Improving Accessibility to Potable Water in Yuu, Ecuador

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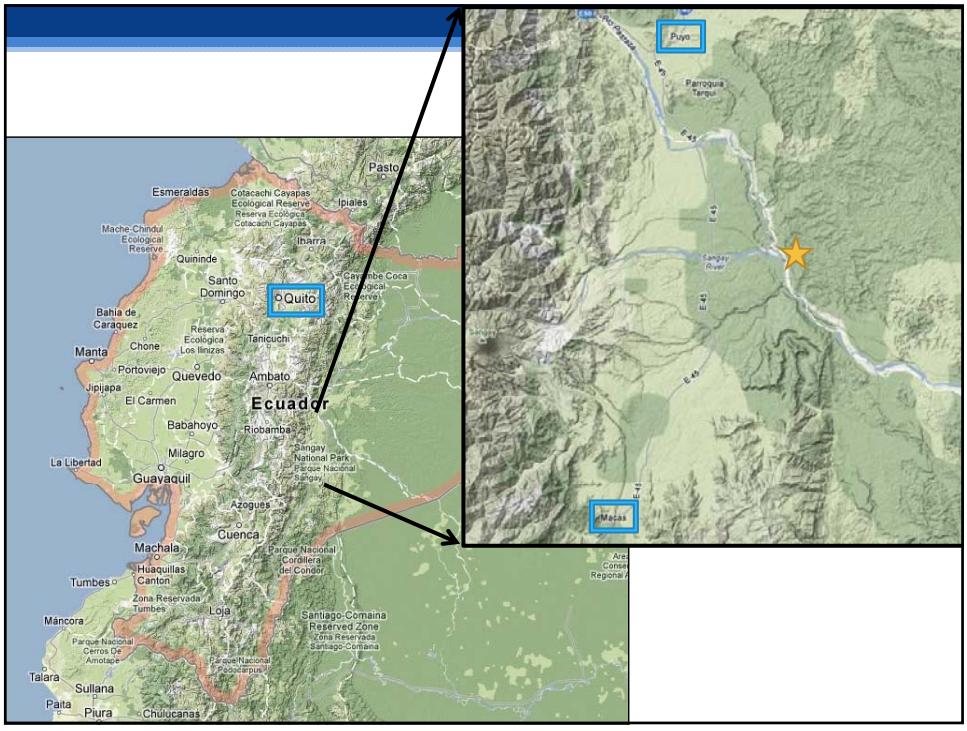
Outline

- Introduction
- Define the Problem
- History
- Data Collection
- Methods
- Preliminary Design
- Conclusions
- Questions

Introduction

- Located in Amazonias Region of Ecuador
  - Between Macas and Puyo
- Community lies on a ridge approximately one mile from large river
- Ninety percent of homes are visible from main highway



Community Dynamics

Defining the Problem

- Procedure
  - Community Meeting
  - Interviewing families
  - Examining community's needs vs. desires
    - Struggles during dry season to obtain potable water
    - Concerns about children
- Problem Statement
  - "Improving sustainable accessibility to potable water"

History

- Pre-existing System
- Pump Problems
  - Lack of Adequate Flow
  - Incorrect Pump Size
  - Diesel Fuel
- Piping
- Tank
- Lack of Maintenance

Design Options

- Distribution System
- Rain Water Harvesting System

Data Collection

- Consumption/Population Demographics
- Surveying
- Water Quality/Turbidity
- Stream Bed Analysis
- Flow Data at current sources

Data Collection

- Water Consumption/ Population Demographics

House L5		
Coordinates	S01	52.506
	W077	48.636
Elevation	2797	
Picture	508	514
Population	4	
Tank	No	
Water Source	Rainwater	PondL4-6

Notes:

1)	Cooks outside
2)	Wash and bathe in pond L4-6
3)	Collect in Small Buckets

Data Collection

- Surveying

ROAD SURVEY DATA GATHERED FROM YUU, ECUADOR (5-6-12 thru 5-8-12)

Equation :	HI	+	Shot	=

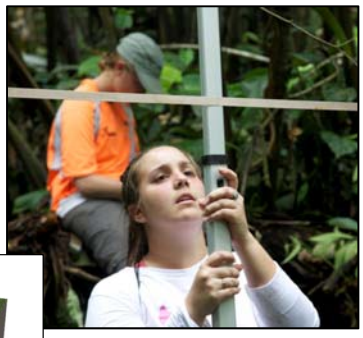
Station	HI			Shot			"+ or - (ft)"	Elev (ft.)
	Feet	Inches	Converge (ft)	Feet	Inches	Converge (ft)		
0+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3024.00
R3´OS0+00	5.00	5.13	5.43	4.00	10.00	4.83	0.59	3024.59
L3´OS0+00	5.00	5.13	5.43	5.00	11.63	5.97	-0.54	3023.46

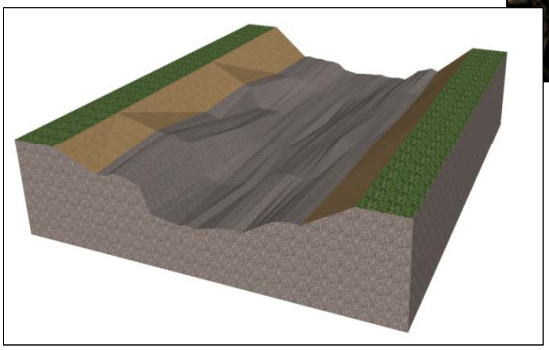
Data Collection

- Water Quality/Turbidity

Data Collection

- Stream Bed Analysis



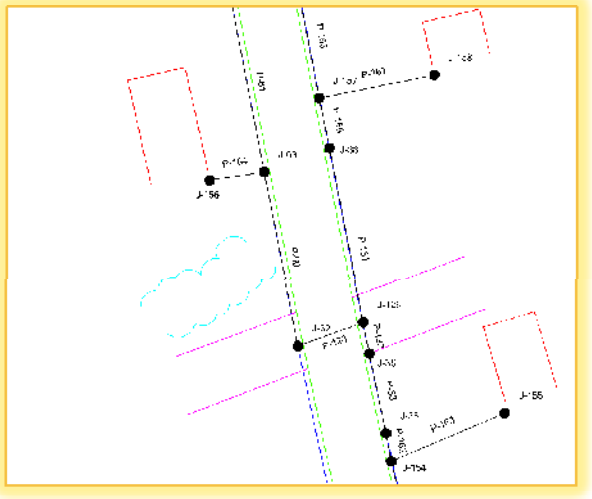


Data Collection

- Flow Data

Average Flow	0.5	ft^3/sec
	43,000	ft^3/day
	1,221,000	liters/day

Preliminary Design



Cost Estimate

Table 1: Cost Estimate for Yuu, Ecuador Piping Project

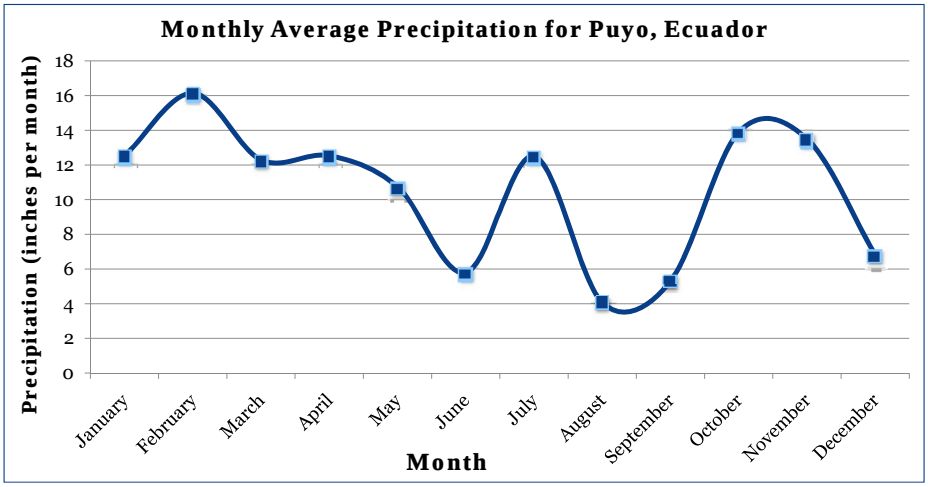
Material	Cost of Materials (U.S. $)
2" Pipe (in ft)	$ 7000
Pipe Connections	$ 2800
Tees	$ 43
Overhead (20%)	$ 2000
Pump 1	$ 9000
Pump 2	$ 4000
Total	**$ 25,000.00**

Assume no transportation cost

Concerns

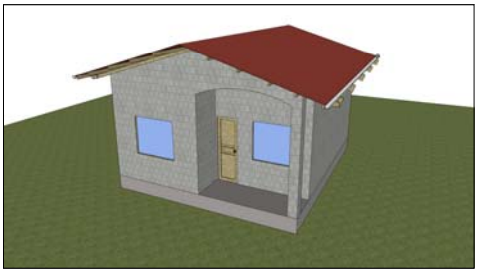
- Sustainability
- Ownership
- Insufficient Flow
- Pipe Breaks
- Cost
  - Capital
  - Operational and Maintenance

Final Design- Rain Water Harvesting



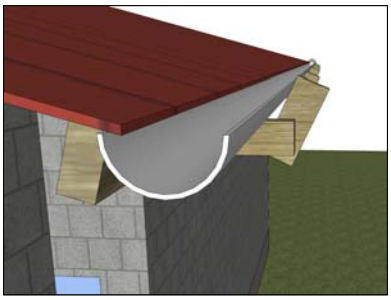
Overall Rainfall Harvesting System Design

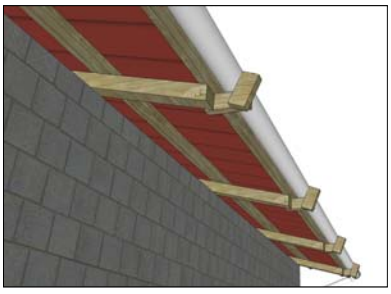
- Modeled for generic house
- Components
  - Gutters
  - Filtration apparatus
  - Storage tank



Gutters

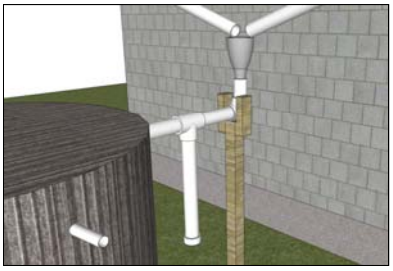
- 6” PVC pipe
- Gutter hangers
  - Wood

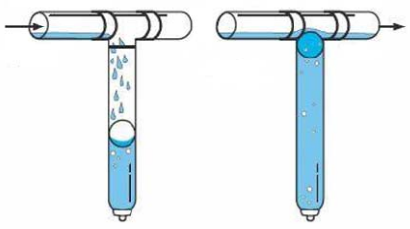




Filtration Apparatus

- Funnel
  - Coarse Screen
  - Fine Screen
  - Notched
- First Flush Device
  - Ball Style
  - Purge contaminants from roof



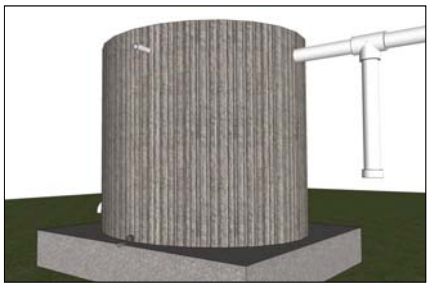


http://www.aquabarrel.com/product_downspout_filters_first_flush_inline.php

Prototype

Storage Tank

- Dimensions
  - Height = 1.5 m
  - Diameter = 2.2 m
- Characteristics
  - Ferro Cement
    - Wire
    - Rebar
  - 5500 L



Tank Size Determination

	Liters/Person	Frequency
	0-10	0.00
	10-20	0.00
Target Range	**20-30**	**24.00**
	30-40	**0.00**
	40-49	**0.00**
	50	**341.00**
	Reliability =	**100.0%**

Assumptions:

- 70% of rainwater is harvested
- Conserve percent is when the household will begin to use 20 liters per day instead of 50 liters per day

Inputs		
Roof Area =	2500.00	sft
Tank Size =	5500.00	Liters
Household =	6	People
Conserve %=	40%	

Cost Estimate

Table 2: Cost Estimate of Rain Water Collection System	
FERROCEMENT TANK	$ 75
WATER FILTRATION UNITS	$ 12
GUTTER SYSTEM	$ 74
TOTAL COST PER HOUSE	$ 193
TOTAL COST FOR COMMUNITY	$7,500

Assumption: No labor cost incurred

Sustainability

- Why does this design work?
  - Engineering Aspects
    - Low maintenance
    - Low cost
    - Utilizes precipitation
  - Cultural Aspects
    - Ownership
    - Local materials
    - Basic system; hands off
    - Ability to replicate design

Future Steps

- Research for funding: 6 months
- Order supplies and materials: 2 weeks
- Begin construction of rainwater harvesting systems: 2 months

Conclusions

- Improving accessibility to potable water for all community members
- Creating a sustainable design that is economically and socially appropriate

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