Water Distribution in Quebrada Pastor, Panama

Project Background

AquaVenture was tasked with improving the main aqueduct system in the community of Quebrada Pastor, Panama. The current aqueduct, originally constructed in 2002 to service 8 connections, now services 30 and no longer meets water use demands. AquaVenture spent two weeks in Panama collecting data, gaining a cultural understanding of the community, and identifying areas of concern. Proposed designs include improvements to water supply and quality, system control and lifespan.

Community Background

- Located in the Bocas del Toro province of Panama
- Indigenous Ngöbe community comprised of 800 people
- Sources of income: farming, small businesses, and jobs in nearby cities including tourist destinations
- Water committee appointed to govern current aqueduct system
- Aqueduct originally built to service community school
- Majority of children are students, making water supply at the school a top priority

Data Collection

Surveying: Surveyed entire aqueduct, 14000ft. of pipe using abney level, tape measurer, and laser range finder

Water Use: Conducted interviews with various community members, members of the water committee, and school staff in order to collect data on water use.

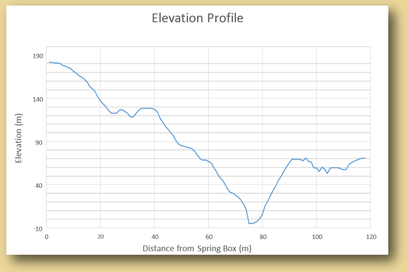
Water Quality: Used Rapid Coliform Count Plates and visual turbidity of water sources to determine quality of water sources

Supply: Flow measurements were taken from two spring boxes that feed the system. Rainwater catchment was determined as potential supplemental supply source

Data Analysis

EPANET:

- Survey data input into EPANET to model entire aqueduct
- Model outputs pressure, flow rates, head loss and demand at any point in the system
- Used to make lifespan and system control improvements



Rainfall:

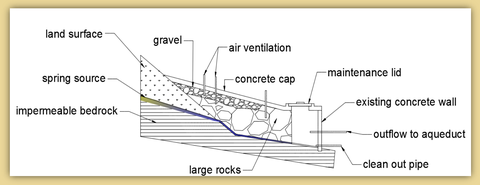
- Performed reliability analysis using rainfall data from Bocas Del Toro
- Percent Demand calculations for each month determine rain catchment to be reliable source for water supply
- Rain catchment at the school will ease stress on aqueduct

Month	Rainfall (mm)	Supply (gallons)	Demand (gal/month)	% Demand Met
Jan	241	17272	30000	58
Feb	148	10573	30000	35
Mar	148	10618	30000	35
Apr	194	13858	30000	46
May	225	16089	30000	54
Jun	205	14663	30000	49
Jul	290	20765	30000	69
Aug	205	14696	30000	49
Sep	107	7634	30000	25
Oct	138	9869	30000	33
Nov	267	19127	30000	64
Dec	345	24657	30000	82
Average Monthly % Demand Met				50

Proposed Designs

Water Supply and Quality

Spring box: Existing spring box lacks proper sealing, causing sediment and contaminates to enter the system. A properly sealed low-profile spring box design is recommended in order to increase water quality and supply.



Rain catchment: Given rainfall data analysis, it is recommended that the school invest in an additional gutter to increase catchment area and the supply of rainwater to tanks. Gutters and a first-flush system should also be considered as a way to improve water quality.

System Control

Additional ball valves should be added to provide easier maintenance and repair of the system and a better regulation of water supply.

Lifespan Improvements

- Replace degraded metal support to prevent collapse of the aqueduct
- Utilize carrier pipes at stream crossings for UV and environmental protection
- Bury or paint exposed line to prevent UV degradation
- Provide pipe supports where the aqueduct rises 600 feet up a 30° incline
- Replace worn or weathered pipe with new pipe
- Educate community on sustainability. (I.e. teach kids to stay off pipes, educate water committee on maintenance and repairs)

Figure 1. Degraded Metal Support

Construction Cost Estimate & Schedule

Improvement	Cost	Duration of Construction (days)
Rainwater Catchment	$193	2
Low Profile Spring Box	$71	16
Pipe Crossings	$653	30
System Control	$346	11
Total:	$1,300	59

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