

# Water Supply and Watershed Protection

## Quebrada Caracol, Panama



### Project Overview

In August of 2015, Clean Water Consulting travelled to the country of Panamá to collect field data for an International Senior Design (iDesign) project at Michigan Technological University. The project site was located in the village of Quebrada Caracol, an indigenous community in the Ngöbe -Buglé Comarca (Figure 1).



Figure 1. Map of Panamá with project location pointed out

### Data Collection & Analysis

Surveying included the following:

- Current system from natural spring source to outlet
- Delineation of micro-watershed containing spring
- Elevation profiles through the community

Water quality tests were performed on the following:

- Water from spring supplying the distribution system
- Runoff near spring box
- Taps throughout community

Water in spring was found contaminated with disease causing bacteria such as Salmonella and Shigella.



Figure 2. Watershed area of 54,000 sq. meters mapped via GPS coordinates

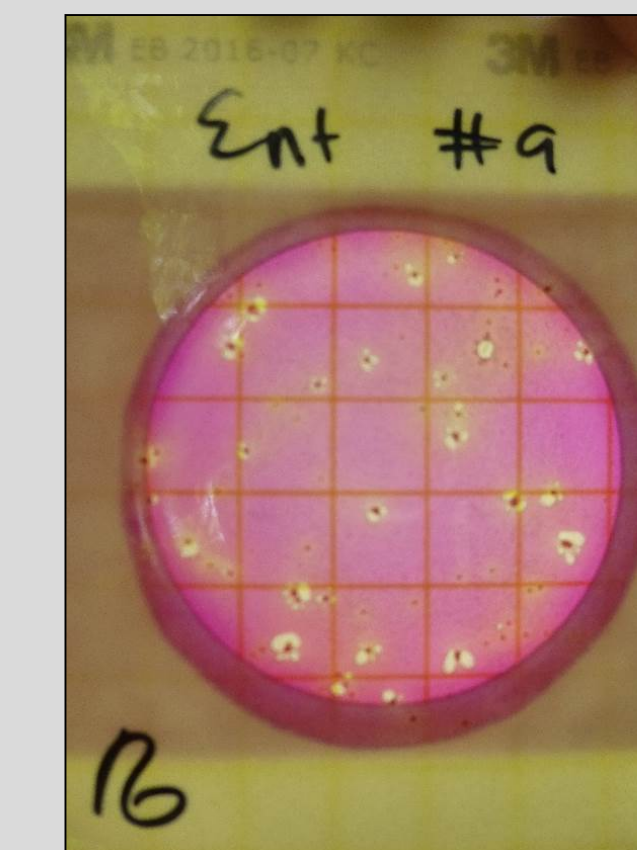


Figure 3. Water test results showing ~40 bacteria colonies

### Project Schedule

A total of 35 work days will be required to construct the system with 8 people working full time (30 hours/week). The community does not work on Saturday or Sunday, so it will take about 2 months to complete the project.

Current System Updates

- Buy/Transport Materials: 4 days
- Replace Broken Pipes: 3 days
- Rehabilitate Spring Box: 8 days

New System Construction

- Extend Pipeline: 11 days
- Install /Test Chlorinator: 3 days
- Install Tap Stands: 6 days

### Recommended System Design Improvements

Pipeline: Update the current system by replacing old pipes that are worn or broken. Extend the current system that serves one house to serve four houses. Add ball valves throughout system to provide convenient shutdown for future repairs (Figure 4).

Pressure Reducing Discs: Install pressure reducing discs to system so that the pressure at each faucet is suitable for water collection. The target pressure at each of the faucets was 40-60 psi.

Tap Stands: Install tap stands to provide clean and easy access to drinking water. Utilizing a control valve will enable the faucet to be turned off when not in use, allowing water to collect in the storage tank.

Runoff Diversion: Reroute the runoff water from the upper spring by digging a trench that directs the water away from the spring box. Create a berm on the downhill side of the channel using the excavated clay and line the new trench with rip rap (Figure 5).

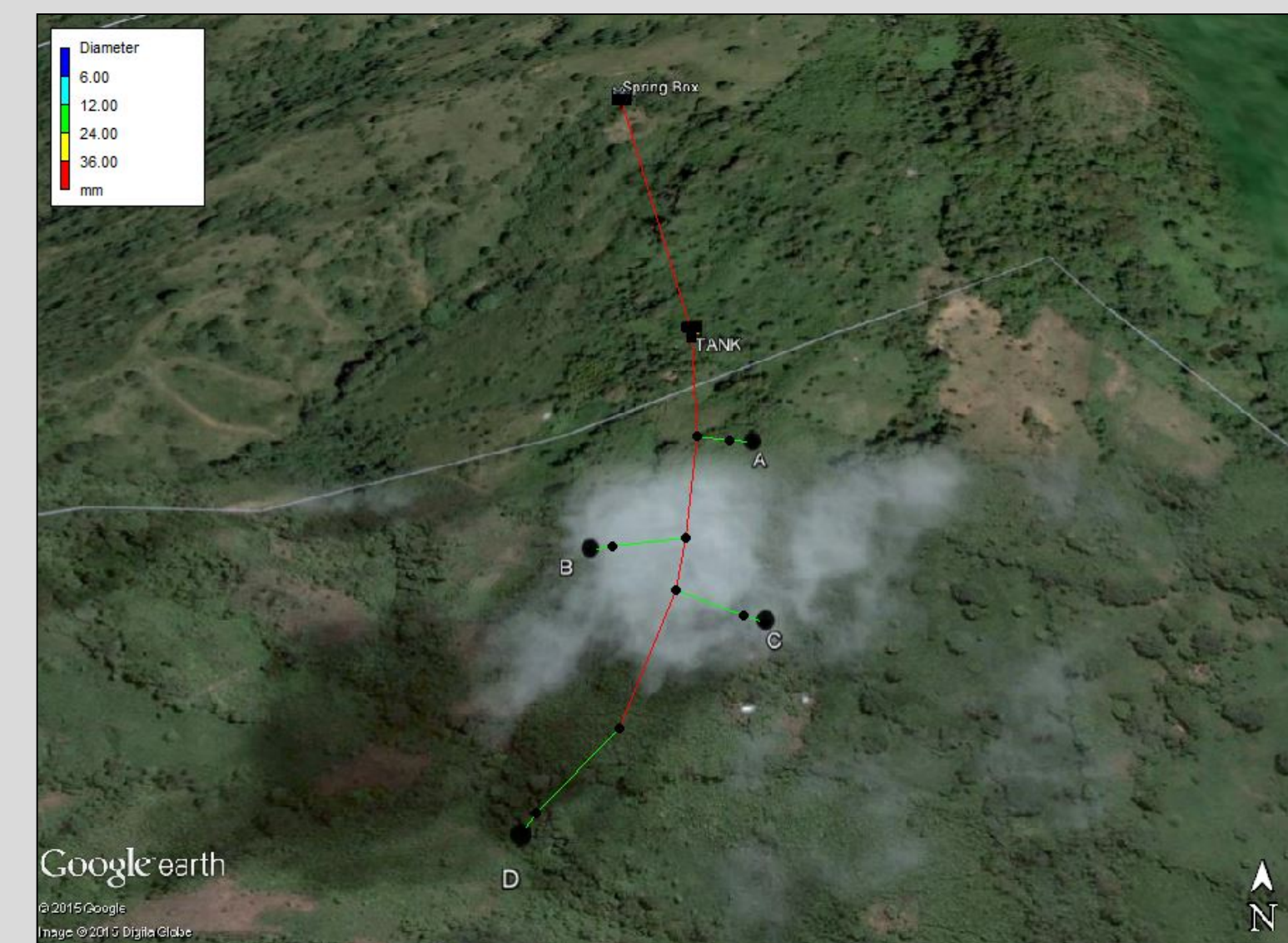


Figure 4. EPANET/Google Earth map of proposed system

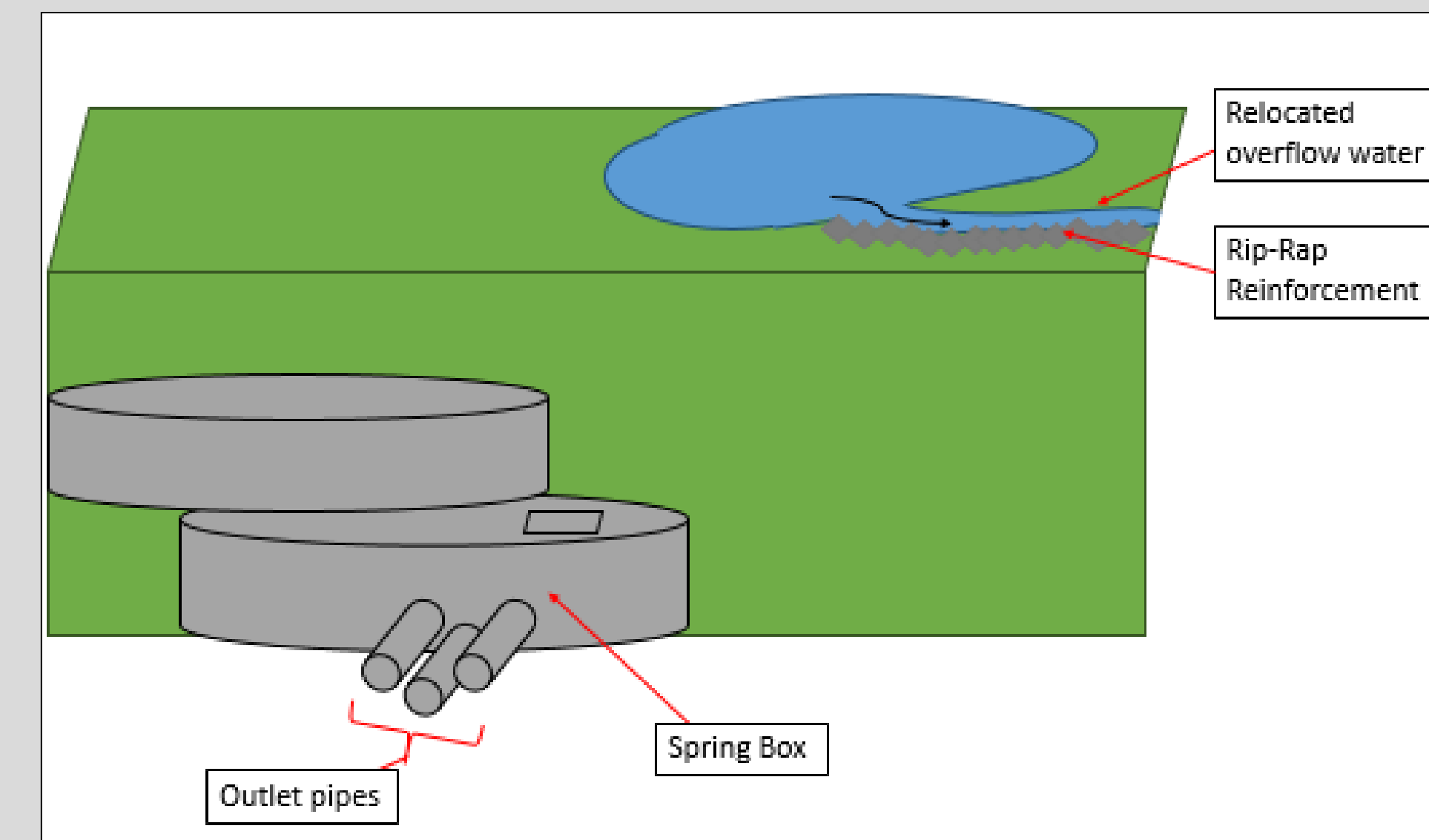
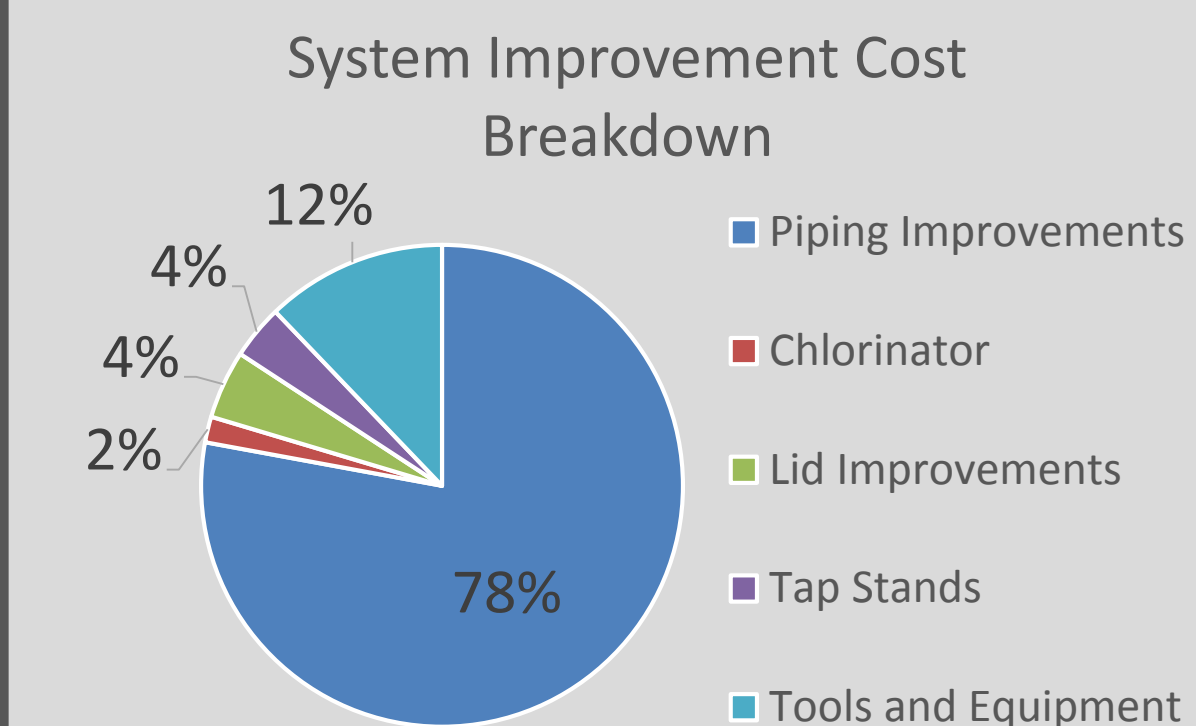


Figure 5. Run off water relocation to protect spring box

### Cost Estimate

The total cost estimate for the aqueduct system is about \$5,700. This accounts for all materials of the design and necessary equipment. Community members will be volunteering their time to construct the system, which has a monetary value of \$1,600.



Component	Cost
Replace & Extend Piping	\$4,400
Spring Box & Storage Tank Lids	\$300
CTI 8 Chlorinator	\$100
Tap Stand Supplies	\$200
Tools & Equipment	\$700
<b>Total Project Costs</b>	<b>\$5,700</b>

### Community Background

- Population: 233 people
- Languages: Spanish & Ngöbe
- Seventh Day Adventists
- Elementary school located in community
- 53% under age of 20
- Average grade: 5<sup>th</sup>
- Cash crop: yucca
- 3 mile hike from nearest road



### Current System

- Gravity-fed water distribution system consists of: spring box, storage tank, chlorinator, and pipeline
- Current system only serves one household
- Pipes break often and are not repaired properly
- Chlorine treatment is not properly maintained



### Recommendations

CWC has designed an updated water distribution system that services three additional homes.. Diverting runoff from the upper spring will prevent contamination from entering the spring box. Relocating the chlorination system upstream of the water storage tank will allow adequate contact time to disinfect the water. Installing tap stands will provide access to clean water. Performing routine maintenance is crucial in protecting the water.



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