GRAVITY-FED WATER DISTRIBUTION SYSTEM BUCORI, PANAMA

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OUTLINE

- Mission Statement
- iDesign
- Background
  - Community/Politics
  - Project
- Methods
- Design Components
- Schedule
- Cost Estimations
- Conclusions and Recommendations
- Questions

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PROJECT MISSION STATEMENT

Create a pipe network that will distribute water from 3 springs to the neighborhood of Central Bucori. Water will be treated individually at home.

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INTERNATIONAL SENIOR DESIGN - IDESIGN

- 2 weeks in Panama
- Help developing communities
- Peace Corps Volunteer host during community stay
- 2016 iDesign: 11 students
  - 2 water teams
  - 1 bridge team
- Spent the semester working on design projects

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SUMMARY OF TRIP

Day 3-11:
- Traveling to Communities
- Data Collection

Day 1-3:
- Exploring Panama City
- Community Prep

Day 11-14:
- Debrief
- Presentations

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TRAVEL DETAILS

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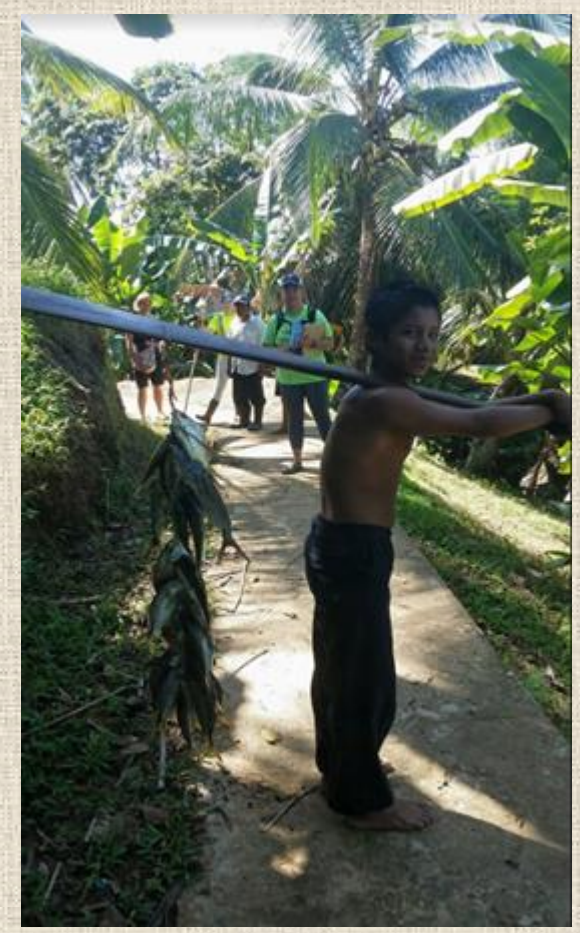
INTRODUCTION – COMMUNITY BACKGROUND

- Bucori, Panama
- Bucori was founded by the current president's grandfather
  - Banana farm lawsuit over wages
- Wooden houses built on stilts to be safe from heavy rains
- Many streams in neighborhood of Central Bucori



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INTRODUCTION – PROJECT POLITICS

- Community Leader
  - Faustino
- Water Committee
  - 7 positions. Only 3 are filled with active members
- Peace Corps Volunteer (PCV), Taylor Domagalla
- Project Funding
  - $8000 grant - PCV to submit application
- Community Contribution
  - Each house pay $1/month for system maintenance

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INTRODUCTION – PROJECT BACKGROUND

- Water source - 3 springs
- System
  - From springs to large holding tank
  - From tank to community
- Access to water – 38 faucets
  - 7 Community Buildings
  - 31 homes (Average of 5 people per house)

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INTRODUCTION – PROJECT BACKGROUND

- Design Components
  - 9 stream crossings
  - 1 valley crossing
  - 1 river crossing
  - Spring boxes
  - Holding tank

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METHODS - SURVEYING OUTLINE

- Gallon Jug and Timer
  - Calculate flow rates of springs
- Petri Films
  - Water Quality Test
- Garmin GPS
  - GPS Coordinates of each location
- Water Leveling
  - Measures level differences across a surface
- Nikon Laser Rangefinder
  - Measure angle of elevation
- Measuring Tape
  - Measure distance between sites

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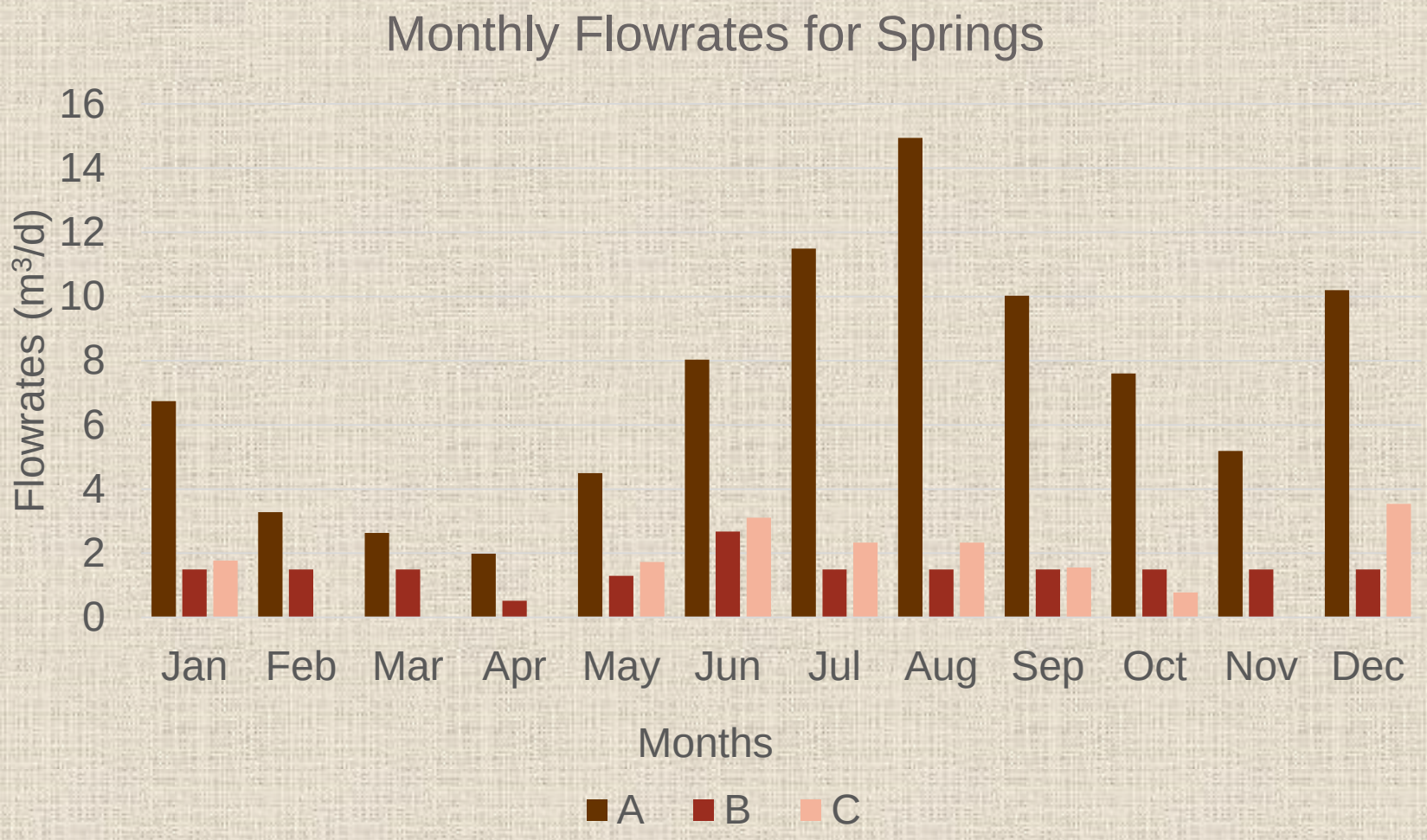
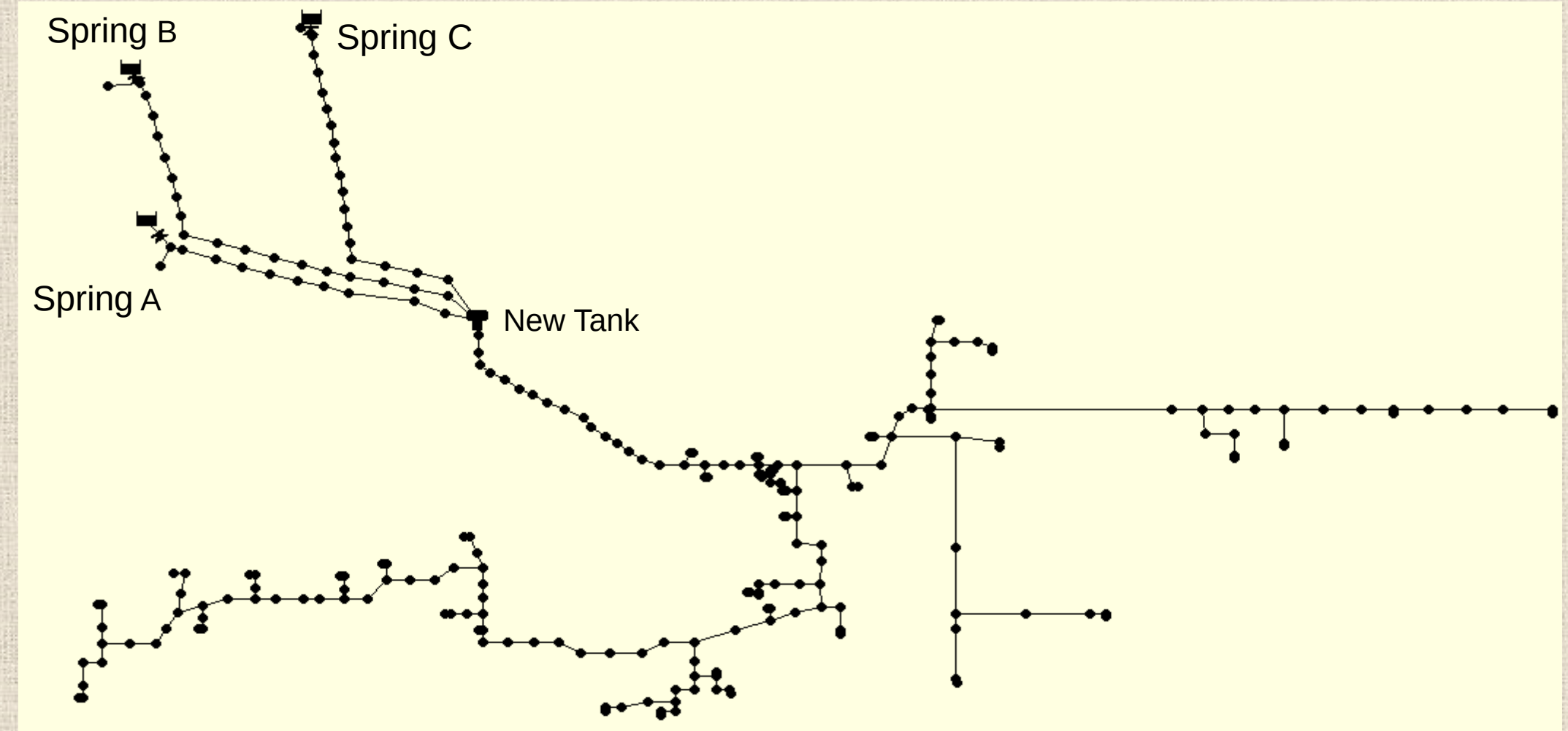
METHODS - ANALYSIS



EPANET – HYDRAULIC SIMULATION SOFTWARE



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METHODS-ANALYSIS

Hazen Williams Equation

$$h_L = 4.727C^{-1.852} * d^{-4.871} * L$$

h_L= Headloss (m)

C = Coefficient for specific pipe material; PVC

d = Diameter of pipe (mm)

L = Length between nodes (m)

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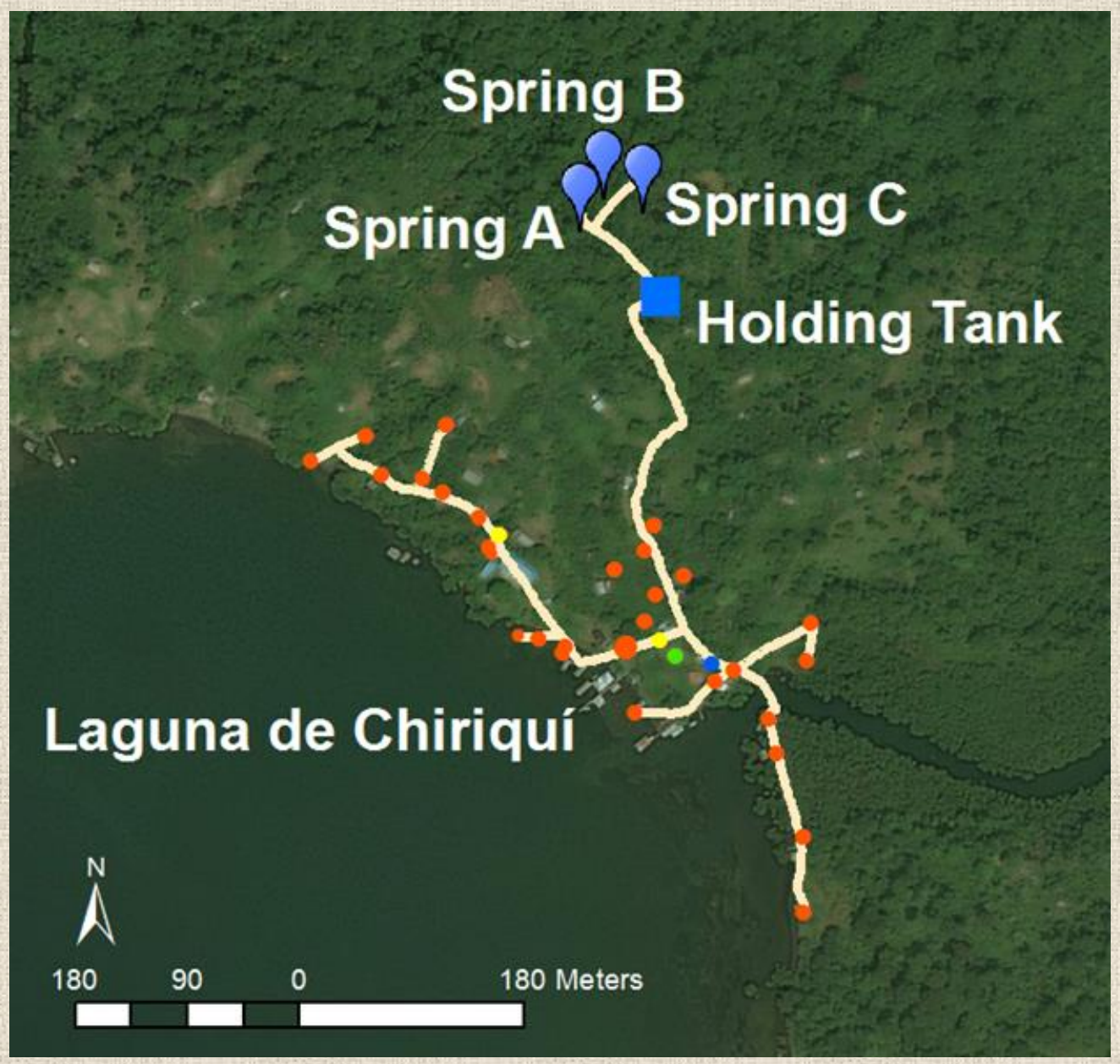
Spring B
Spring A
Spring C
Holding Tank
Laguna de Chiriquí
N
180
90
0
180 Meters

DESIGN - SPRING BOXES

- What is a spring?
- Three Spring Boxes
- Capture water directly from the spring source and protect it from contamination
- Cleanout and overflow pipes will contain mesh screen to prevent contamination.

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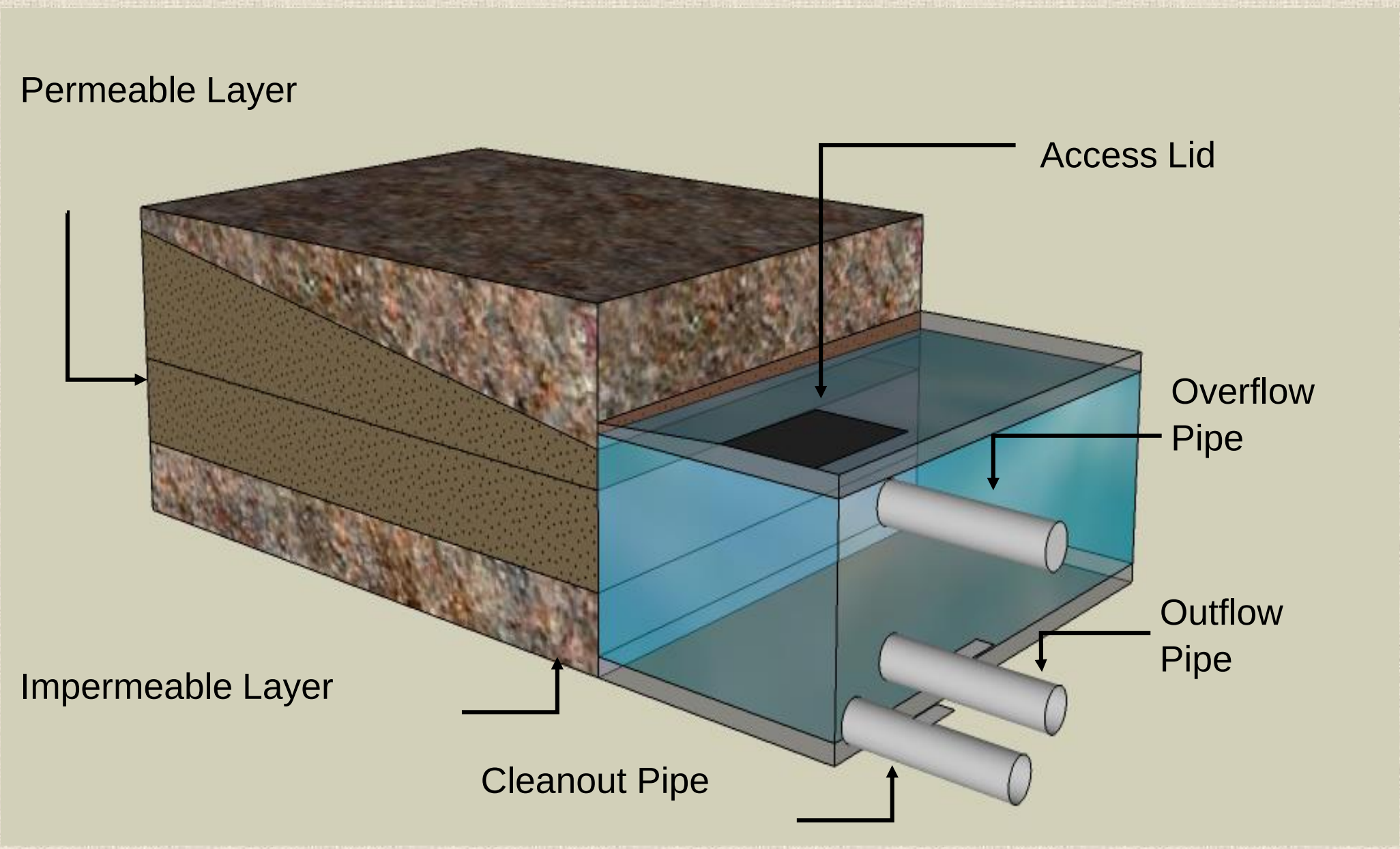
Permeable Layer
Access Lid
Overflow Pipe
Outflow Pipe
Impermeable Layer
Cleanout Pipe

DESIGN - HOLDING TANK

Dimensions:

- 22 m^3 (~6,000 gal)
- L x W x H
  - 3.92m x 3.92m x 2.38m

Water Supply

- Meets current demand for 4 days

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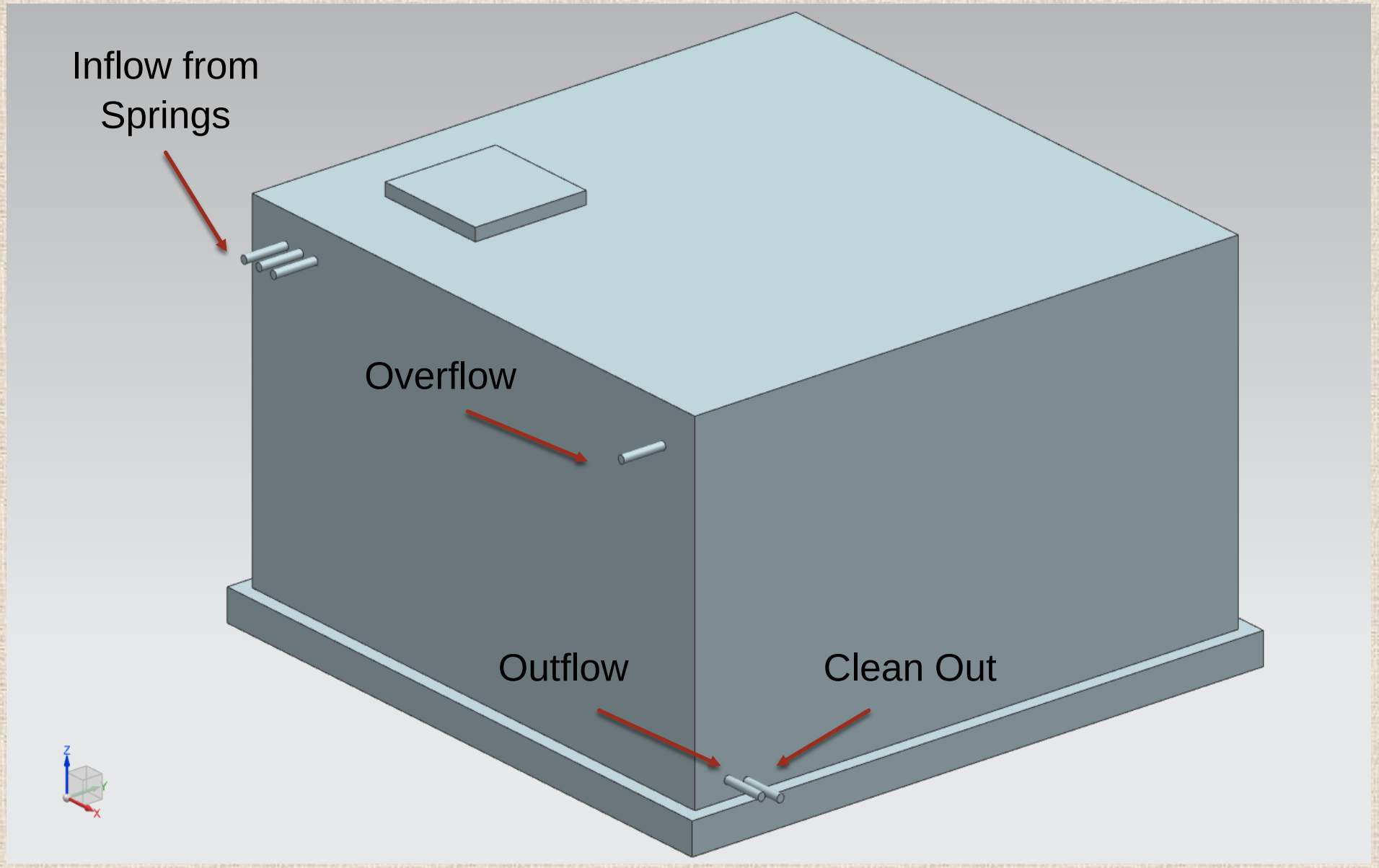
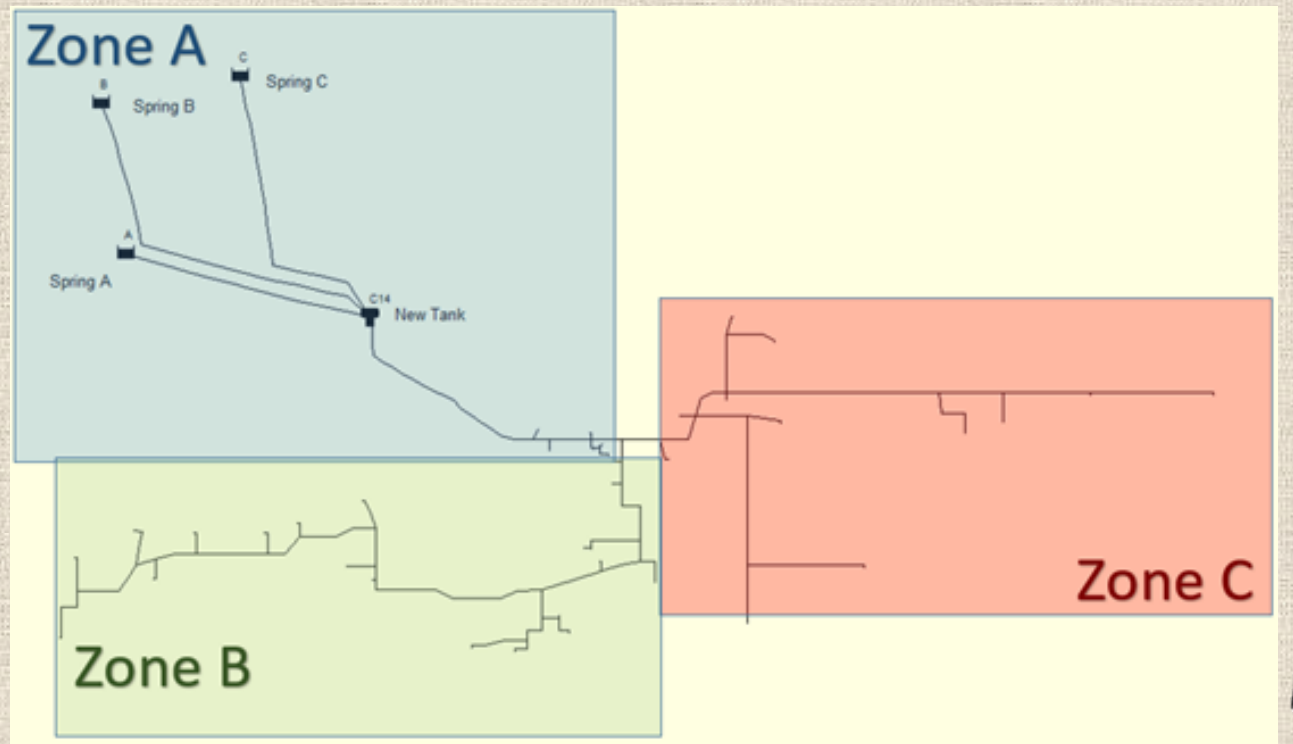

Inflow from
Springs
Overflow
Outflow
Clean Out

DESIGN - PIPING NETWORK

- SDR-26 PVC Piping
  - 2-inch piping Main Network
  - 1.5-inch piping on branches of network
- Pipe Fittings
  - 135 elbows, 400 unions, and 35 Y/T fittings
  - Cleanout/Air Valves
- UV spray for Protection and Maintenance



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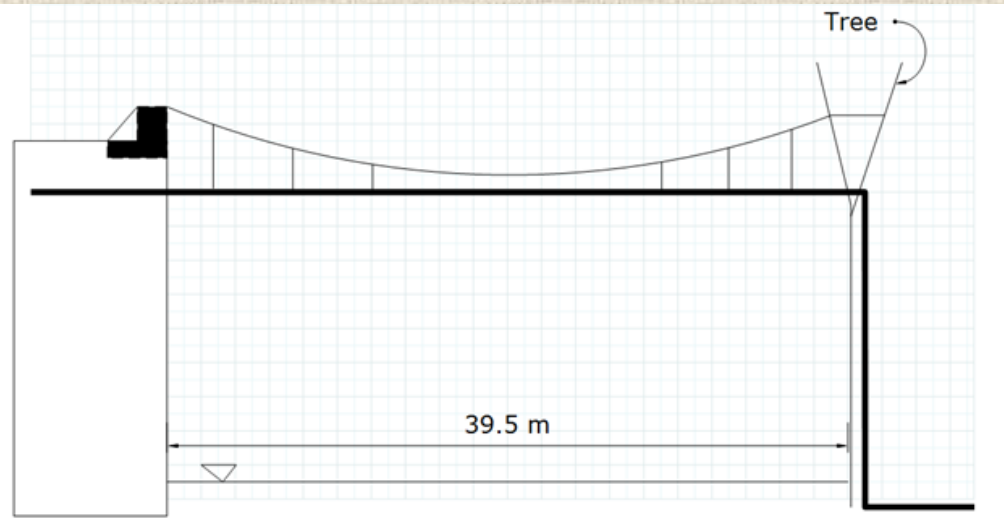
DESIGN - WATER CROSSINGS

- River Crossing
  - 40 meters
  - Suspension system holding the pipe
  - 4" pipe for protection



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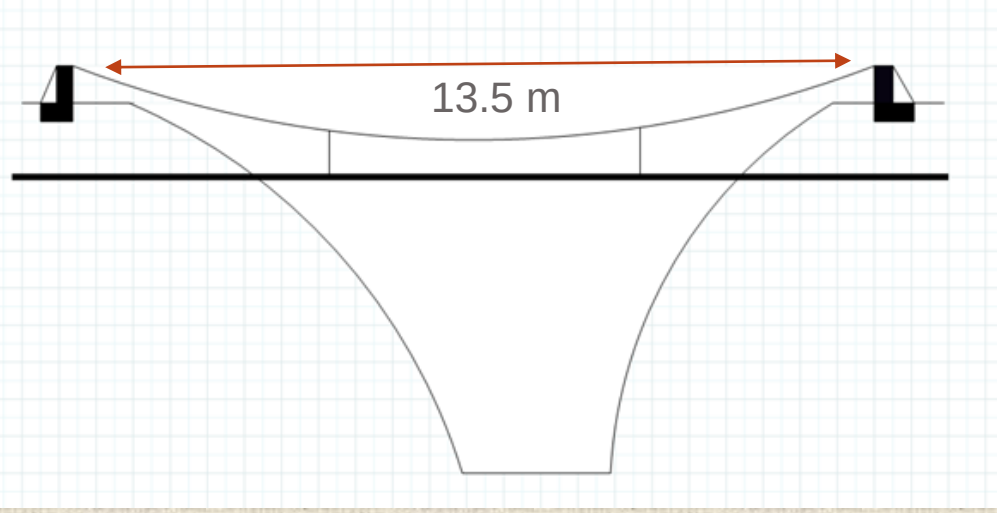
DESIGN - WATER CROSSINGS

- Valley crossing
  - 13.5 meters
  - Suspension system
  - 4" pipe for protection



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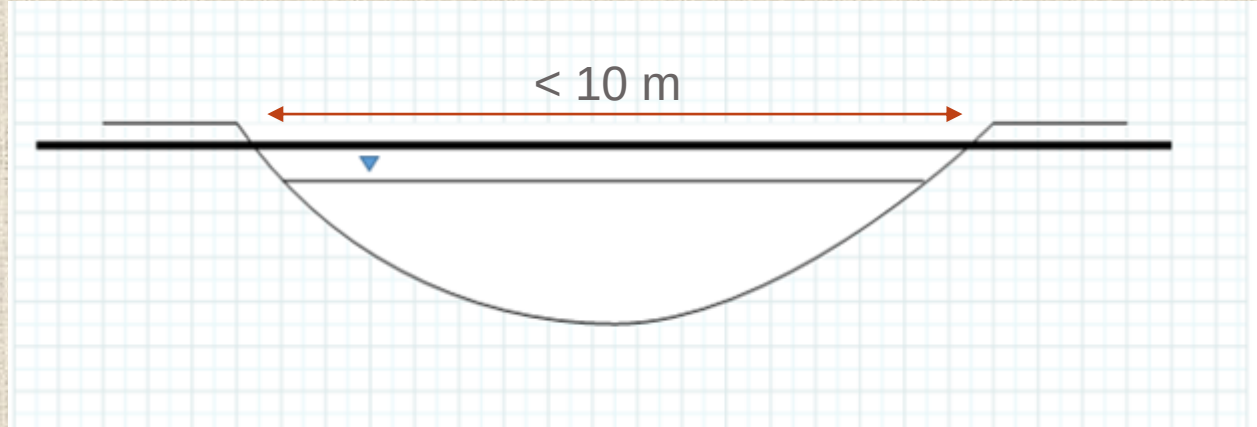
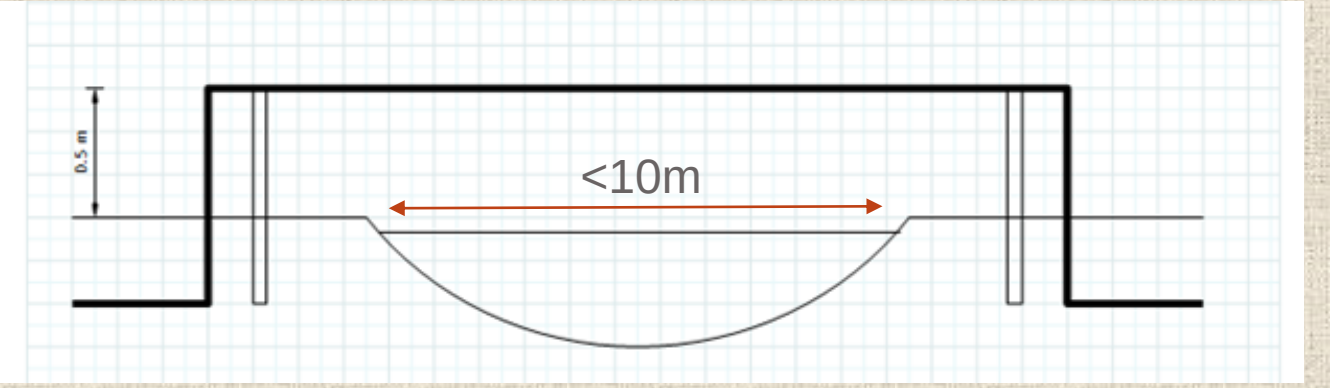
DESIGN - WATER CROSSINGS

- Stream Crossings
  - Case 1
    - No extra support needed
    - < 10 m span
    - No risk of washout



DESIGN - WATER CROSSINGS

- Stream Crossings
  - Case 2
    - Extra support needed
    - < 10 m span
    - Risk of washout



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WATER TREATMENT

- Water will be treated in home
  - Lack of community support
  - Difficult access to holding tank
- Bottle of Chlorine
  - 1 bottle (250 mg) of chlorine every 50 days for 5-person family
  - 0.02 mg chlorine per 1 L of water

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CONSTRUCTION SCHEDULE

- Project will take 40 work days
  - 6-8 hours/work day
- Upwards of 6 people per task
  - Labor provided by community volunteers
- Materials and equipment bought in city and transported by canoe

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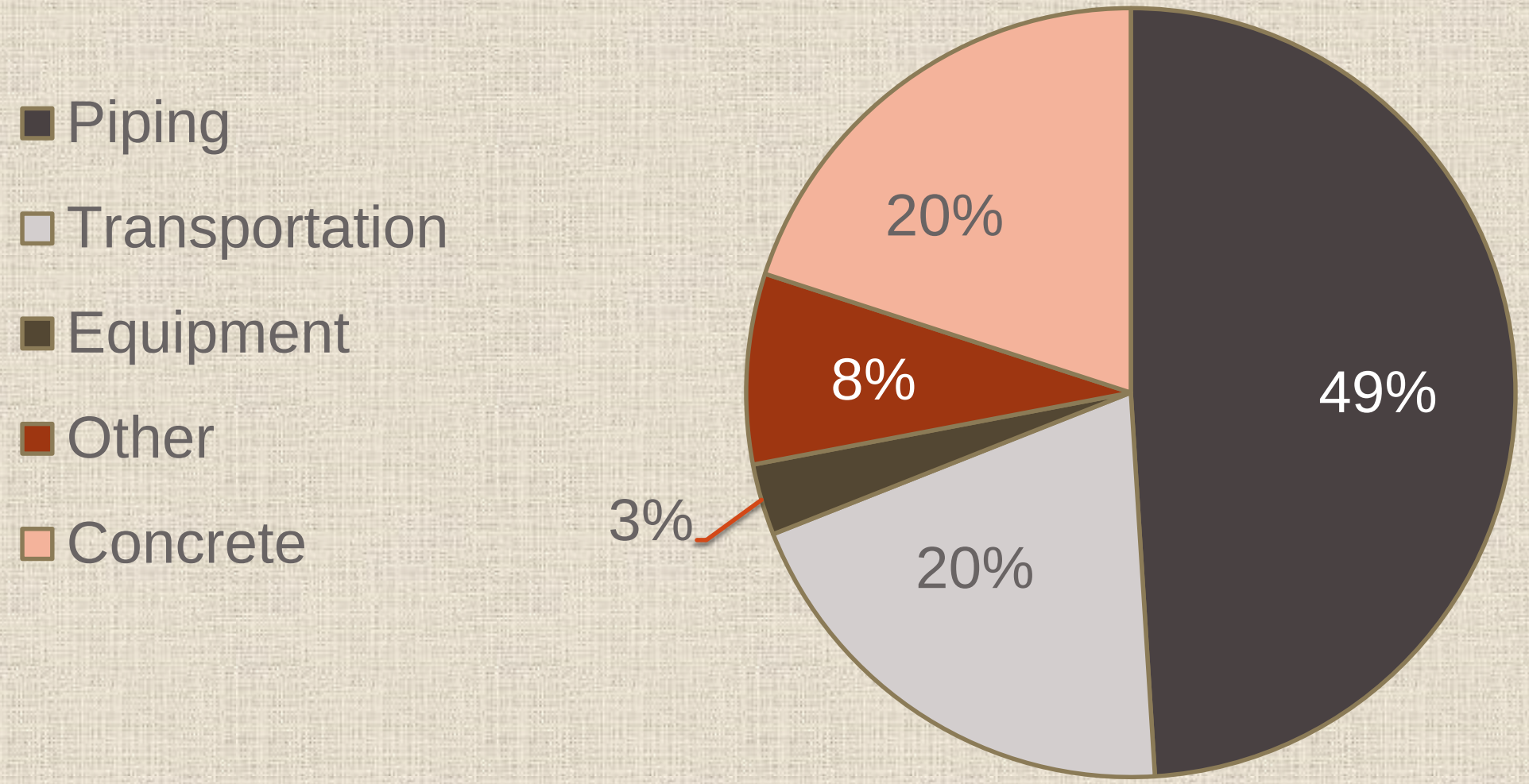
Total Cost: $15,300



CONCLUSIONS - RECOMMENDATIONS - NEXT STEPS

- Improve quality of life
  - Ease of water access
- Education will be provided by Peace Corps Volunteer
  - Maintenance of the system
  - Importance of sanitizing drinking water
  - Water committee training and development
- Grant proposal for funding

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ACKNOWLEDGMENTS AND FINAL THOUGHTS…

Mesele

Beli

Jinchain

Luis

Chame

Messi

Borrichi

Nitikjone

"The purpose of life is to live it, to taste experience to the utmost, to reach out eagerly and without fear for newer and richer experience."

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Questions?

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