Quebrada Platano & Rio Oeste Abajo Water Systems Improvements

Bocas del Toro, Panamá
International Senior Design

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Daniel Woodall
Jacob Herzog
Melody Harmon
Team Introductions

Christine Wood
- Project Manager
- Environmental Engineer
- Water Quality Technician

Lucy-Chen Inc.

Jacob Herzog
- Mechanical Engineer
- SolidWorks Technician

Daniel Woodall
- Mechanical Engineer
- Hydraulics 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

Rio Oeste Abajo
Quebrada Platano
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

Jacob Herzog
Design Proposals - Water Treatment

Quebrada Platano
School Tap
Water Quality Sample

Rio Oeste Abajo
School Tap
Water Quality Sample
## Implementation - EPANET Analysis

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Quebrada Platano: Big Tank</td>
<td>40.9</td>
<td>43.9</td>
<td>17.7</td>
<td>19.0</td>
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## Implementation - Construction Schedule

<table>
<thead>
<tr>
<th>Project</th>
<th>Estimated Working Days</th>
<th>Estimated Non-Working Days</th>
<th>Estimated Total Duration (days)</th>
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<tbody>
<tr>
<td>Big Tank</td>
<td>21</td>
<td>8</td>
<td>29</td>
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<tr>
<td>Spring Source</td>
<td>38</td>
<td>14</td>
<td>52</td>
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<td>School Tank</td>
<td>28</td>
<td>5</td>
<td>33</td>
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<tr>
<td>Palo Seco</td>
<td>49</td>
<td>14</td>
<td>63</td>
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It is recommended that construction take place during the dry season (January-April).
### Implementation - Cost Estimate

<table>
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<tr>
<th>Project</th>
<th>Labor</th>
<th>Equipment</th>
<th>Material</th>
<th>Total Cost Estimate*</th>
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<tbody>
<tr>
<td>Big Tank</td>
<td>$ 1,010</td>
<td>$ 140</td>
<td>$ 430</td>
<td>$ 1,600</td>
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<td>Spring Source</td>
<td>$ 1,830</td>
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<td>$ 700</td>
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<tr>
<td>School Tank</td>
<td>$ 1,350</td>
<td>$ 230</td>
<td>$ 460</td>
<td>$ 2,100</td>
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<tr>
<td>Palo Seco</td>
<td>$ 2,350</td>
<td>$ 370</td>
<td>$ 990</td>
<td>$ 3,700</td>
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</tbody>
</table>

*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 Committee
- Water Treatment
- Secure Funding
Thank you!

Questions?