Document 526
POST IMPLEMENTATION REPORT

CHAPTER: Oregon State University
COUNTRY: El Salvador
COMMUNITY: Las Mercedes
PROJECT: Gravity Fed Water System

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January 2010

ENGINEERS WITHOUT BORDERS-USA
www.ewb-usa.org

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Oregon State University
Las Mercedes, El Salvador
Gravity Fed Water System

Post Implementation Report
Part 1 – Administrative Information

1.0 Contact Information

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Mentor #2	Greg Kupillas	phggek@bctonline.com	503-632-5016 ext. 10	EWB- OSU Professional
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NGO/Community Contact	Jefferson Tyler Francisco	jeffersont.francisco@gmail.com	503-7729-3049	Peace Corps
Education Lead	Katie Bruce	bruceka@onid.orst.edu	541-954-1749	EWB- OSU

2.0 Travel History

Dates of Travel	Assessment or Implementation	Description of Trip
March 2006	Assessment	Three students and one professional traveled to the communities of Las Mercedes and El Naranjito to initiate contact between the community and EWB-OSU and to become acquainted with the geography, health and culture of the community.
September 2006	Assessment	Four students and one professional traveled to the communities to assess the community for EWB-OSU involvement.
March 2007	Implementation	Four students and one professional traveled to the communities to distribute Potters for Peace filters in the community and to collect data about potential water sources in the area.

December 2007	Implementation	Eight students and two professional mentors traveled to the communities to construct a rainwater catchment system on the El Naranjito school and to collect extensive data on health of community members and locations of people and homes.
March 2008	Assessment	Three students and one professional traveled to the communities to collect technical feasibility data and obtain landowner permission to develop sources for gravity-fed water delivery systems.
June 2008	Implementation	Five students and one professional traveled to the community of Las Mercedes to construct a gravity fed water system and obtain additional field information for the next project.
December 2008	Implementation	Six students and one professional traveled to the community of Cerro Segovia to construct 3 rainwater catchment systems.
March 2009	Assessment	Two professionals traveled to the community of Lower Las Mercedes to obtain hill-slope data for a spring water gravity fed system and to check on the previously completed projects in the communities.

3.0 Travel Team

Name	E-mail	Phone	Chapter	Student or Professional
Katie Bruce	katie.helen.bruce@gmail.com	541-954-1749	EWB- OSU	**Student**
Cierra Eby	cierraeby@gmail.com	541-720-3646	EWB- OSU	**Student**
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Malia Kupilias	phg@bctonline.com	503-632-5016	EWB- OSU	**Professional**
Greg Kupilias	phggek@bctonline.com	503-632-5016	EWB- OSU	**Professional**

4.0 Safety Incident Reports

There were no Safety Incidents requiring documentation on this trip.

There was one close call with a sharp end of a wire coming close to a student's face early in the trip- that was understood to be a caution point, and in all other occurrences involving wire, faces were kept beyond the range of a sharp wire end, and wire ends were trimmed short for the work area.

5.0 Budget

5.1 Cost

Expense	Total Cost
Airfare	$2,187
On Ground	$553
Materials	$1,093
Other	$422
Total	**$4,255**

6.0 Project Location

Longitude: 89°58'1.07"W
Latitude: 13°52'7.17"N

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Post Implementation Report Part 2 – Technical Information

1.0 INTRODUCTION

In December of 2009, the Oregon State University student chapter of Engineers Without Borders sent three students and two professionals to El Salvador to implement a gravity fed water system in the community of Lower Las Mercedes. The system consisted of an infiltration gallery at the water source, a pipeline, and a storage tank. The December 2009 implementation trip was part of a multiphase water project in the communities of El Naranjito and Las Mercedes and was the eighth trip that EWB-OSU has made to the project region. This report details the trip and includes an overview of the trip goals, a description of the project's technical design, a summary of health promotion activities, and logistical information such as the trip budget and lodging. The appendices contain additional resources including an itemized budget, design drawings, inventory of leftover materials, and pictures. This report is meant to serve as not only a post-trip report for EWB-USA, but also as a resource for the project team in the future.

2.0 PROGRAM BACKGROUND

EWB-OSU has been working in the communities of Las Mercedes/El Naranjito, El Salvador, for nearly four years. Due to the dispersion and diversity of the sub-communities in the area, EWB-OSU has broken the overall water project down into many implementation trips, in order to ensure that the most appropriate solution is applied to each unique situation. This will be the ninth time that EWB-OSU has sent members down to the communities; because of this the project team is experienced with travel in El Salvador and familiar with the people and customs of the area.

3.0 TRIP DESCRIPTION

The technical aspect of the proposed December 2009 trip will be similar to the June 2008 trip, in that the main components of the system are an infiltration gallery, a pipeline, and a cinder block storage tank. The community members of the area have expressed a strong desire to participate in this project, and a willingness to work toward its completion. In fact, one of the project beneficiaries is the president of the water board. Legal permission from the landowner to use the spring was obtained. EWB-OSU's main community contact is the Peace Corps Volunteer stationed in the area, who is in close communication with Lower Las Mercedes residents.

Primary Goals
Design and build a spring water catchment system.
Design and build a water storage tank.
Solidify community and team relationships.
Assess the community of Cerro Segovia for a future project.
Establish connections with the San Salvador Rotary club.

Secondary Goals

Assess community usage of water filters.
Assess community knowledge in hand washing techniques.
Assess the households that have not yet been served.

Completion of Goals

The spring water catchment tank was designed by EWB members during the spring and summer of 2009, and implemented by the community members during this trip. The original design was changed due to tank and water level issues and built of boulders found on site rather than blocks.

The water storage tank was designed by EWB members during the spring and summer of 2009. The original design of the tank was changed on site due to water level issues. It was built by the Salvadoran mason, with assistance from the beneficiaries. Direction and technical information were provided by EWB travel members.

The relationships between the community, the EWB team, and the Peace Corps Volunteer (PCV) Jefferson Tyler Francisco were strengthened. Initially, the community was very unsure about the design and placement of the tank, but after water was delivered to the tank, their skepticism was proven unfounded.

Cerro Segovia was assessed for a future project and the most feasible sites for constructing rainwater catchment tanks were identified.

Contact was made with a Salvadoran Rotary club in the fall of 2009. The travelers were able to meet with Rotary chapter members to discuss the project while in San Salvador. Three members of the rotary chapter were invited up to the community to verify our construction process and meet the community.

The Peace Corps Volunteer had conducted an informal survey of the beneficiaries before our arrival and found that most beneficiaries use water filters and cleaned them regularly, but do not replace them as recommended.

Not all of the houses that remain to be served were evaluated, but the PCV was able to identify the number of houses that still do not have access to nearby water sources.

4.0 COMMUNITY

4.1 Description of Community

The ridge top community of Las Mercedes consists of ten families and approximately 50 people. Prior to the project, family members (usually women and children), had to traverse steep trails to collect water from nearby ravines multiple times per day. Families often spent over two hours a day collecting water, detracting from time that could have been spent on other activities such as earning an income or gaining an education. Issues with sanitation were problematic because of the lack of readily available clean water, possibly leading to associated health problems such as diarrheal diseases.

During previous assessment trips, teams of travelers and professional mentors surveyed the spring source to determine if it had adequate flow to supply water to the community. They also located an appropriate tank location with enough elevation difference to overcome friction losses.

Three OSU students and two professional mentors traveled in December 2009:

Katie Bruce, Undergraduate student, Environmental Engineering
Cierra Eby, Undergraduate student, Civil Engineering
Carl Moen, Undergraduate student, Industrial Engineering
Malia Kupillas, Professional Mentor, Hydrogeologist
Greg Kupillas, Professional Mentor, Hydrogeologist

4.2 Community Relations

The relationships between the community, the EWB team, and the Peace Corps Volunteer (PCV) Jefferson Tyler Francisco were strengthened. Initially, the community was very unsure about the design and placement of the tank, but after water was delivered to the tank, their skepticism was proven unfounded.

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5.0 PROJECT SUMMARY

5.1 Summary

The communal water system constructed for the community of Lower Las Mercedes consists of five main components: the infiltration gallery, pipeline, tank, roof, and wash stations. The infiltration gallery is designed to impound water for in-ground storage and to meter water into the pipeline that serves the tank. The pipeline is set to carry water from the infiltration gallery to the tank over a long distance and varied elevations. The tank is designed to hold water for ten families (approximately 50 people) and store water for their use during the day. The foundations for two wash stations were built to assist the community in reducing their travel to the stream for clothes washing. These wash stations also reduce the chemical load on the water system for downstream users and the environment.

5.2 Difference Between Planned and Actual Implementation

Wash stations: One wash station and one pila were added to the construction plan and foundation layout. This was upon request of the beneficiaries because one wash station would not have been sufficient for the ten families. The original design has the wash station placed in the middle of the tank wall. However, with the addition of the second wash station and the pila, the orientation was changed.

Tank dimensions: Because the elevation of the tank was too high in relation to the infiltration gallery, water delivery issues from the infiltration gallery were found. The tank design was changed to be wider and shorter to give more elevation difference to the system. This was achieved without changing the foundation footprint (largest material consumption). Each tank wall was lengthened by one block and lowered by one block. The original tank volume was 3.9 m^3 and the current tank was measured at 4.1 m^3. The change in tank dimension also changed the amount of Portland cement, blocks, and sand needed for construction.

Materials: The December 2008 trip left behind a large quantity of excess materials. These materials reduced the cost of expected material purchases on this trip by approximately $100.

Infiltration gallery: Due to significant concerns with the head available to provide natural flow from the infiltration gallery to the tank, the wall of the spring box was built higher. This increased the head pressure on the system, allowing the water to flow past the original height of the tank. The additional head available and the reduced tank height ensures that the tank will have water if the spring box is full.

5.3 Drawings

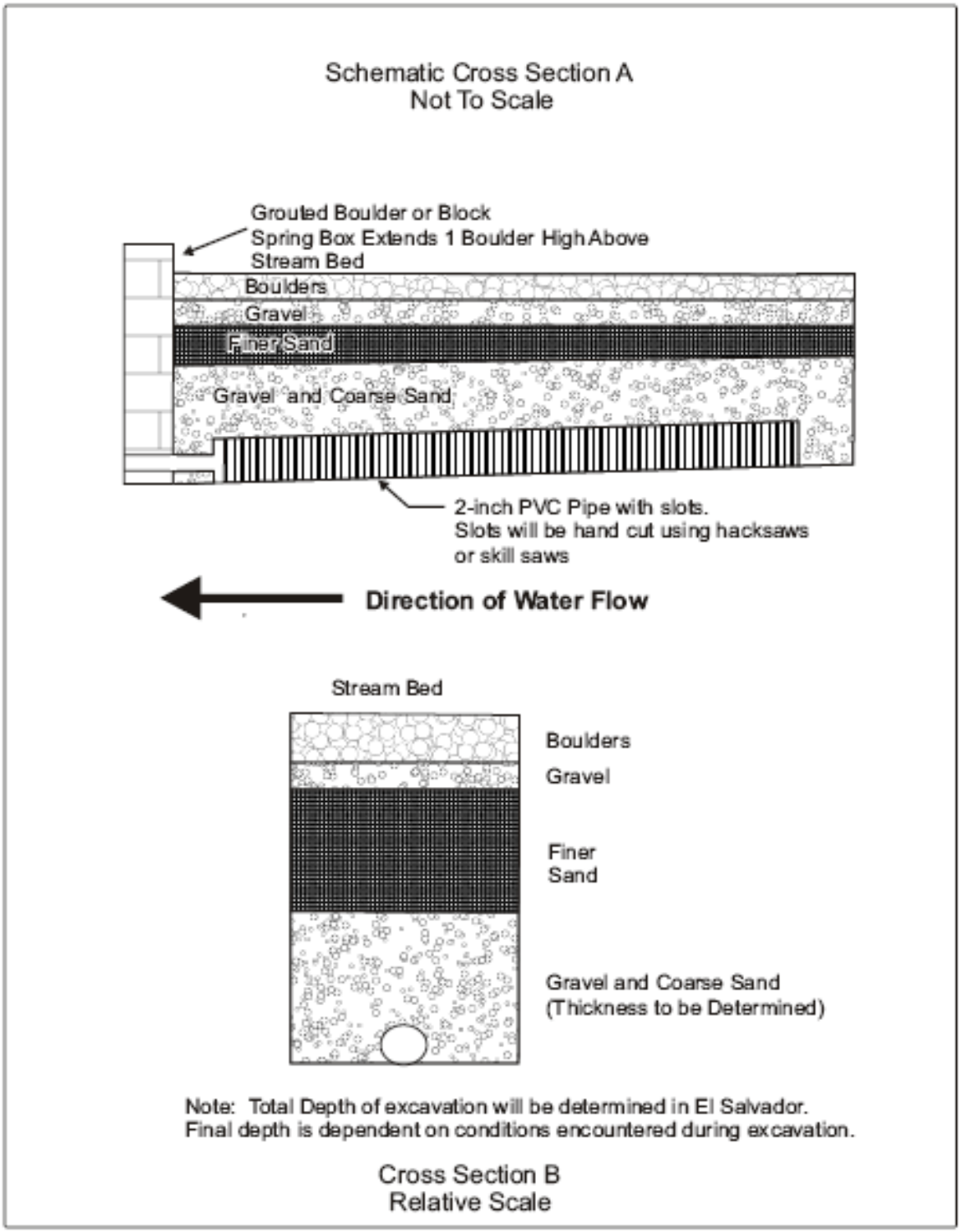

Fig. 10: Schematic drawing of the infiltration gallery. A nearly identical system was built in the community in June 2008.

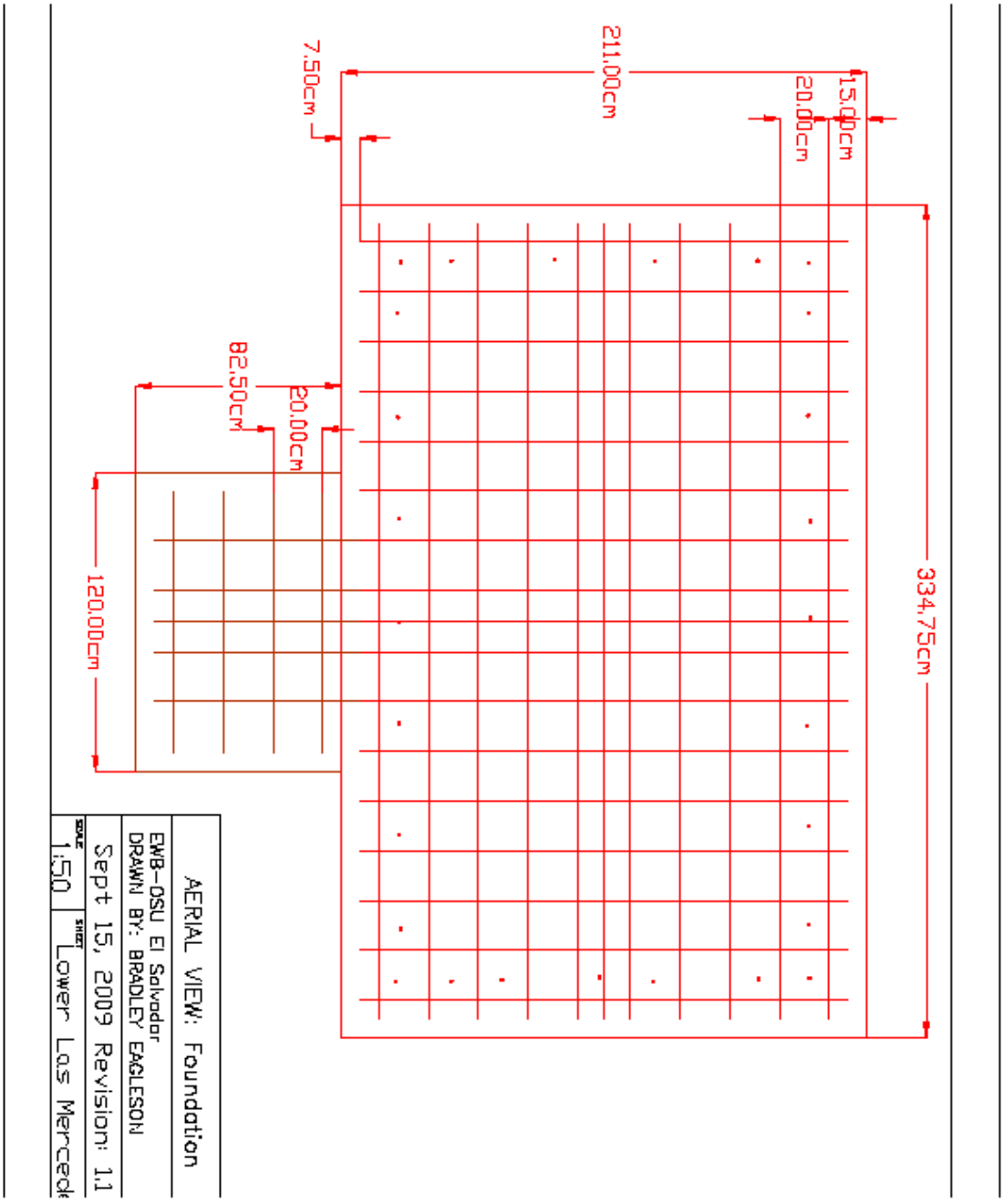

Figure 11: Foundation schematic drawn at 1:50 scale for the Lower Las Mercedes tank system. The small dots are locations of “L” hooks tied into the foundation.

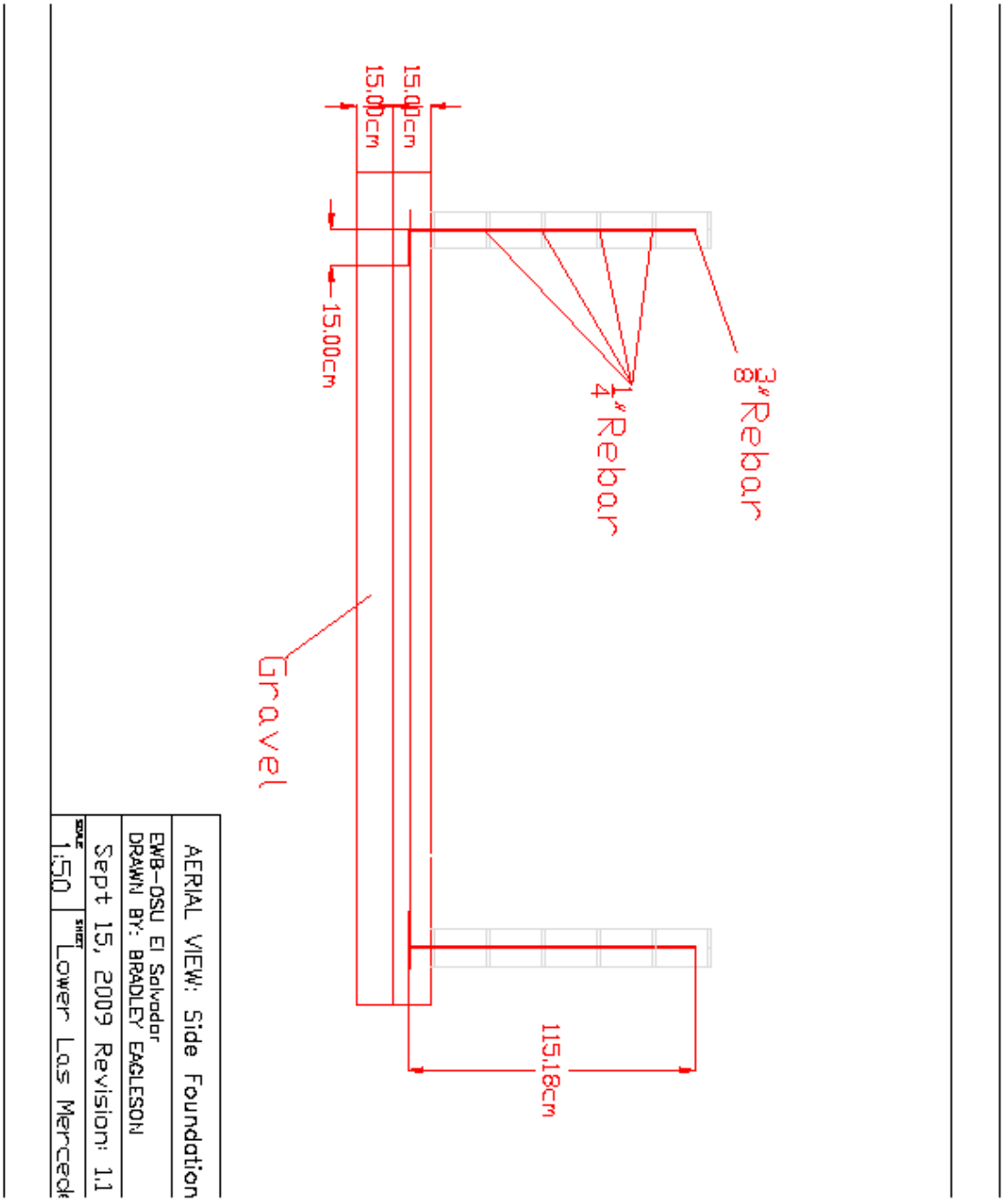

Figure 12: Side schematic of the Lower Las Mercedes Tank Foundation. Schematic draw at 1:50, and shows a side view of the “L” hooks and rebar ties.

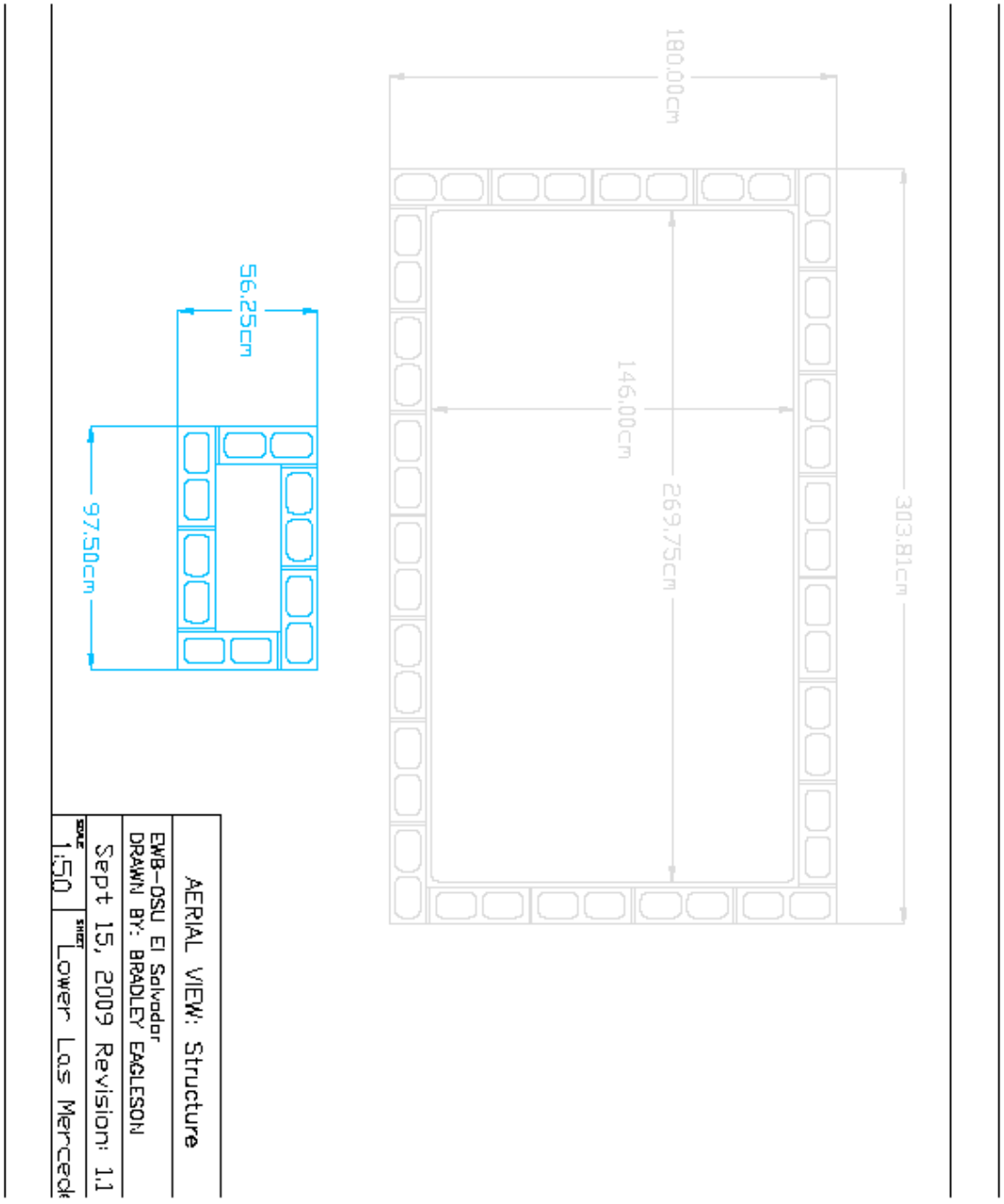

Figure 13: Aerial view of the brick structure of the tank. Drawn at 1:50 scale, and showing the location of the wash station.

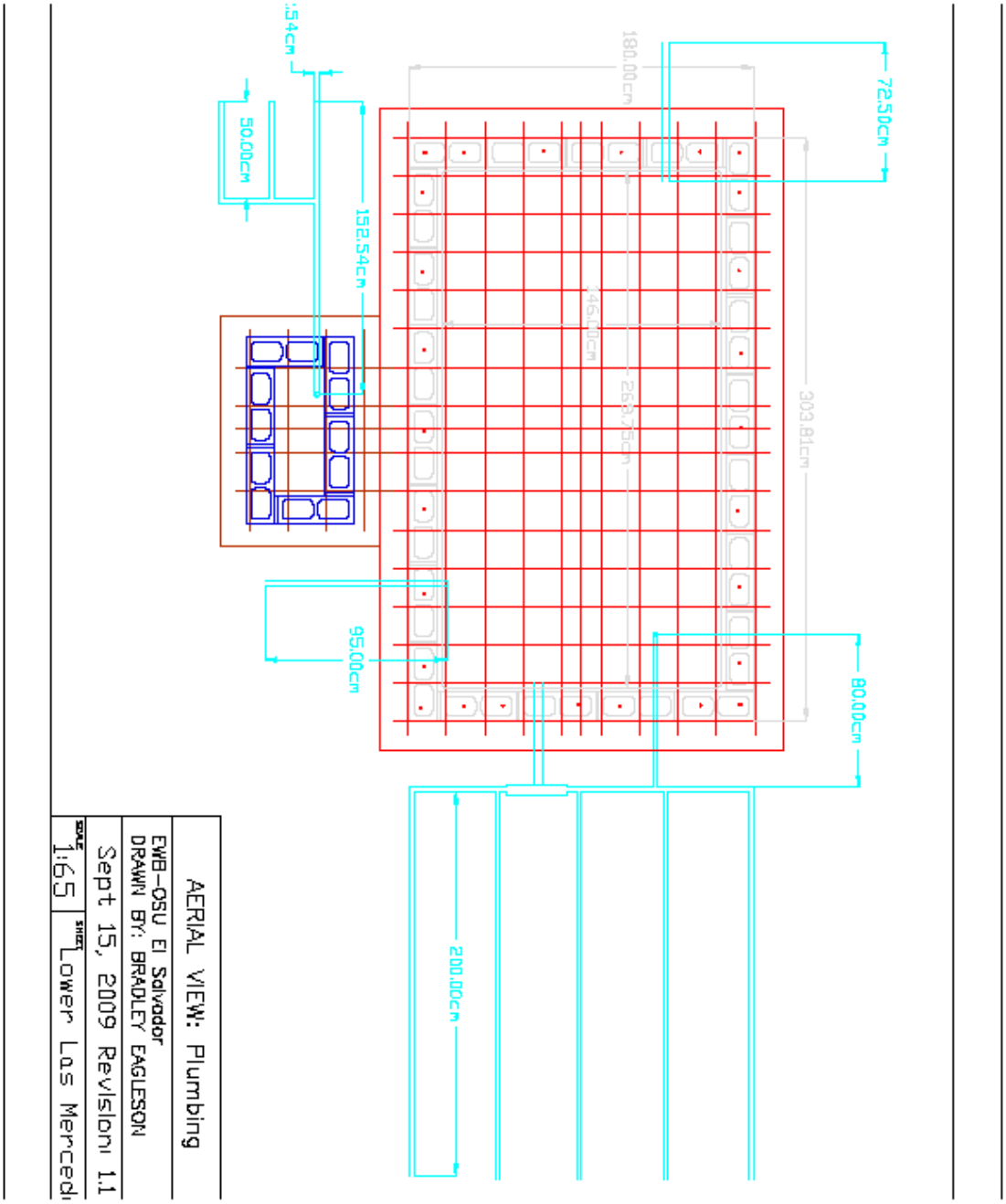

Figure 14: Schematic and dimensioning of the plumbing layer. This includes both seepage lines to prevent erosion. The line on the far edge of the tank is the inlet line, and the line next to the wash station is for removing water from the tank.

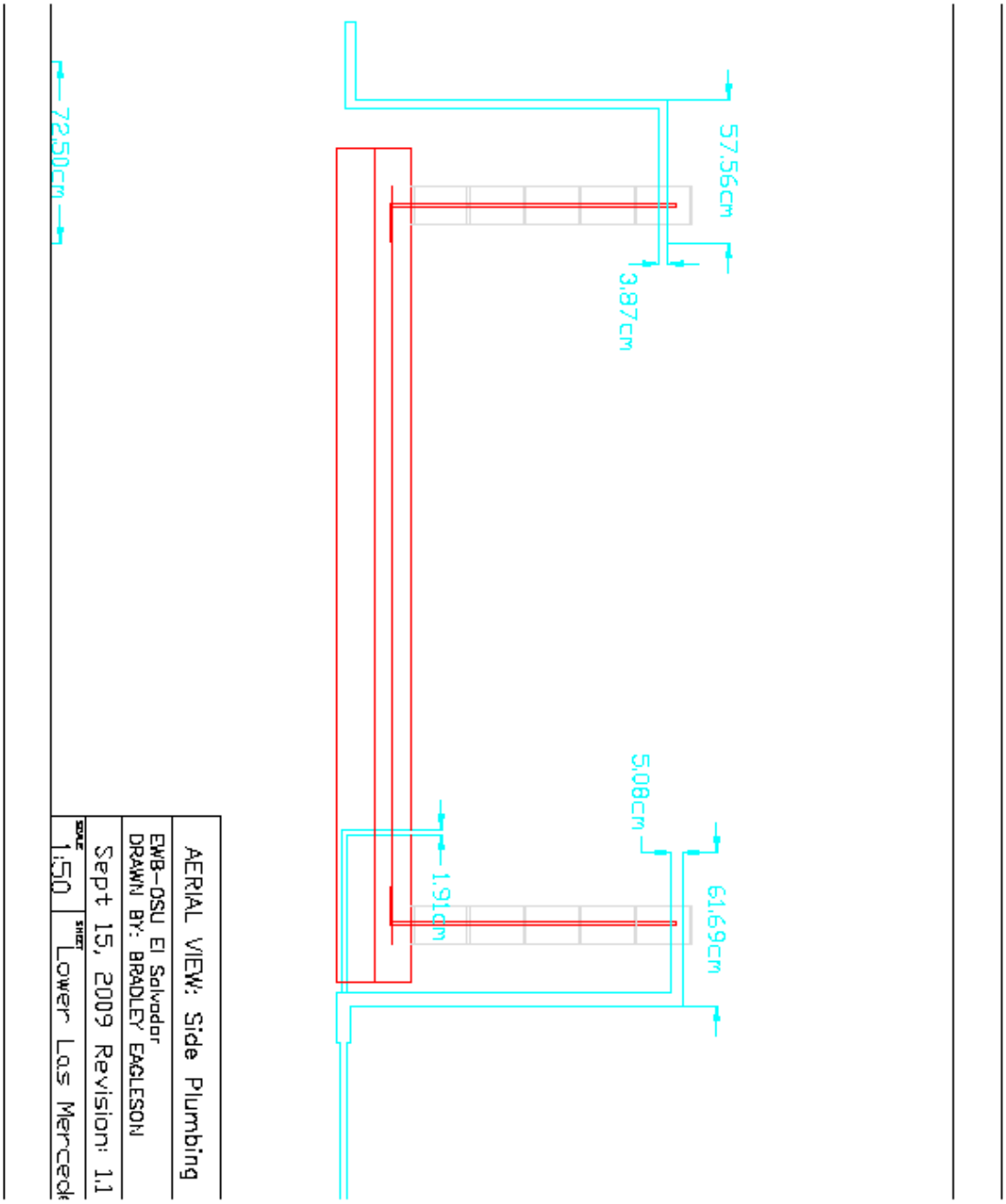

Figure 15: Side view of the plumbing layer. This shows the diameter of the pipes being used to plumb the system.

6.0 PHOTO DOCUMENTATION

Figure 1: Left - Collection Screens in the bottom of the infiltration gallery. Right – Mason Don Maximino and PCV Jefferson Tyler Francisco in the finished infiltration gallery.

Figure 2: Polyducto pipeline connection

Figure 3: Rebar grid with vertical ties and drain piping.

Figure 4: Underside of finished roof and finished plastered tank.

7.0 MONITORING AND EVALUATION

At the time of construction, the team will instructed community members on the operation and maintenance of the system. The team emphasized the importance of using the roof that covers the tank, and discussed how to maintain the pipeline, and the infiltration gallery. The team discussed suggestions for unclogging the screens of the infiltration gallery, removal of the tank roof and periodic cleaning of the tank, and care of the polyducto pipeline.

Improves water quality:
The laundry station will provide a place for people to wash laundry outside of natural stream systems. The laundry station will not drain directly to a stream, which will reduce loads of phosphates and bleach to the streams.

Local materials & resources:
Labor will be provided by the local beneficiaries of the water system. As in previous implementation trips, as many construction supplies as possible will be ordered from local hardware stores. A local mason will also be hired to help construct the tank.

Maintenance:
This tank is similar to other tanks installed during the June 2008 and December 2008 implementations, and the maintenance plan will be essentially the same. The maintenance plan is familiar to the Water Board and neighboring families, so the large knowledge base for this type of maintenance will ease the transfer of knowledge to the Lower Las Mercedes community members. The polyducto for the pipeline is the most commonly used pipeline and tubing material in the area, and locals are clearly skilled at using and repairing it. At some time in the future, if the community wishes to make improvements to the system and possibly with the support of EWB-OSU, the polyducto may be replaced with a buried PVC pipeline.

Reproducibility:
This type of cinder block tank is now familiar to community members and the local masons. A major reason that this tank design was selected over other designs considered was local familiarity with the building materials and design. The design is comparable to what is currently done for houses in the area. The roofing style will be slightly different, but the community can reproduce this type or their current type of roof truss if they wish. Polyducto is widely available in the area and is less expensive than other materials such as PVC or galvanized steel. People's familiarity with polyducto may encourage locally organized water projects, such as the project in the community of El Naranjito.

No energy requirement:
The system will provide accessible water to Lower Las Mercedes without requiring inputs of energy to function. Rather than being pumped from the spring, the flow through the pipeline will be driven by gravity. This creates a situation that is financially sustainable for beneficiaries and also ecologically sustainable.

8.0 LESSONS LEARNED

Better description of tank location and placement when talking between EWB members in the USA and our contact in the community. This was the driving factor in the largest change in implementation: the tank elevation was higher than expected in relation to the infiltration gallery.

Better drawing controls or 'Trust the local mason to build the tank his way'. The first (and only) drawing the mason used was the foundation drawing. He built the foundation to specifications, but when shown the tank wall layout (tank dimensions) he only saw the lines, not the numbers; and since the lines confirmed what he was thinking, the numbers showing the tank dimensions did not register with him. The mason proceeded with making the tank fit the foundation, with no space between the edge of the foundation and the tank wall (to maximize the tank size), and the team member supervising the construction did not catch the small change to the tank dimensions until after concrete was poured. The change in tank dimensions was made when connecting the vertical rebar into the foundation rebar grid.

Expect the community to not have completed any preparation steps. Hope and plan for the best, expect the worst non-preparation scenario and have a contingency plan for it. This was apparent in that the community did not have the water pipeline to the tank site for concrete mixing. If the water pipeline had been at the site, the tank elevation would have been seen to be too high, and the tank could have been moved downhill as needed. But with the intent to get the tank completed on time, the tank foundation was started before the water was available on site, which compounded the tank elevation issue by forcing a bad tank location with very little water head to fill the tank.

Plans change, be sure to keep the project intent and appropriate building guidelines. The tank was built according to plan, but the dimensions were larger than designed, which led to a materials deficit. But with removing a layer of bricks from the tank (shortening the tank), we were able to achieve the appropriate head height to the spring gallery, maintain the needed volume of water for the community, and have only a small materials deficiency.

9.0 NEXT PHASE OF THE PROGRAM

First we must determine if there will be funding available by the next possible travel time. Secondly, the Peace Corps volunteer has informed us of difficulties that the water board is having with staying organized. In addition, the community has voiced the request to stop having construction trips in December; which is during their coffee harvesting season. These complications have led us to hold off on planning a trip in the near future. The Peace Corps Volunteer departs the community next spring and after he is gone we will not a have an available translator or access to day-to-day information about what is occurring in the community. We have a hope that we will be able to communicate with the water board, but until their internal issues are rectified, we cannot guarantee someone from that group will be available. This has the unfortunate possibility of the project being discontinued due to a lack of communication requirements. The next travel time that works for both the community and the students will be Spring of 2011, and it is the intent of EWB-OSU to travel at that time. Until then, focus has turned to supporting reorganization of the water board through a possible water filter distribution.

10.0 MENTOR ASSESSMENT

This trip faced many obstacles before we even arrived in El Salvador. The major obstacles were access into the community, elevation of the tank relative to the spring box, and re-laying the pipeline. The alternate route into the community worked for delivering supplies and materials, and the location of the tank proved sufficient for water to gravity flow from the spring box to the tank. The community re-laid the pipeline, but they were not familiar with removing air bubbles that were causing air locks. In the end, the students learned how to adapt, improvise, and persevere, which are lessons that will help them in their professional careers. The students faced each obstacle with determination and good humor, and they worked well with the members of the community. Some of the major decisions that were made in the field were to build the wall of the spring box higher to increase the head pressure and build the tank lower.

10.1 Mentor Names (Greg and Malia Kupillas)

