Water for Honey Hill:

Supplying Water to the Community of Cerro Miel

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Manda Schierbeek – ENVE, Merete Sørum – ENVE

UNO MÁS ENGINEERING

Outline

- Background
- Data Collection
- Data Analysis
- Design Recommendations
- Cost Analysis and Construction Schedule
- Conclusion

Water tap in community
Photo by Manda Schierbeek

Assessment Trip to Panama

paradisehunter.com

Community Background

- Located in a mountainous region
- Ngöbe People
- 300-400 People in Community
- Subsistence Farming
- Learn Spanish in School

Ngöbe girls in traditional dresses
Photo by Brittany Allen

Project Objectives and Background

- Primary Objective
  - Design a sustainable way to provide the community with clean water
- Existing Systems
  - Old System
  - New System
- Project Objectives
  - Improve Existing System
  - Expand System
  - Educate People on Use and Maintenance

Storage tank for the new system in Cerro Miel
Photo by Merete Sørum

Data Collection

- Survey and GPS
- Water Quality
- Water Availability

Team members doing water quality testing
Photo by Manda Schierbeek

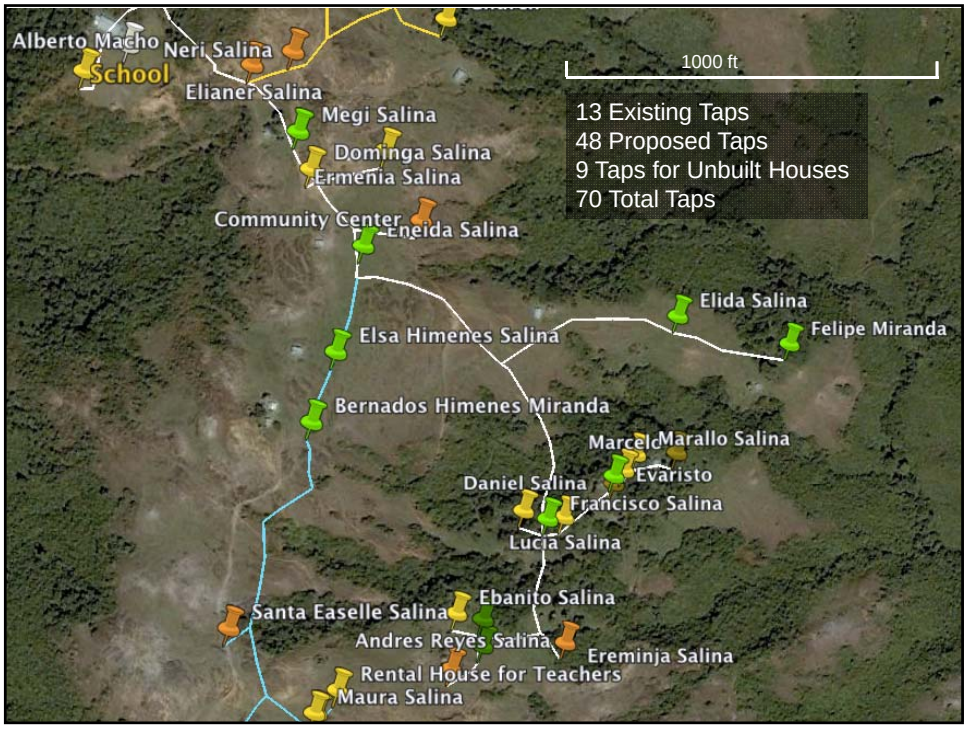
Data Analysis

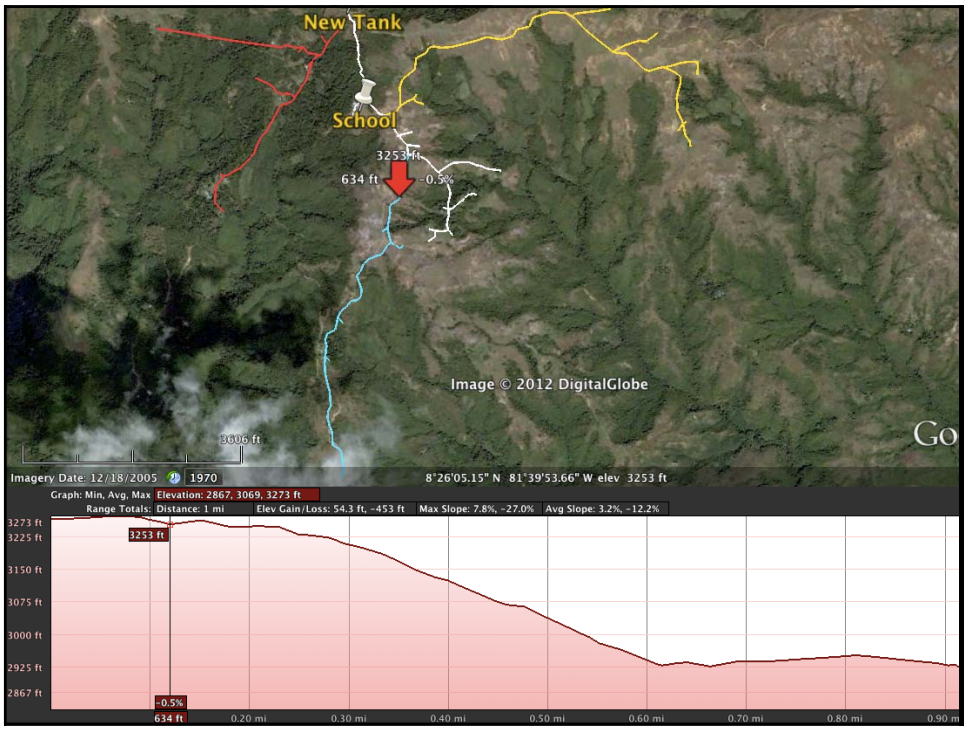
- Google Earth Mapping
- Water Availability Analysis
- EPANET Modeling

Peña Blanca, near Cerro Miel
Photo by Elizabeth Jefferson

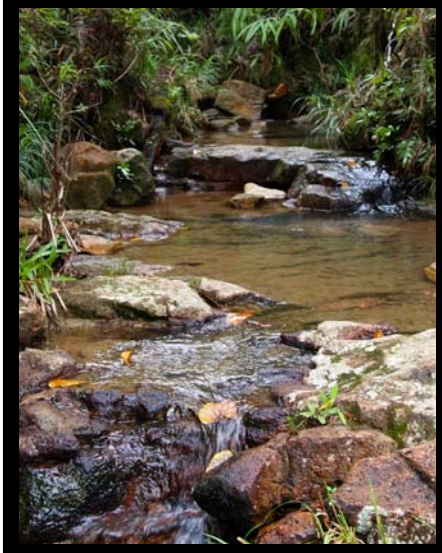
Total Length of Pipe: 16 miles
Pipe in Community: 7 miles

Google Maps by Elizabeth Jefferson


Alberto Macho
School
Neri Salina
Elianer Salina
Megi Salina
Dominga Salina
Ermenia Salina
Community Center
Eneida Salina
1000 ft
13 Existing Taps
48 Proposed Taps
9 Taps for Unbuilt Houses
70 Total Taps
Elida Salina
Felipe Miranda
Elsa Himenes Salina
Bernados Himenes Miranda
Marcelo Marallo Salina
Evaristo
Daniel Salina
Francisco Salina
Lucia Salina
Ebanito Salina
Santa Easelle Salina
Andres Reyes Salina
Ereminja Salina
Rental House for Teachers
Maura Salina


New Tank
School
3253 ft
634 ft
-0.5%
Image © 2012 DigitalGlobe
3606 ft
Imagery Date: 12/18/2005 1970
8°26'05.15" N 81°39'53.66" W elev 3253 ft
Graph: Min, Avg, Max Elevation: 2867, 3069, 3273 ft
Range Totals: Distance: 1 mi
Elev Gain/Loss: 54.3 ft, -453 ft
Max Slope: 7.8%, -27.0%
Avg Slope: 3.2%, -12.2%
3273 ft
3225 ft
3150 ft
3075 ft
3000 ft
2925 ft
2867 ft
3253 ft
-0.5%
634 ft
0.20 mi
0.30 mi
0.40 mi
0.50 mi
0.60 mi
0.70 mi
0.80 mi
0.90 mi

Water Availability and Quality



Stream in Cerro Miel

Photo by Elizabeth Jefferson

- Old system
  - Flow rate: 4.8 gal/min
  - Spring source
  - Good quality
- New system:
  - Flow rate: 50.7 gal/min
  - River source
  - Low quality

Water Treatment

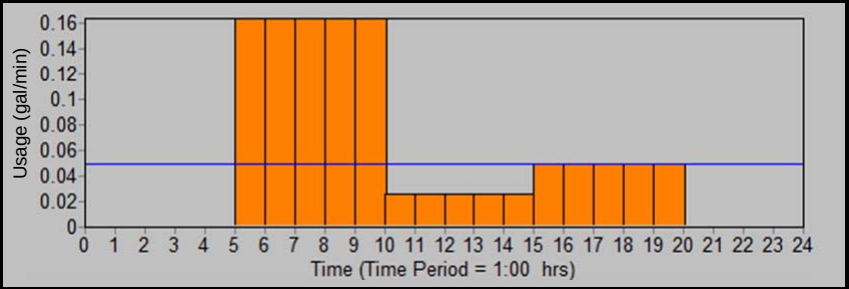
Slow sand filter in Tugri

Photo by Elizabeth Jefferson

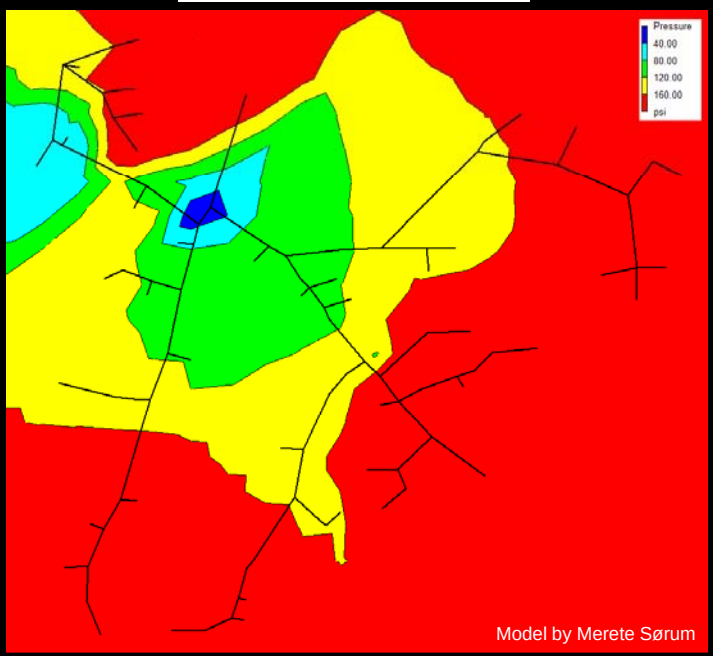
- Slow Sand Filter
- Inline Chlorination
- Located in Tugri
- Suggested move to Cerro Miel

Water Usage

- Christopher Kingsley's Survey
- Ministry of Health Estimation
- Distributed over the day
- 240 gal/day



EPANET Model



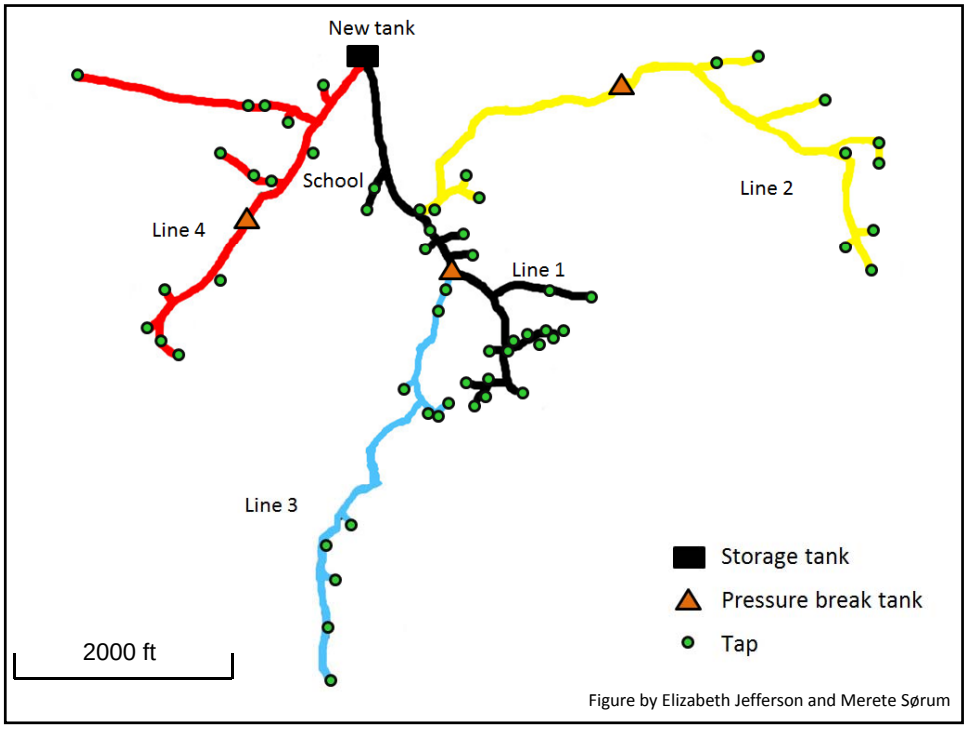


Figure by Elizabeth Jefferson and Merete Sørum

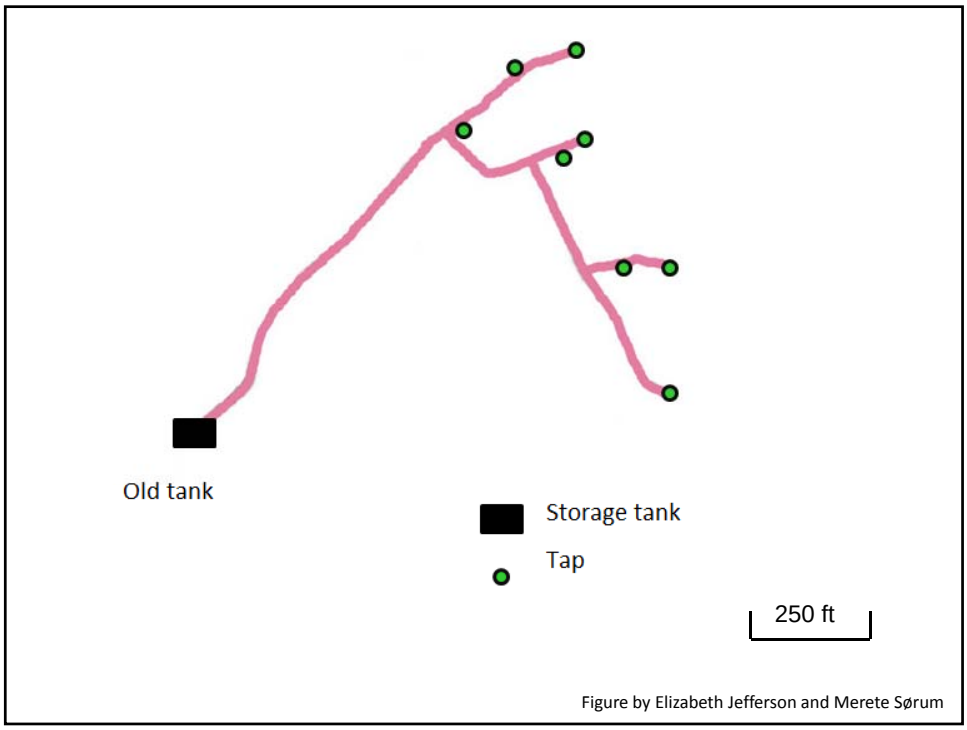


Figure by Elizabeth Jefferson and Merete Sørum

Pressure Release

- High elevation changes cause high pressures in pipes
- Two options considered
  - Mason-Break Pressure Tanks
  - HDP Pressure Tanks

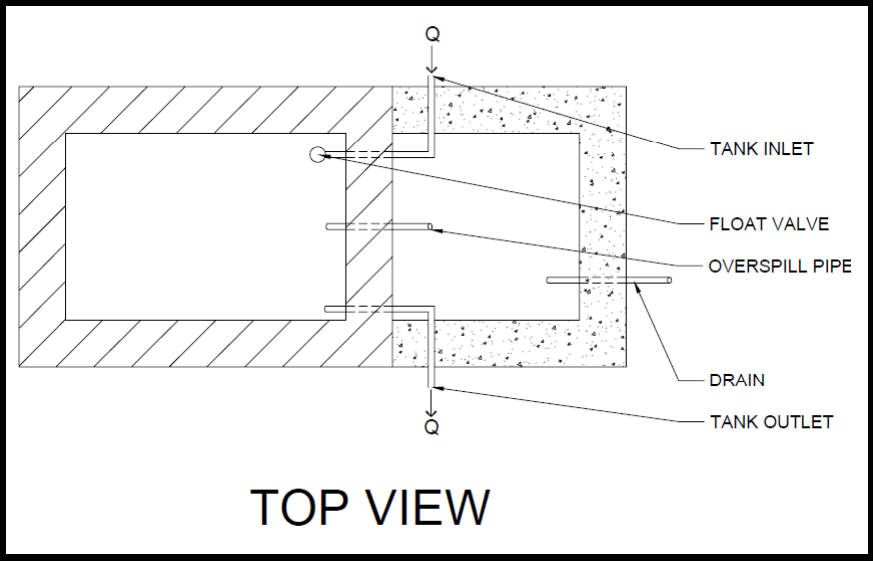
goinsurancerates.com

Mason-Break Pressure Tanks

Barefooteconomics.com

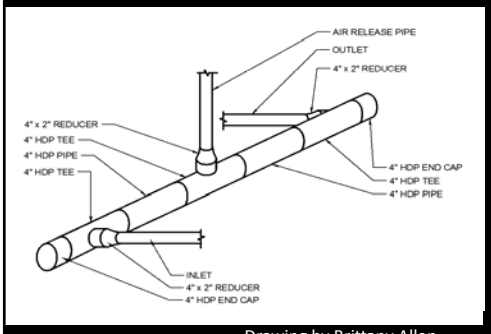
- 3 Tanks Total
- Located within Cerro Miel
- Most Durable Option

Mason-Break Pressure Tank

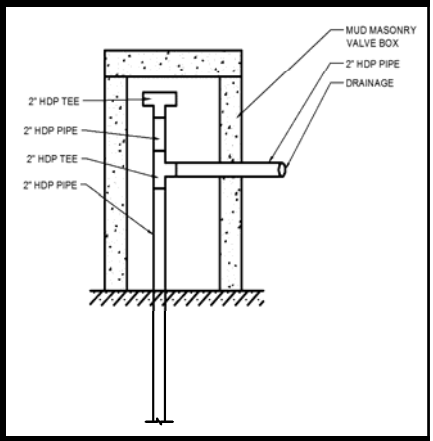


Drawing by Brittany Allen

HDP Pressure Tank



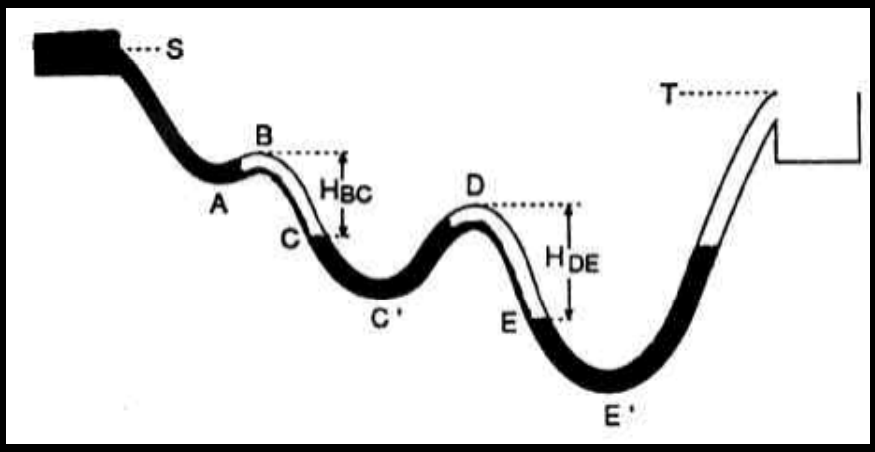
Drawing by Brittany Allen



Drawing by Brittany Allen

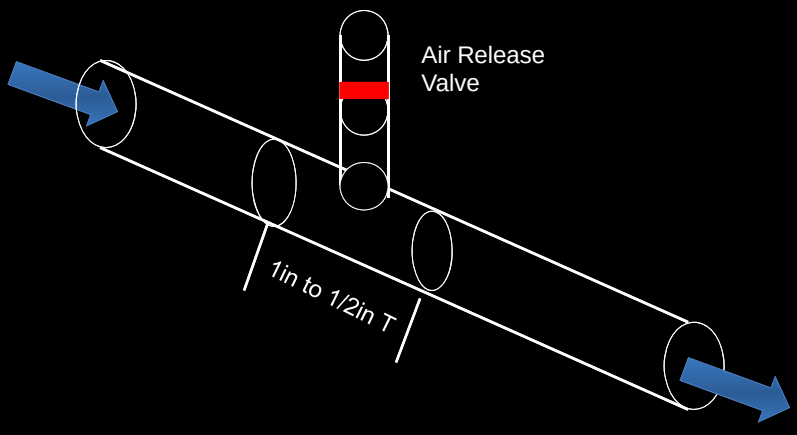
- Located by storage tank in Tugri

Air Block

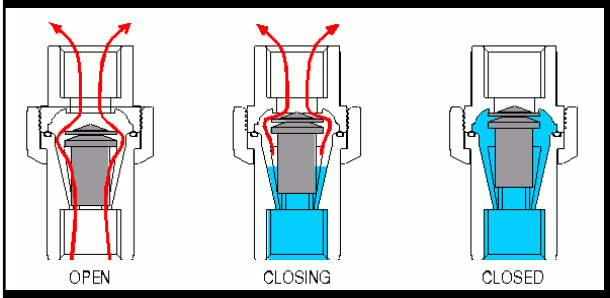


www.aplv.org

Air Release Design



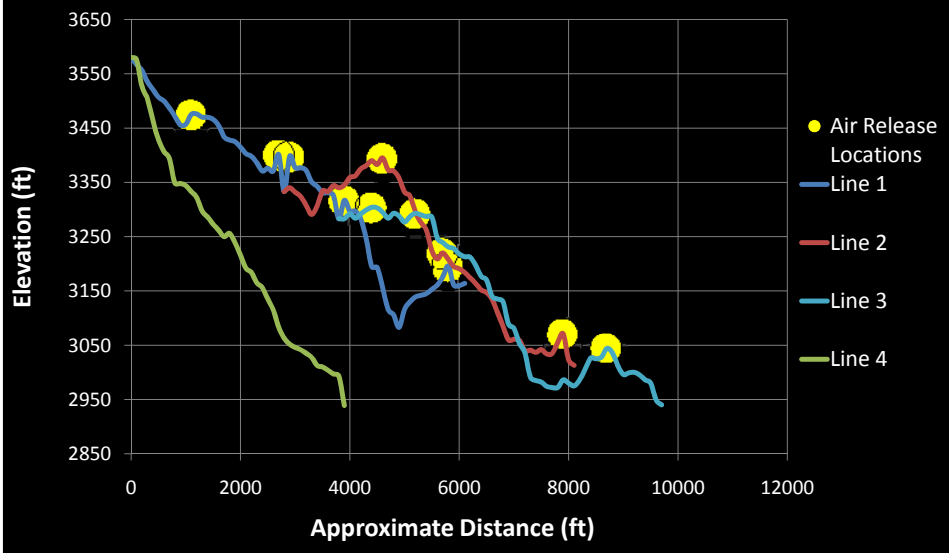
Air Release Valves



plastomatic.com

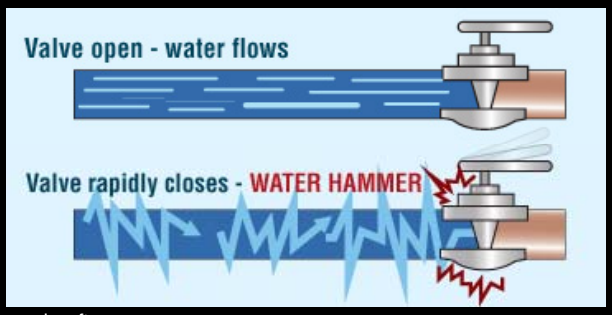
asahi-america.com

Air Release Locations



Water Hammer

- Pressure increases from rapidly closing valve
- Additional pressure may cause pipe to break



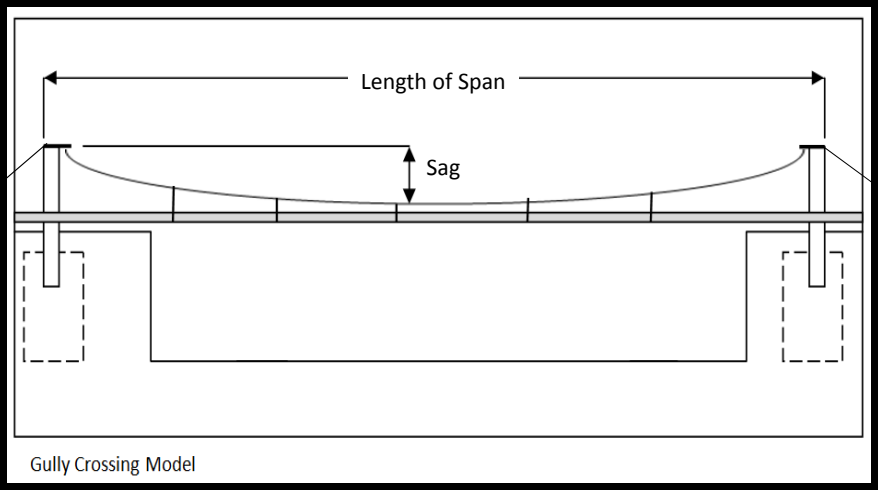
maplesoft.com

Gully Crossings

Break in pipe between Tugri and Cerro Miel

Photo by Elizabeth Jefferson

Suspension Bridges



Gully Crossing Model

Drawing by Manda Schierbeek

UV Protection

- UV Rays degrade PVC pipe
- Best Option:
  Burying the pipe
- Alternative:
  Painting the pipe

drain-experts.ca

Cost Estimating

- Material Data
  - Bajo Salitre Cost Estimate
  - Online Quotes
- Key Assumptions:
  - No Labor Cost
  - No Equipment Cost

Coinquest.com

Final Cost Estimate

Item	Cost
Pipeline, Fittings, Valves	4350
Pressure Release	535
Air Release	215
Gully Crossing Supports	1380
UV Protection	440
Transportation of Materials	930
Total:	**$7,850**

Construction Schedule

- Total time to construct: 105 Days
- Key Assumptions
  - Crew of 17 workers each day
  - 0.5 mi of pipe can be laid per day
  - RS Means Data Valid

Ngöbe women in traditional dresses
Photo by Elizabeth Jefferson

Conclusions

- Met the community's needs
- Designed a sustainable, reliable, and economical project
- Supplied tools to help community maintain their system

Photo by Mike Drewyor

Acknowledgments

Chet Hopp

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Mike Drewyor (PE)

Questions

Team in front of the Panama Canal Expansion Site
Photo by Rebecca Bender