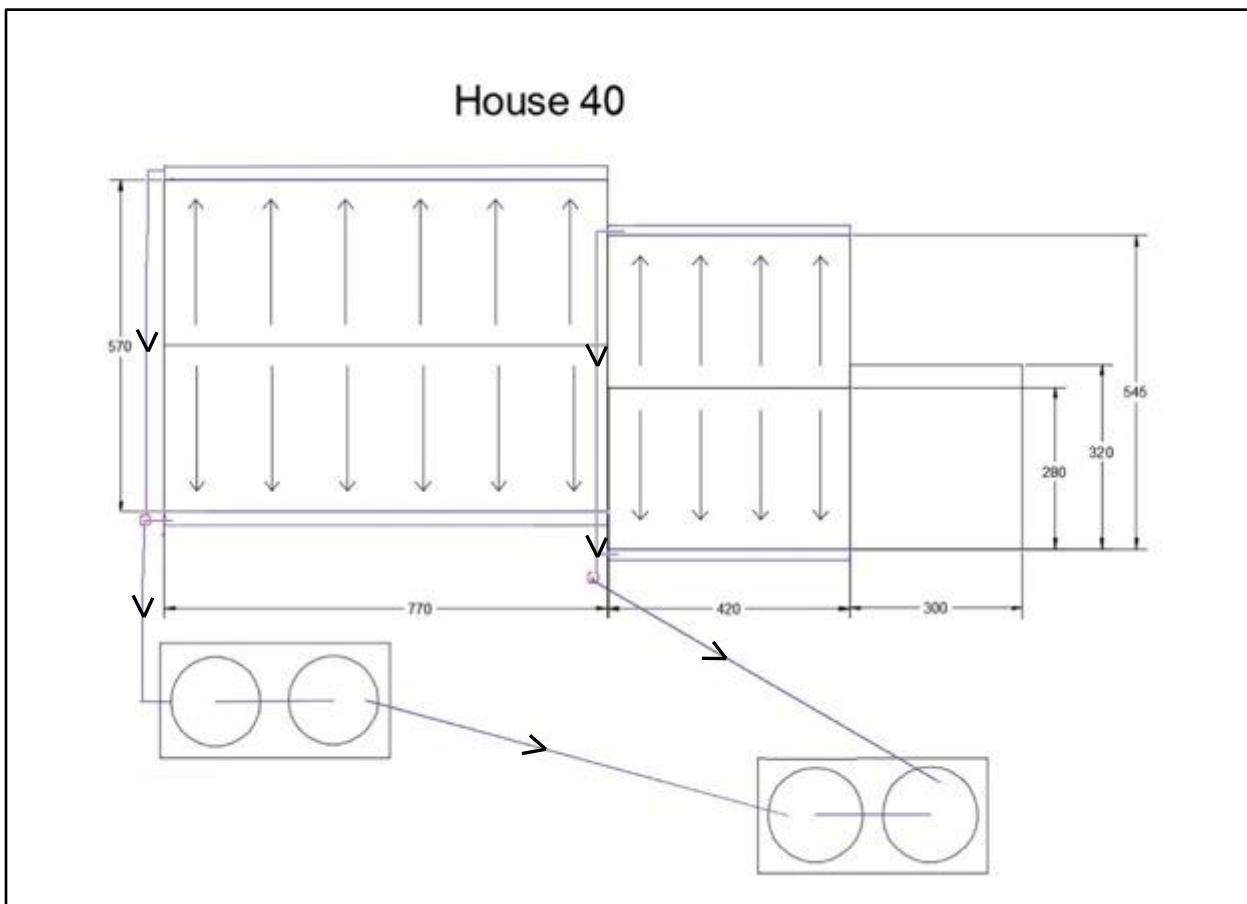


Figure 64: Modified drawing for House 40.

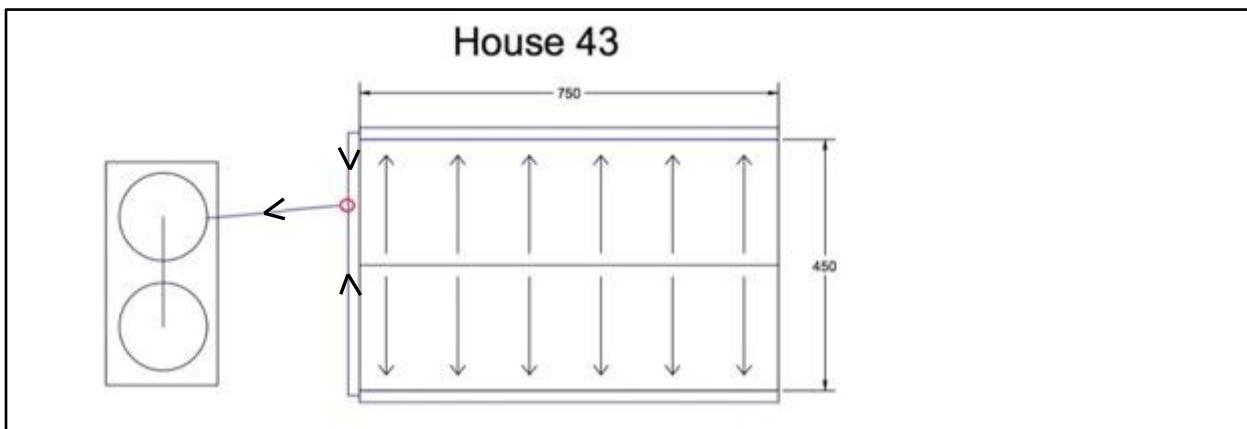


Figure 65: Modified drawing for House 43.

## 8.0 Appendix H – Education Booklet

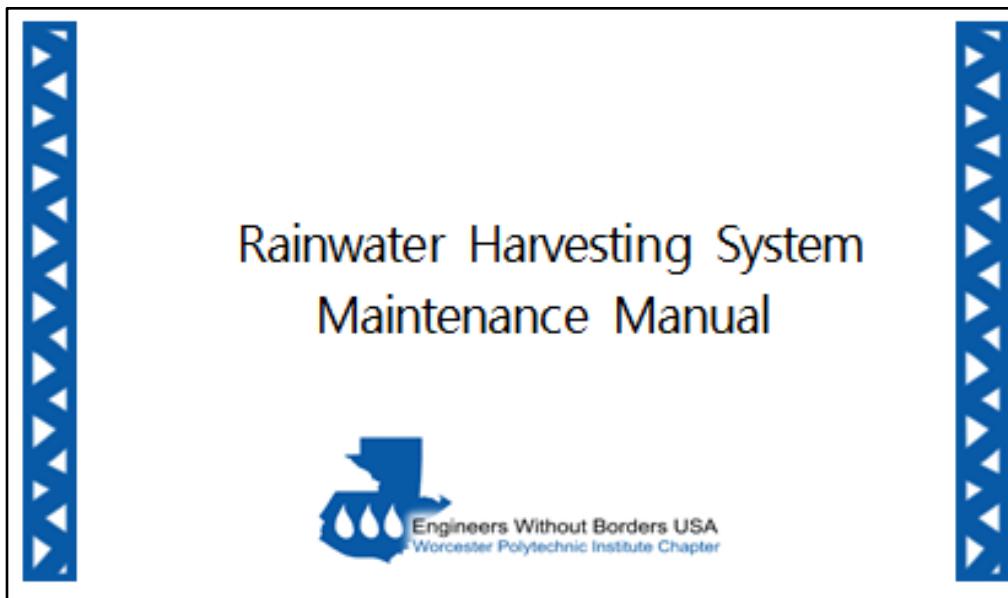


Figure 66: Cover of the Education Manual.

This education manual was distributed to every family in the community, regardless of their status as a system owner. The diagrams used in each page were further explained on a house-to-house basis.

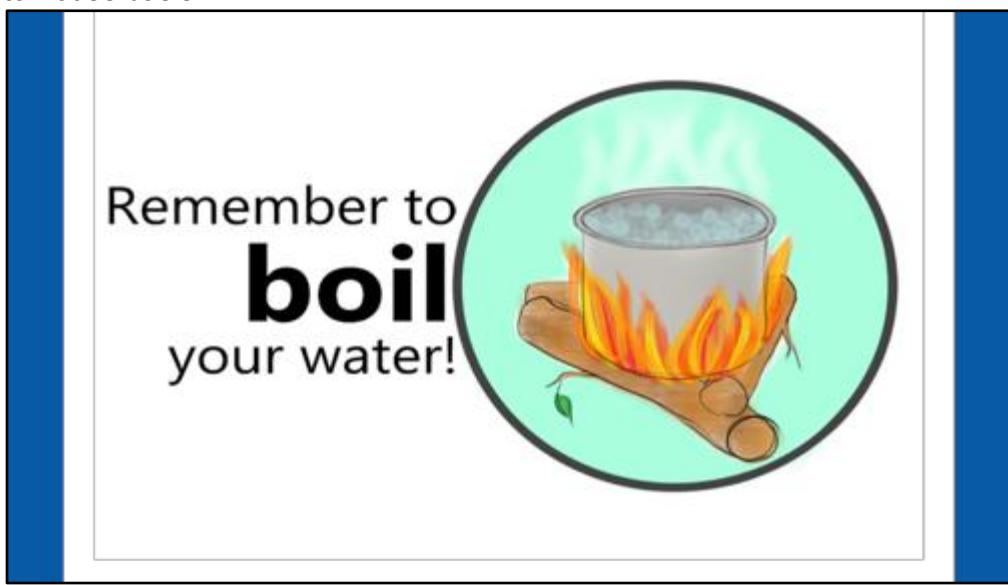


Figure 67: Page 1 of the Education Manual.

The first page in the manual depicts the most important message: boil water. Until the team can guarantee that tank water is potable, boiling water is an excellent precaution to prevent illness. Thankfully, this message is something that has been reinforced culturally for years. Based on information gathered through community interviews, nearly every family knew to boil their water before the EWB-USA WPI team first arrived.

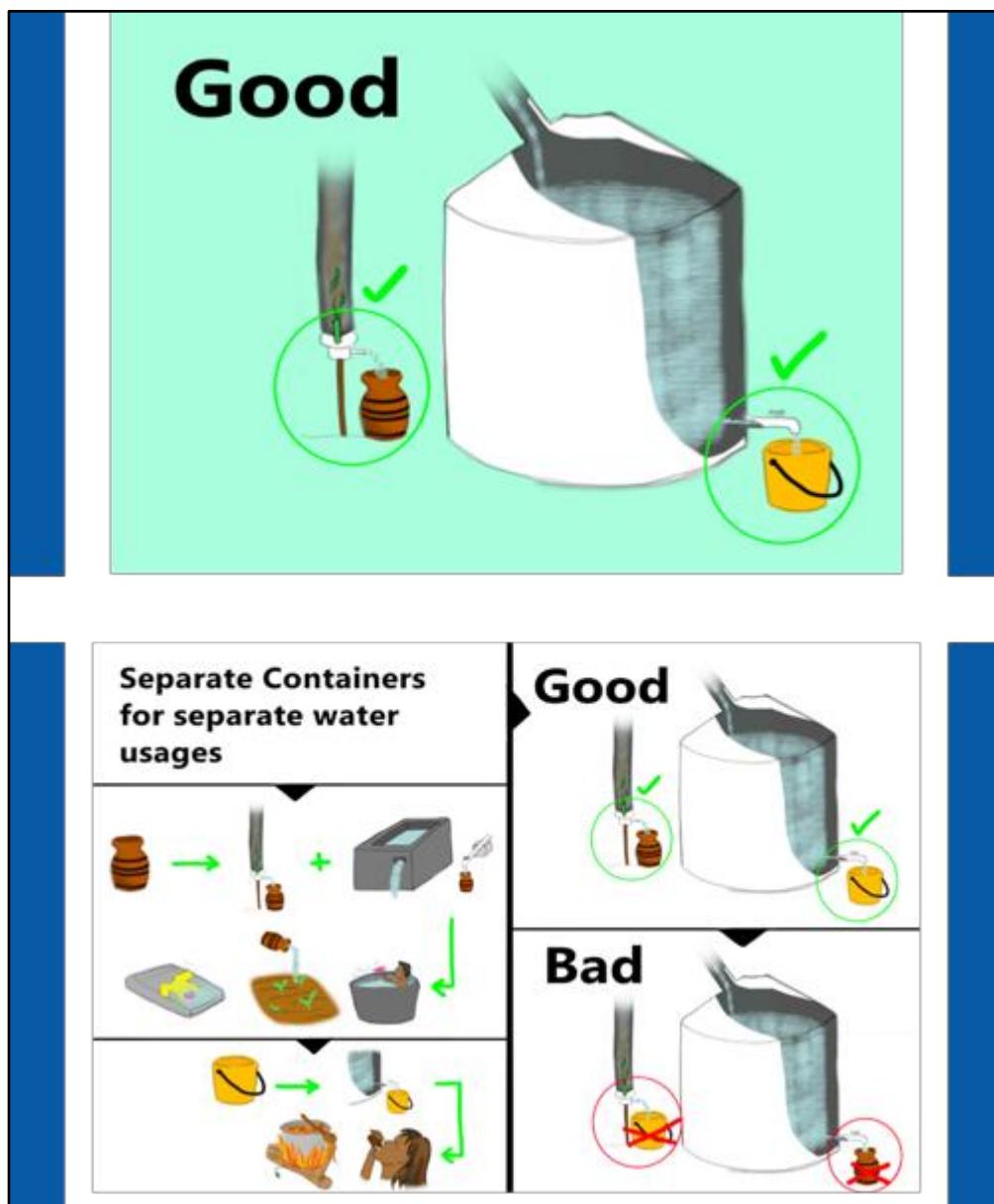


Figure 68: Pages 2 and 3 of the Education Manual.

The next two pages encourage the practice of separation of containers. It is important to use separate containers to collect water from the tanks (cleaner), the first flush (less clean), and the finca (dirty) to reduce cross-contamination. Each water source also has its specific uses (diagrammed on the bottom page).

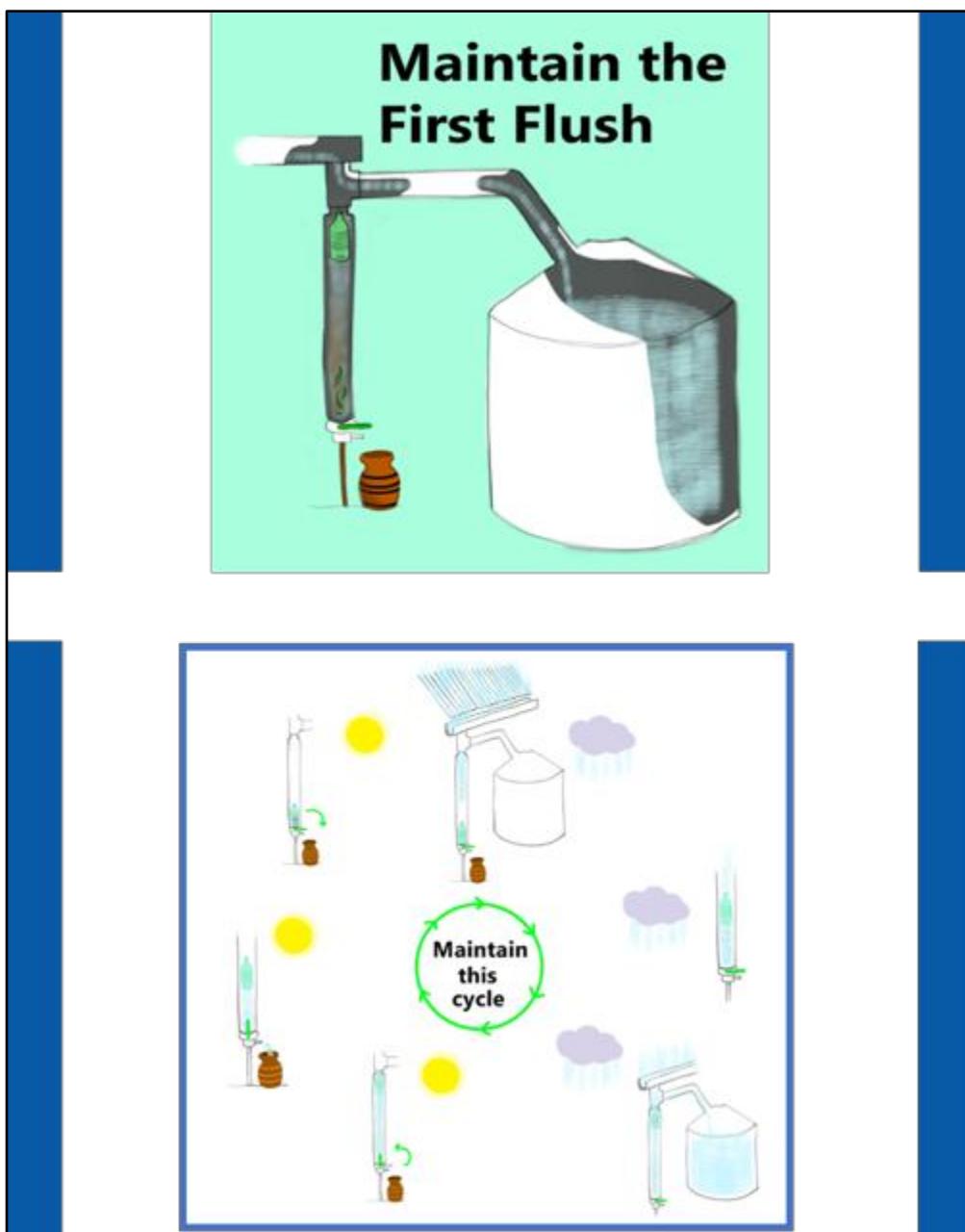


Figure 69: Pages 4 and 5 of the Education Manual.

In order for the first flush to effectively serve as the initial catchment for dirty water, the system must be maintained regularly with the weather. These pages emphasize the importance of taking action to maintain the first flush as weather dictates.



Figure 70: Page 6 of the Education Manual.

This diagram encourages regular cleaning of this filter, as seen in the miniature calendar. Families who received systems in prior years have already become acquainted with the idea of cleaning this filter and do so regularly.



Figure 71: Page 7 of the Education Manual.

The tanks themselves must also be regularly cleaned. Ideally, at the start of the rainy season, every family will chlorinate their tank water as pictured above. The reason for this timing is that the increased rainfall will be able to flush out the chlorine through the overflow more quickly, thereby removing the chlorine flavor from the water faster. Overall, this concept is a difficult one for community members to agree with as water is such a precious resource, sacrificing any amount of it for cleaning purposes sounds unreasonable.

## 9.0 Appendix I – Completed Community Payments

The document is a payment record card for House 1. At the top, it has the logos for "Museo Nacional de Arqueología y Etnología" and "ENGINEERS WITHOUT BORDERS USA WORCESTER POLYTECHNIC INSTITUTE CHAPTER". Below the logos, there is a table with the following data:

NOMBRE BENEFICIARIO:	Oscar Vicente Laj Lem
FECHA DE IMPLEMENTACIÓN:	10 enero 2,014
MONTO INVERTIDO EN SISTEMA:	Q6,723.55
MONTO TOTAL A PAGAR:	Q.336.18

Below the table is a grid for tracking payments, with columns for "NO.", "PAGO", "FECHA", "ABONO", "SALDO", "FIRMA ENTERANTE", and "NOMBRE RECEPTOR". The grid shows the following entries:

NO.	PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1	2014-01-10	Q.75.00	261.00	261.00	<i>[Signature]</i>	<i>[Signature]</i>
2	2014-01-10	240.00	21.00	241.00	<i>[Signature]</i>	<i>[Signature]</i>
3	2014-01-10	21	0100	—	<i>[Signature]</i>	<i>[Signature]</i>
4						
5						
6						
7						
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11						
12						

Handwritten signatures are present over the grid and below it. At the bottom left, it says "DOBLE CONTROL" and has a signature. On the right, there is a circular stamp for "CeCEP Coordinadora Educativa Popular MINISTRACION".

Figure 72: Payment record for House 1.

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NOMBRE BENEFICIARIO: Filomena Guatim  
FECHA DE IMPLEMENTACIÓN: Mayo 2014  
MONTO INVERTIDO EN SISTEMA: \$7489.39  
MONTO TOTAL A PAGAR: Q 374.45

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1	01/06/2014	30000	74.45		
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

DOBLE CONTROL

Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.

Figure 73: Payment record for House 5.

Museo Kekchi  
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MONSIEUR BENEFICIARIO: Cecilia Lem Soto

FECHA DE IMPLEMENTACIÓN: 22/05/14

MONTO INVENTARIADO EN SISTEMA: Q 1,500.00

MONTO TOTAL A PAGAR: Q 1,555.84

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTREGANTE	MONSIEUR RECEPTOR
1	22/05/14	Q 100.00	Q 1,455.84	Eugenio Gómez	Cecilia Lem Soto
2	22/05/14	Q 100.00	Q 1,355.84	Eugenio Gómez	Cecilia Lem Soto
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

CRÉDITO CONTROL:

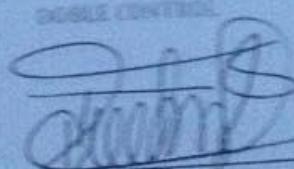
  
Cecilia Lem  
Coordinadora CeCEP  
San Cristóbal V.



Figure 74: Payment record for House 9.

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NOMBRE BENEFICIARIO: Elvira Ca. Xim

FECHA DE IMPLEMENTACIÓN: 7 mayo 2014

MONTO INVERTIDO EN SISTEMA: Q 5070.59

MONTO TOTAL A PAGAR: Q 154.87

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

DÓBLE CONTROL

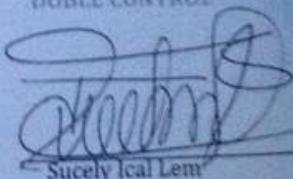
  
Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.



Figure 75: Payment record for House 16.

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NOMBRE BENEFICIARIO: Domingo Ical Popt

FECHA DE IMPLEMENTACIÓN: Mayo 2014

MONTO INVERTIDO EN SISTEMA: \$ 146.32

MONTO TOTAL A PAGAR: \$ 341.07

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1	13/06/2014	35.00	331.07		
2	21/06/2014	25.00	314.07		
3	8/09/2014	50.00	264.07		
4					
5					
6					
7					
8					
9					
10					
11					
12					

DOBLE CONTROL:

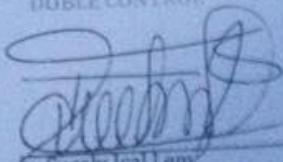
  
Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.



Figure 76: Payment record for House 18.

Museo Katsina  
San Cristóbal Verapaz  
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NOMBRE BENEFICIARIO: House 21 PSC

FECHA DE IMPLEMENTACIÓN: 7/10/2014

MONTO INVERTIDO EN SISTEMA: \$ 4,000.00

MONTO TOTAL A PAGAR: \$ 400.00

NO. PAÍSO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1	6/27/2014	\$50.00	\$50.00		
2	7/10/2014	\$100.00	\$50.00		
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

PROBLEMA SOLUCIÓN  
Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.

Figure 77: Payment record for House 21.

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NOMBRE BENEFICIARIO: CRISTOBAL COY MAX  
FECHA DE IMPLEMENTACIÓN: 10 enero 2,014  
MONTO INVERTIDO EN SISTEMA: Q.7738.61  
MONTO TOTAL A PAGAR: Q.386.93

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1	16-01-2014	Q200.-	Q186.93		Alvaro L.
2	18-01-2014	50.00	136.93		Sucely
3	28-03-04	5000	86.93		
4	22/6/14 ✓	50.00	36.93		
5					
6					
7					
8					
9					
10					
11					
12					

DOBLE CONTROL

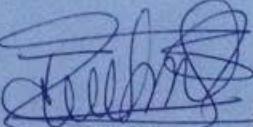
  
Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.





Figure 78: Payment record for House 27.

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NOMBRE BENEFICIARIO: Alonso Xonjux

FECHA DE IMPLEMENTACIÓN: Mayo 2014

MONTO INVERTIDO EN SISTEMA: Q 4,155.74

MONTO TOTAL A PAGAR: Q 242.80

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

DOBLE CONTROL

Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.

Figure 79: Payment record for House 28.

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NOMBRE BENEFICIARIO: Picardo Guzman Chal

FECHA DE IMPLEMENTACIÓN: Mayo 2014

MONTO INVERTIDO EN SISTEMA: Q 4353.61

MONTO TOTAL A PAGAR: Q 217.68

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1	<u>24/05/14</u>	<u>100.00</u>	<u>117.68</u>		<u>(Signature)</u>
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

DOBLE CONTROL

Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.

Figure 80: Payment record for House 29.

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NOMBRE BENEFICIARIO: MONSEÑOR JESÚS MORENO

FECHA DE IMPLEMENTACIÓN: Mayo 2014

MONTO INVERTIDO EN SISTEMA: Q. 4562.59

MONTO TOTAL A PAGAR: Q. 228.13

NO. PAGO	FECHA	ABONO	SALDO	FIRMA ENTERANTE	NOMBRE RECEPTOR
1	23/06/2014	5000	178.00		
2	22/07/2014	5000	128.13		
3	13/08/2014	728.13	-		
4					
5					
6					
7					
8					
9					
10					
11					
12					

DOBLE CONTROL

Sucely Ical Lem  
Coordinadora CeCEP  
San Cristóbal V.

Figure 81: Payment record for House 31.