



# Quebrada Platano & Rio Oeste Abajo Water Systems Improvements

Bocas del Toro, Panamá  
International Senior Design

Christine Wood  
Daniel Woodall  
Jacob Herzog  
Melody Harmon

# Team Introductions

Christine Wood



Christine Wood

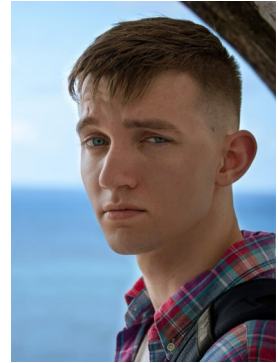
- Project Manager
- Environmental Engineer
- Water Quality Technician



Lucy-Chen Inc.

Daniel Woodall

- Mechanical Engineer
- Hydraulics Technician



Jacob Herzog

- Mechanical Engineer
- SolidWorks Technician



Melody Harmon

- Civil Engineer
- Concrete Technician
- Editor



# Outline

- Lucy-Chen Inc. Objective
- Project Background
- Data Collection & Analysis
- Design Proposal
- Implementation



# Lucy-Chen Inc. Objective

## Site Visit:

- Assess water systems of two Ngobe communities in Bocas del Toro, Panama.
- Test water quality.

## Semester Project:

- Identify potential design proposals.
- Develop and propose design alternative.



# Project Background



# Project Background

## Site 1: Quebrada Platano



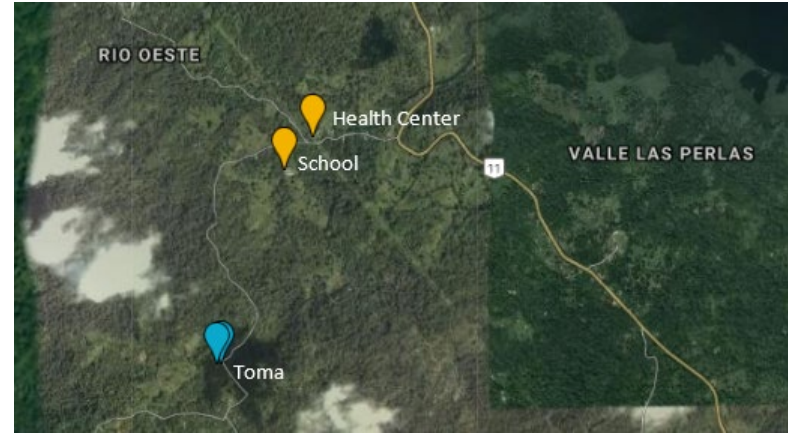
Travel time from Almirante: 2 hours

Population: ~200

Community Features: 3 water sources, Primary School, Community Meeting Center

Peace Corps Volunteer: Micah Kohler

## Site 2: Rio Oeste Abajo



Travel time from Almirante: 20 minutes

Population: >200

Community Features: 1 water source, shared Primary School, Community Health Center

Peace Corps Volunteer: Elisabeth Schlaudt



# Problem Description

## Site 1: Quebrada Platano



- Water reliability - sedimentation/clogging
- Turbidity
- Transportation
- Water Quality



# Problem Description

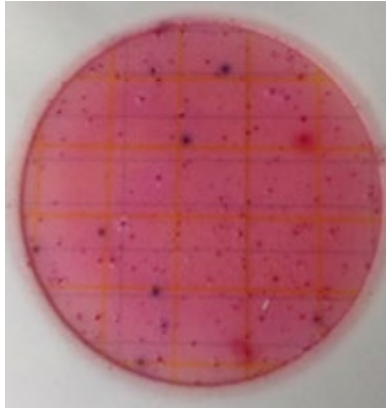
Site 2: Rio Oeste Abajo

- Water reliability
  - sedimentation/clogging
  - pressure
- Turbidity
- Water Quality

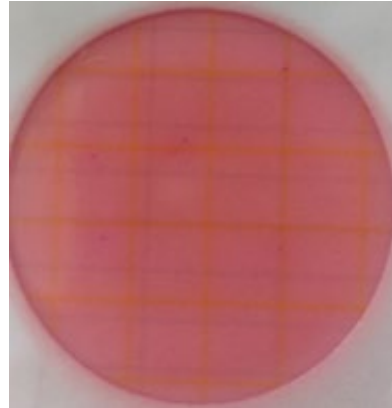




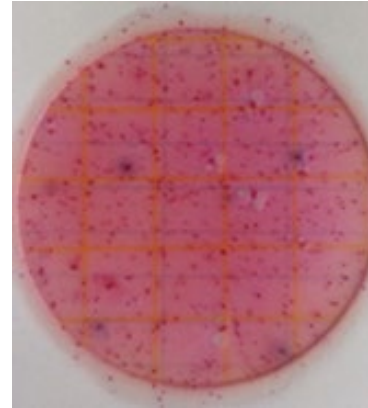
# Problem Description - Water Quality



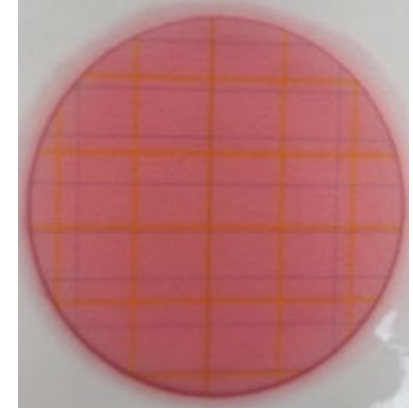
Quebrada Platano  
Host Family Tap  
Water Quality Sample



Quebrada Platano  
Spring Source Pool  
Water Quality Sample



Rio Oeste Abajo  
Palo Seco Union Tank  
Water Quality Sample



Chlorinated Water  
Water Quality Sample

# Site Visit - Data Collection: Quebrada Platano

## Site 1: Quebrada Platano

- Three Systems
  - Big Tank
    - Intake
    - Storage Tank
    - Users: Western Side
  - School
    - Intake
    - Storage Tank
    - Users: School & Eastern side
  - Spring (potential)
    - Intake
    - Users: One Family



# Site Visit - Data Collection: Quebrada Platano

## Data Collected

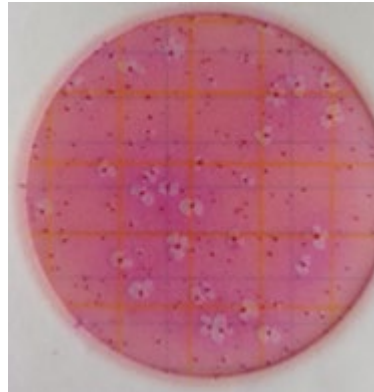
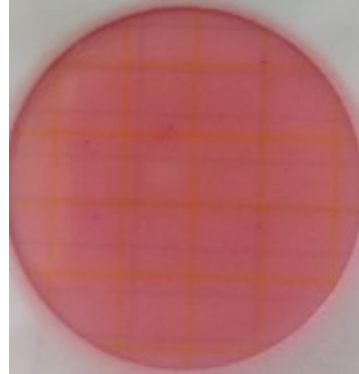
- Water Quality
  - Various Sites
- Flow Rate
  - Head Loss
- GPS/Elevation
  - GPS: Lengths
  - Elevations:  
Pressures
- Surveying
  - Intakes
  - Potential Tank



# Site Visit - Data Collection: Quebrada Platano

## Data/Observation Conclusions

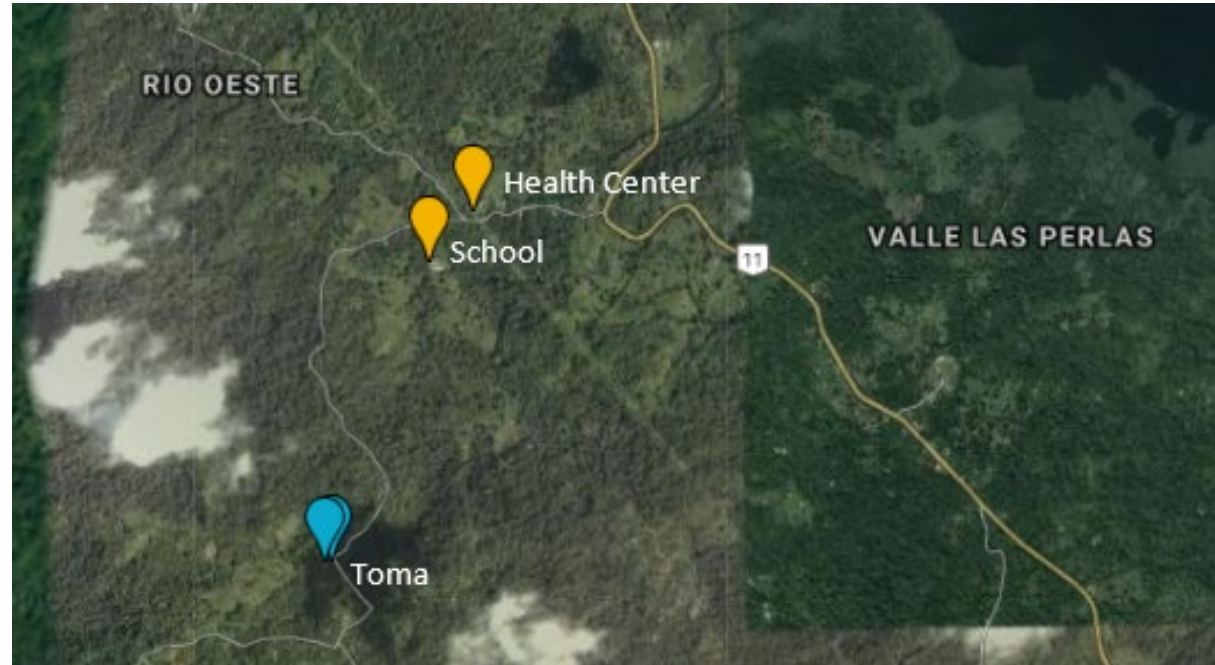
- Surveying/Elevation results
  - Source elevations provide sufficient head
  - Spring proposed tank elevation too low
- Water Quality
  - Water Treatment
  - Reduce Sedimentation



# Site Visit - Data Collection: Rio Oeste Abajo

## Site 2: Rio Oeste Abajo

- One System
  - Palo Seco
    - Intake
    - Storage Tank
    - Users: School, Health Center, Community



# Site Visit - Data Collection: Rio Oeste Abajo

## Data Collected

- Water Quality
  - Various Sites
- Flow Rate
  - Head Loss
- GPS/Elevation
  - GPS: Lengths
  - Elevations:  
Pressures
- Surveying
  - Intake



# Site Visit - Data Collection: Rio Oeste Abajo

## Data/Observation Conclusions

- Survey/Elevation Results
  - Intake & Tank = Good
  - Too much pressure
- Water Quality
  - Reduce sediment & bacteria
  - Water conservation



# Project Identification

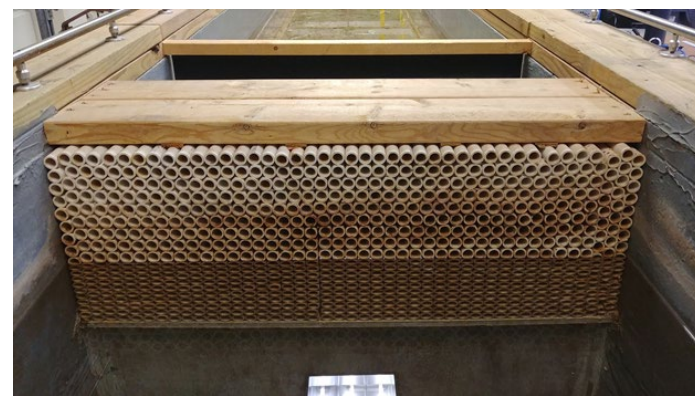
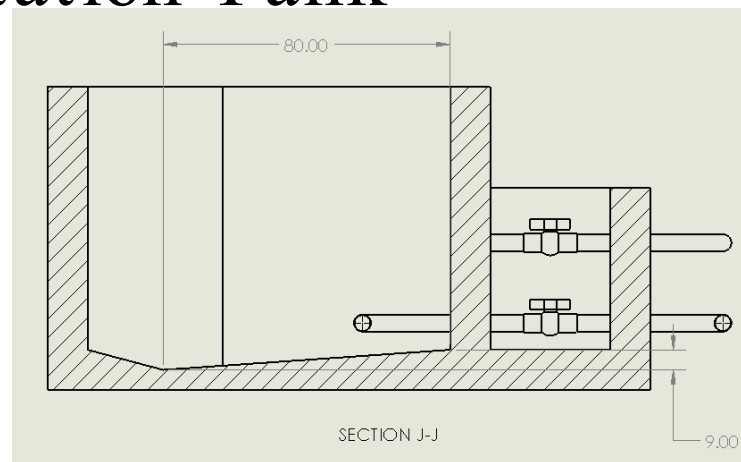
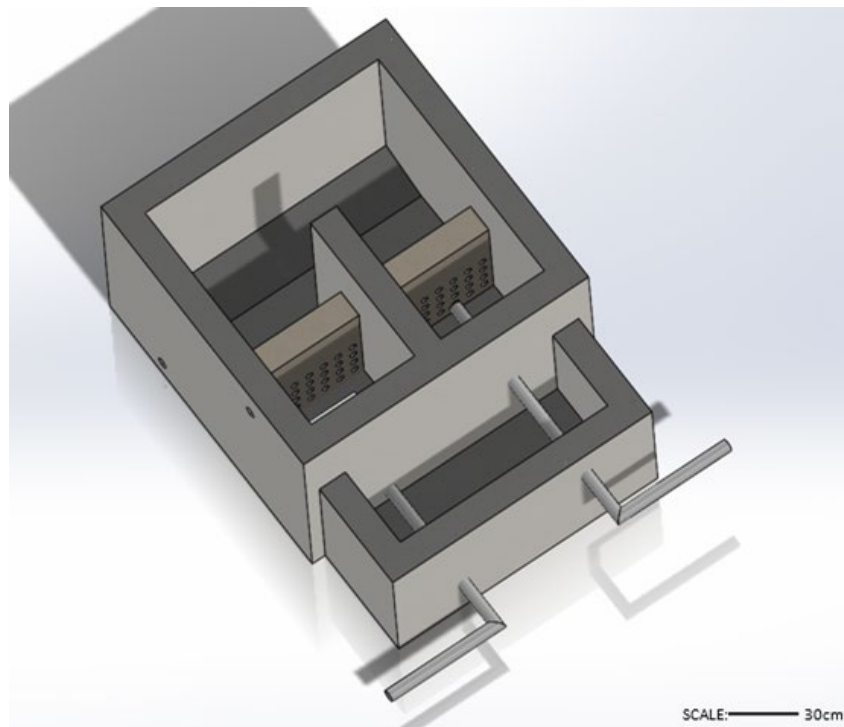
## Summary List of Proposed Designs

- Quebrada Platano
  - a. Big Tank Network
    - i. Sedimentation Tank
    - ii. Inlet Alternatives
    - iii. Pipe Systems
  - b. Spring Network
    - i. Spring box
    - ii. Storage Tank
    - iii. Pipe System & Taps
  - c. School Network
    - i. Sedimentation Tank
    - ii. Inlet Alternatives
- Rio Oeste Abajo
  - a. Palo Seco Network
    - i. Sedimentation Tank
    - ii. New Storage Tank
    - iii. Inlet Alternatives
    - iv. Pipe System

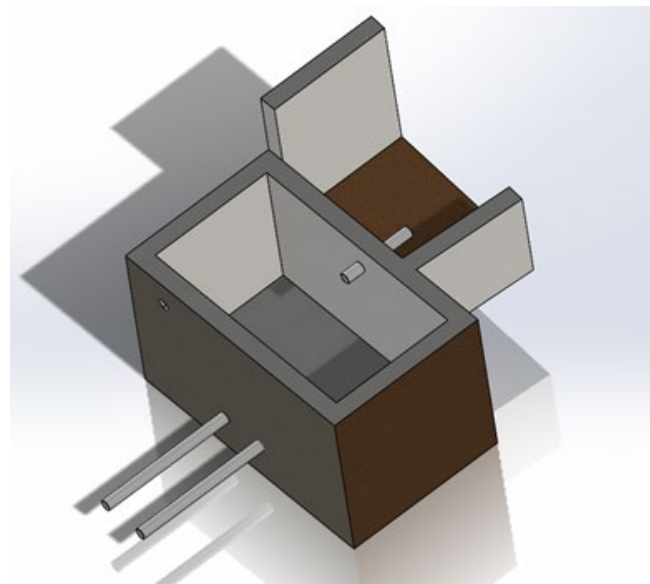
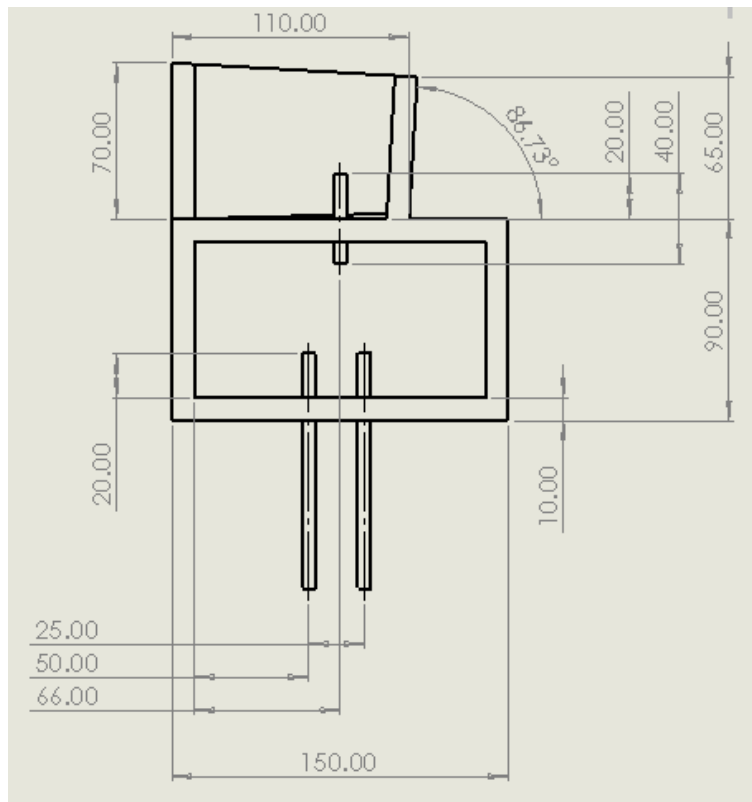




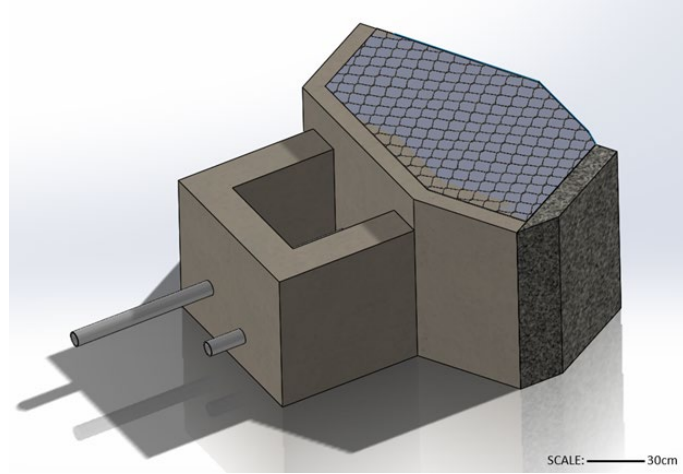
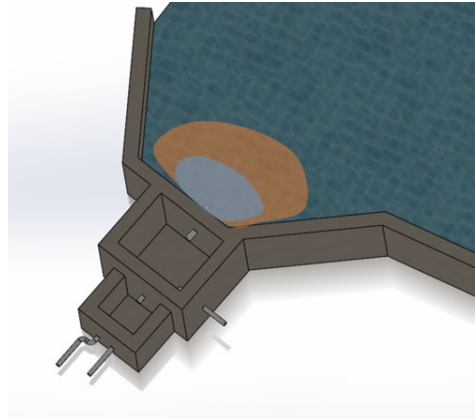
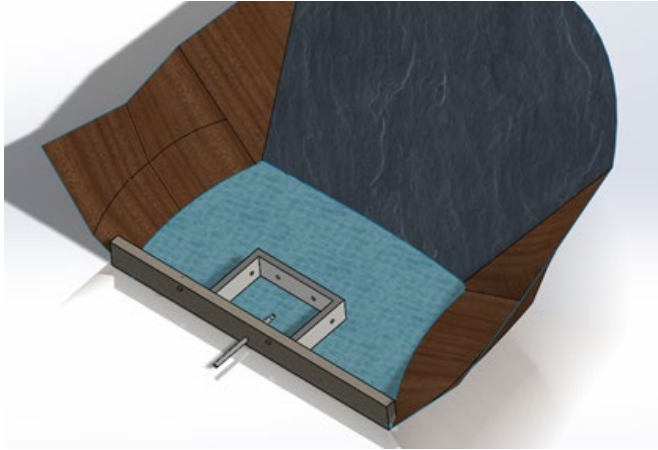
# Design Proposals- Sedimentation Tank



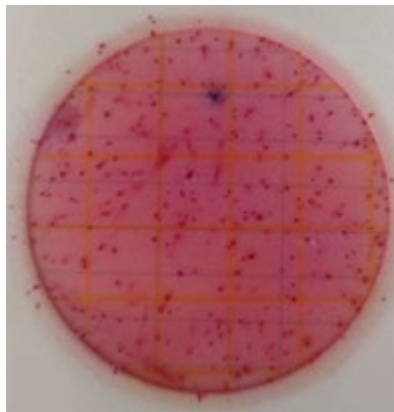
# Design Proposals- Spring Box



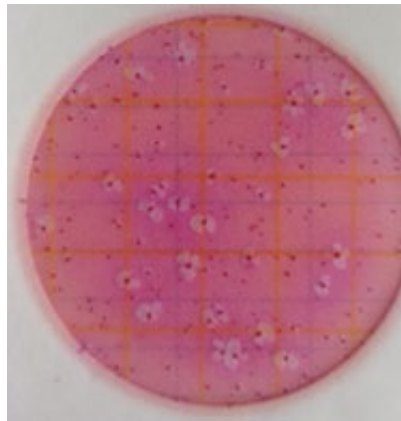
# Design Proposals- Inlet Improvements



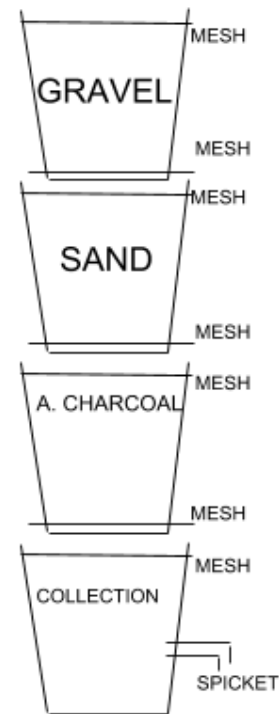
# Design Proposals- Water Treatment



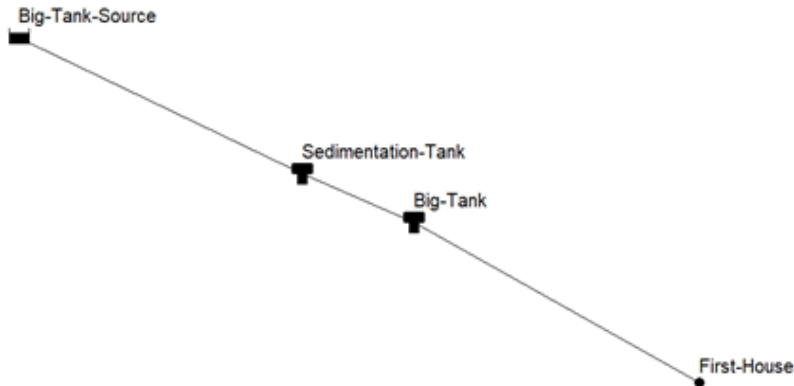
Quebrada Platano  
School Tap  
Water Quality Sample



Rio Oeste Abajo  
School Tap  
Water Quality Sample



# Implementation - EPANET Analysis



<b>Network</b>	<b>Min. Head in System (ft)</b>	<b>Max. Head in System (ft)</b>	<b>Min. Pressure in System (psi)</b>	<b>Max Pressure in System (psi)</b>
Quebrada Platano: Big Tank	40.9	43.9	17.7	19.0

# Implementation - Construction Schedule

<b>Project</b>	<b>Estimated Working Days</b>	<b>Estimated Non-Working Days</b>	<b>Estimated Total Duration (days)</b>
Big Tank	21	8	29
Spring Source	38	14	52
School Tank	28	5	33
Palo Seco	49	14	63

It is recommended that construction take place during the dry season (January-April).

# Implementation - Cost Estimate

<b>Project</b>	<b>Labor</b>	<b>Equipment</b>	<b>Material</b>	<b>Total Cost Estimate*</b>
Big Tank	\$ 1,010	\$ 140	\$ 430	<b>\$ 1,600</b>
Spring Source	\$ 1,830	\$ 280	\$ 700	<b>\$ 2,800</b>
School Tank	\$ 1,350	\$ 230	\$ 460	<b>\$ 2,100</b>
Palo Seco	\$ 2,350	\$ 370	\$ 990	<b>\$ 3,700</b>

\*20% contingency not included.

\*Mobilization of materials was calculated for an overall site, not per project.

# Implementation

- Peace Corp Volunteers Propose Designs
- Dry Season Construction (January - April)



# Sustainability

- Sedimentation Tanks Maintenance
- Inlet Structures Maintenance





# Conclusion/Recommendations

- Implementation Adjustments
- Water Treatment
- Water Committee
- Secure Funding



**Thank you!**  
**Questions?**

