Outline

- Community Background
- Problem Description
- Project Description
- Data Collection
- System Modeling
- Final Design
- Scheduling and Cost Estimation
- Construction and Maintenance
- Conclusion
Community Background

- **Location**
  - North of the Pan-American Highway
- **Peace Corps Volunteer**
  - Shellee Merryman, stationed in Guayabital
- **Four villages in area**
- **People**
  - Subsistence farmers or employees of larger farms
- **Education**
  - Grade school and “Colegial”
Problem Description

- El Hueco - Low income community of 15 people
- Five homes in community
- Rio Chico is main source of water
  - Health risks
  - Carried uphill

Rainwater Catchment in El Hueco
Project Description

- Design a gravity-fed system to deliver water to the people of El Hueco
- Project stakeholders
  - People of El Hueco
  - Inieda - Loma Chata Water Committee President
  - Representante of Toza area
- Paid for by the representante with government funds
- Built by people of El Hueco

Loma Chata Tank
Data Collection-Surveying

Elevation Profile

Satellite View
Data Collection

- **Flow Rate Tests**
  - Total Water Flow: 23,000 (gal/d)
  - Available Water: 105 (gal/person/day)
  - W.H.O. Guidelines: 5.3 (gal/person/day)
  - MINSA Guidelines: 26.4 (gal/person/day)

- **Coliform Tests**
  - Very Few Coliforms Found
  - Storage Tank is Chlorinated
System Modeling

HGL - 2 Open Taps

Graph showing elevation profile and HGL against distance.

Diagram showing pipeline network with labels for Storage Tank, Pressure Break Tank, and El Huevo Taps.

Legend for pressure and velocity in the diagram.
System Modeling

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- **SPRINGS**
- **STORAGE TANK**
- **LOMA CHATA TAPS**
- **PRESSURE BREAK TANK**
- **EL HUECO TAPS**

**Pressure**:
- 25.00
- 50.00
- 75.00
- 100.00

**Velocity**:
- 0.01
- 0.10
- 1.00
- 2.00
- m/s
Spring Box/Tank and Water Treatment

- *Tomas* and tank already established
- Water chlorinated on distribution side of tank
- Residence time of chlorine calculated:
  - 536 minutes
  - Sufficient time
  - Residuals may be depleted
- Recommend chlorine testing at homes
Pipe Network

- SDR 26 PVC pipe (160 psi)
- 7960 meters tank to branch
- 2” Pipe - 1360 meters
- 1” Pipe - 6600 meters
- ½” Pipe to taps
- 1.5 gpm design tap flow
- 25-50 psi at taps
Pipe Network

Each house has tap with:
1 - ½" Spigot
1 - ½" Shut Off Valve
2 - ½" Elbows
1 - Reinforced Concrete Tap Stand
Shut Off and Clean Out Valves

- 11 shut off valves:
  - 3 upstream of highest pressure points
  - 2 at the pressure break tank
  - 1 before the road crossing
  - 1 at each water tap stand
- Clean out valve: One clean out valve at a low point in the system where sediments are most likely to build up
- No air release valves needed
Tap Stands

- Reinforced concrete tap stands at five sites
- Shut off valve beneath tap stand in case of breaking
- Community members can build off of tap stand

Pressure Reducing System

- Attempted use of flow reducing disks
  - Impractical
- Pressure break tank will be used
  - 0.5 km from the village
  - Made of concrete blocks and cement mixture
  - Float valve
Road Crossing

- Paved road requires crossing
- Paid for and built by Guayabital Water Committee

Anchor concrete volume: 0.08 yd³
Tension in cable: 126 lbs

View from one side of proposed road crossing to the other

Basic Design of Suspended Crossings
(Field Guide to Env. Eng. for Dev. Workers, Mihelcic, et al., 2009)
Two River Crossings

- Two rivers that water line must cross
- Current crossings for Guayabital system are unsustainable

20-meter river crossing
- Anchor concrete volume: 0.07 yd$^3$
- Tension in cable: 78 lbs

40-meter river crossing
- Anchor concrete volume: 0.18 yd$^3$
- Tension in cable: 155 lbs

Road and river crossing anchor design
Reinforced concrete

(Field Guide to Env. Eng. for Dev. Workers, Mihelcic, et al., 2009)
Stream Crossings

- Many small stream crossings
- Estimated at 1.5 meters wide
  - Tension in cable: 12 lbs
- Use 15” ground anchors
Construction Scheduling

- Anchors:
  - Road Crossing
  - Two River Crossings
- Pressure Break Tank
- 8 Main Line Sections
- Distribution Lines
- Water Tap Stands
- Four months to complete: January - May

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<th>Task</th>
<th>Duration</th>
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Cost Estimation

Budget Goal/Pump Cost: $8,000

Total Cost: $14,500
- Road Crossing: $600
- Fuel for Trench Digger: $2,400
- Reinforced Tap Stands: $800
- Water Crossings: $1,400
- Delivery: $2,000

Reduced Cost: $7,500
- Pipes: $6,800
- Miscellaneous: $700
Construction and Maintenance

Buckets must be placed on the ground when being filled.

Two taps may be open at once in the village of El Hueco.

The pressure break tank should be cleaned at least every 6 months.

Clean out valve must be cleaned every 2 weeks.

*Tomas* and storage tank must be cleaned out occasionally.

*Inside of toma*
Conclusion

- Provide clean source of water to El Hueco
  - 5 taps for 15 people
- Funding from Panamanian government
- Reduced budget is less than the budget goal of $8,000
- Construction Time: 4 Months from January to May 2018
Thank You!