

**Document 523 – Alternative Analysis Report**  
**Tufts University**  
**El Porvenir, El Salvador**  
**Rural Development**



**Document 523**  
**ALTERNATIVES ANALYSIS REPORT**

**CHAPTER: Tufts University**  
**COUNTRY: El Salvador**  
**COMMUNITY: Porvenir**  
**PROJECT: Rural Development**

PREPARED BY

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**Jessica Perkins**  
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**September 1st, 2010**

**ENGINEERS WITHOUT BORDERS-USA**  
**[www.ewb-usa.org](http://www.ewb-usa.org)**

## **Alternatives Analysis Report Part 1 – Administrative Information**

### **1.0 Contact Information**

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### **2.0 Travel History**

| <b>Dates of Travel</b> | <b>Assessment or Implementation</b> | <b>Description of Trip</b>                               |
|------------------------|-------------------------------------|--|
| <b>1/3/09-1/14/09</b>  | <b>Assessment</b>                   | <b>Focus on community needs and site characteristics</b> |
| <b>7/3/09-7/17/09</b>  | <b>Assessment</b>                   | <b>General Assessment</b>                                |

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|                 |            |  |
|-----------------|------------|--|
| 3/21/10-3/28/10 | Assessment | Technical feasibility of project options |
|-----------------|------------|--|

### 3.0 Project Location

Longitude: W089deg17.518min

Latitude: N13deg33.027min

## Alternatives Analysis Report Part 2 – Technical Information

### 1.0 INTRODUCTION

The purpose of this report is to document the process that the Tufts University Student Chapter of Engineers Without Borders (EWB-Tufts) is going through to determine a solution for the rural development project in Porvenir, El Salvador. EWB-Tufts is considering the following project alternatives: construction of a well, construction of a new spring box, repairs to the current spring box, construction of a foot bridge, implementation of biosand filters, point-of-use water treatment, implementation of individual rainwater collection systems, construction of a community center.

### 2.0 PROGRAM BACKGROUND

In 2008 Epilogos Charities, an NGO in San Jose Villanueva, El Salvador, connected Tufts EWB with the community of Porvenir. Tufts EWB performed an initial assessment trip in January 2009. A community meeting was held, a health survey was performed, and existing water sources were evaluated. An additional technical assessment trip was performed in July 2009. During this trip, Tufts EWB met with a professional engineer about constructing a well in Porvenir. After Hurricane Ida in November 2009, plans for the construction of a well in this community were no longer thought possible. Since that time, Tufts EWB has used its efforts to develop alternative ideas for water access and sanitation.

Porvenir uses a variety of water sources for household drinking and cooking. Water is collected from a springbox, a well, and cisterns. During the height of the dry season, water is collected from two surrounding rivers, the Río Muyapa and Rio San Antonio

The main water source is a spring box on the side of a hill next to the Río Muyapa. Most of the community uses this as their primary water source. Filled with groundwater, the spring box is open to the environment, and is prone to contamination. It lies downhill from agricultural land, and farm animals use

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the nearby river for drinking. Although the springbox captures ground water from a shallow spring, it is possible that this water is contaminated from fertilizers and animal waste from the cornfield. Residents report draining the spring box and clearing it of debris after storms.

The rainy season in El Salvador is from approximately May through October. During this time most households have some sort of rooftop runoff collection into a cistern. Cisterns are generally uncovered 55-gallon plastic or steel drums. An *abate* packet is used to prevent mosquitoes from growing in the cisterns.

The majority of households interviewed reported that there was not a sufficient quantity of water available at all times of the year. Residents report that at the end of the dry season – during April and May – there is not always enough water in the well and the springbox, and so most families are forced to drink river water. People know that the river water is not clean and so use chlorine tablets or bleach to disinfect the water.

All residents report using the rivers for bathing and clothes washing.

### **3.0 DESCRIPTION OF COMPARISON METHODOLOGY**

During each trip to Porvenir, group members performed household surveys to gather information regarding health, sanitation, finances, and social habits. We then generated a list of community needs and desires based upon the information collected. At a community meeting, we used visual displays and a bean voting system to determine what the members of Porvenir prioritized most.

With this community feedback on potential projects, we then analyzed each project with regard to cost, feasibility, availability of appropriate materials, availability of labor, physical sustainability, economic sustainability, projected impact, and community acceptance.

### **4.0 DESCRIPTION OF ALTERNATIVES**

#### *Construction of a well*

The construction of a well requires a hydro-geological study to determine the feasibility of drilling a well in El Porvenir. The hydro-geological study helps us determine the optimum locations for drilling. After the study, we would hire a professional drilling company to perform test drills. The purpose of the test drill is to gauge the supply of groundwater at specific drilling locations. If the test drill was successful, we would contract a local well-drilling company to construct a well in the community.

#### *Construction of a new spring box*

To construct a new spring box, the first task our team would have to complete is locating a spring source where ground water discharges from the land. Discharge points are often found at the base or edge of a river. Once we located a spring, we would survey and record dimensions of the land surrounding the spring. We would use the dimensions to design a spring box. Then we would contact the local hardware store in San Jose Villanueva to order and get a price estimate for materials. At Tufts University we would build prototype spring boxes to prepare for the implementation trip. On the implementation trip we would use local labor to build the spring box.

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#### *Repairs to the current spring box*

We would improve the collection of water in the spring box and the quality of water in the spring box. First we would design a concrete lid to the spring box based on our dimensions taken on previous assessment trips. We would construct the spring box lid in the community with concrete and rebar. We would also install reinforcements in the current spring box and ensure that no water was leaking in or out of the spring box.

#### *Construction of a foot bridge*

To construct a foot bridge, we would first survey the land around the river to find the best possible location for building. We would measure the height and the width of the river base, and speak with local hardware stores to determine what materials we would need, their prices, and their availability. We would then speak with a local contractor about construction, and determine whether it would be feasible for our group to construct. This alternative would need more research.

#### *Implementation of bio-sand filters*

We would build prototypes of bio-sand filters in order to determine the optimum materials and method for filtration in Porvenir. We would purchase local materials and gather sand from the surrounding area. The sand would be cleaned and then sifted into different grain sizes for use in the filter. We would work with the community to build the bio-sand filters and install them in households.

#### *Point-of-use water treatment*

Implementing a system of point-of-use filters would require that we obtain individual ceramic filters for distribution in Porvenir. The level of community contribution would then need to be determined and eventually collected. Additionally, educating the community members on proper use and maintenance would be necessary.

#### *Implementation of individual rainwater collection systems*

Rainwater collection systems would require developing a plan for each household. In general, the systems would involve a collection system on the rooftop of the households. We would build channels to carry the water from the roof into barrels located near the household. Ideally, the families would store this water for use in the dry season. We would also give households point-of-use treatment to purify the stored water.

#### *Construction of a community center*

For a community center, we would need to determine a viable location for construction and work with the local government on obtaining the land. A design would be completed and approved, and local materials would be ordered from our hardware store contact in San Jose Villanueva. Construction would involve members of the community, who have agreed to volunteer their time for any labor needed.

## **5.0 ANALYSIS OF ALTERNATIVES**

We wanted to make sure that the focus of our project was in line with the main priorities of the community, so we hosted two meetings to understand which needs of the community were most important to the people. First, we met with all of the women in Porvenir. They said that the access to water was their main priority. This makes sense because the women often are the ones to collect water for the family. The time it takes to walk to any source of water in the community is 10 to 30 minutes. They liked the idea of bringing the water to a central source and supported the idea of a community center where they could meet with other community members. They suggested that a community center would be a good place to collect the water. The women also suggested that a central location for this gathering place would be in the area of the conocaste tree. Another main priority that the women expressed was a way for the people of Porvenir to leave the community during the wet season. During the wet season, the water level of the river rises, restricting people from leaving the community. The women suggested the construction of a footbridge for people to cross when water level is too high to cross safely.

Our second assessment of the community's priorities was performed at the community-wide meeting on March 27, 2010. At the meeting we asked people to vote for what they thought were the most important needs of the community. The five necessities of the community were presented graphically. Five jars were labeled with a graphic that represented one necessity of the community. Each community member received ten beans. We asked the people to place their beans in the jars that they thought represented the greatest priorities of Porvenir. They could place more of their beans into one jar if they felt that one need was more pressing than another. If they felt that one of the necessities was not important compared to the others, they could choose to put no beans in the corresponding jar. Our hopes were that the distribution of beans would help us understand the overall priorities of the community. The bean vote helped the community rank their needs and visualize the priorities of the community. According to the bean vote method, the lack of potable water is the most important priority of the community. Improved access to outside communities and improved access to water sources were ranked second and third priorities of Porvenir respectively.

The alternative that meets the community's priorities and our standards of feasibility is the construction of a new spring box. The construction of a well is not under our expertise or within our scope of work. The bio-sand filters and point-of-use treatment do not address the issue of low water supply during the dry season. The rainwater collection system may be a consideration later on in the program; however, it is not the most sustainable option. Rainwater collection is only successful if the community members are capable of storing the water throughout the rainy season into the end of the dry season when they experience droughts. The immediate satisfaction of having barrels of water near the household may overwhelm their ability to store the water for extended periods of time. After thinking through the alternative solutions and their possible effects on the community, we believe that building a new spring box and repairing the current spring box will be the most sustainable alternative for supplying more clean water to the community.

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## 6.0 DESCRIPTION OF PREFERRED ALTERNATIVE

The cover to the spring box will be built almost entirely out of concrete, with rebar for reinforcement, but with a small section covered with a piece of sheet metal on a hinge to allow for easy access to the water for the community members. The concrete cover is design to fit roughly on top of the walls of the spring box and clay will likely be used to fill in any gaps created by the rough edges of the existing box.

The new spring box will be designed with a partially open side and bottom to allow for infiltration from underneath the spring box as well as from the seepage face along the bank of the river. The earth will be dug back before building the structure. Concrete will be used to create the bottom of the box and concrete blocks with cement will be used to construct the sides of the box. The cover for the spring box will be constructed in the same fashion as the cover for Domingo's spring box.

## 7.0 MENTOR ASSESSMENT

### 7.1 Mentor Name: John Durant

The team is making very good progress toward meeting their overall project goal of providing Porvenir increased supplies of potable water. The March 2010 trip was important step in that direction in terms of evaluating different technologies and gathering essential design data. The team is now well poised to begin the design process and to implement their design in 2011. As usual, the team did an excellent job of interacting and helping the NGO achieve its community-outreach goals. The immediate challenge for the project will be to raise sufficient funds to allow construction in Porvenir in 2011.

Jessica Lee Perkins 9/1/10 11:14 AM

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jdurant 9/1/10 8:38 AM

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