About Aldo Pierini

Aldo Pierini - Providing Access to Clean Water

Growing up in Venezuela, I understood that to reconstruct my country I needed more than just being good at Math and Physics. My exposure through high school in Model United Nations and my interest in STEM and sustainability showed me that not only was there a place for someone with my interests in Civil Engineering, but that there is a global need for people who can look at problems from a broad range of perspectives.

The reason for choosing the Grand Challenge of providing access to clean water came from finding out about Villanova Engineering Service Learning (VESL) trips during the Summer before starting at Villanova through a "water for Waslala" video. Ever since that moment, I knew I wanted to be involved with these trips and be able to serve in a way I considered meaningful given the importance of water in our daily lives. At about the same time, I realized another issue related to consumption, not in Nicaragua or in any other distant country but at Villanova itself. This issue was food waste from those that have excessive access to it. Food waste is directly related to a waste of energy, land and water. In California alone, 80 percent of water consumption is related to agriculture. When food is simply discarded, all of the water used to grow the produce and raise the livestock is also wasted. So, I realized that it was not enough to

just provide water to those who need it, but it was also necessary to reduce our own consumption of water by controlling food waste.

In the following sections I intend to share my journey that started with my involvement at Villanova which led me to travel to multiple communities in Panama and eventually work with a school in Honduras. I hope to promote the different programs in which I have been involved throughout the se 4 years, as well as open a door to new opportunities that could come from being in the Program to continue learning how to face "Grand Challenges."

Multidisciplinary Solutions

In the Fall of Sophomore year, I started classes toward an Engineering Entrepreneurship Minor. While I had no idea what was yet to come and even asked my professor what a civil engineer could do with entrepreneurship, one of the first things I learned was to keep my eyes open to find opportunities others simply missed. "Keeping my eyes open" helped me one day during my 8:30 am Theology class when we were talking about Hunger and Homelessness Awareness Week. We discussed that there is food on campus going to waste that people in need would appreciate, but for reasons beyond our control, it was simply not possible (legally) to donate all of it. This waste of food is also a waste of water, since a large amount of water in the United States is used for crop irrigation and raising livestock.

Thinking a little bit about this issue from an entrepreneurial mindset, I thought that maybe if we cannot do much about the food that we do not consume, why don't we just produce less? This is a way we can reduce waste and conserve water. The obvious answer is that an "all you can eat" dining h all cannot run out of food. This is true; but, I did not feel comfortable telling myself that there was no way around that problem. If this happens every day, people's schedules are similar week after week, and menus hardly ever offer any new options, there has to be a way that we can collect information to predict how many people are going to show up to a given dining location. This knowledge should at least give us a better idea of how much food should be prepared per location.

The semester ended without me giving this idea much more thought, partially because "I am a Civil Engineer." Why should I be concerned about a mathematical model of people getting food in a dining hall? However, the Spring semester began, and the time came for us to choose what project we would want to work on for the rest of the minor. I could not stop thinking whether I should try to pursue my "Food Calculator" idea. I talked with my professors expressing concern that even with my efforts, I could not see a "mathematical model" as something that a Civil Engineer could build. I also was not sure if it would even fit the scope of the minor as a product that could be sold. Regardless of this, they loved the idea. Having this conversation with them showed me that not only was there a way for me to manageably approach the problem, but that the potential of this idea was tremendous.

Business/Entrepreneurship

INNOVATE
L3HARRIS Summer Program

With the Summer approaching, I was hesitant to apply for internships. I instead focused on other opportunities like the incoming emails about the Harris Summer Innovation Program/HSIP (now called INNOVATE) at Villanova. This program is a partnership between Villanova University's College of Engineering and L3Harris Technologies. It provides funding for students to develop innovative solutions to unmet societal or technical challenges over a two-month summer program. I figured why not give it a

try? The program would fund my development of the "Food Calculator," and I get to keep everything I work on. I also do not have to apply for jobs that did not motivate me as much.

A few weeks after applying to the program, our project team learned that the Food Calculator had been accepted. By the time the Summer began, the Food Calculator was renamed "Feastimate" (Feast + Estimate) after a desperate brainstorming session, and I did my homework to try to understand the underlying issues of the problem. This process began through meetings with the staff in Dining Services. I carefully listened to what they had to say, using this newly gained knowledge to begin forming a solution. During these interviews, I realized that the demand for Feastimate was real. In a meeting with one of the dining services software contractors, they wanted to continue conversations with me to test a similar product of theirs.

Once the HSIP program began, the project team was off to a great start learning about how Dining Services was currently predicting how much food to make. We decided that counting each person would be a waste of our time, and that in reality that was not feasible. We were no longer developing just a mathematical model, but we also began building sensors to count the number of students in the dining halls for us. During the HSIP program, I kept in touch with my Entrepreneurship Professors. Since the Summer version of the Entrepreneurship minor was running in parallel to HSIP, our HSIP team utilized resources in the Entrepreneurial minor and our HSIP budget to file a provisional patent application for our system of sensors.

While junior year is not the best time to try to start a venture, we tried to keep going; but, all our other commitments did not allow us to seriously focus. We did apply to a few different competitions at Villanova and secured some funding to continue supporting the development of Feastimate at a later time.

Feastimate

Problem

Food Waste accounts for 5% of greenhouse gas emissions worldwide

$200M per year are spent in U.S. colleges due to food waste

No easy way to track consumption **AND** forecast demand

FAO. "Key Facts on Food Loss and Waste You Should Know!" *Food and Agriculture Organization of the United Nations*, 2019, www.fao.org/save-food/resources/keyfindings/en/.

Feastimate

Solution

Feastimate is an automated data collection system and food demand forecasting platform that helps college and university Dining Halls:

Save Money
by cutting down on purchasing costs

Save Time
by reducing tasks that staff needs to perform

Promote Sustainability
by providing them with bragging rights

Feastimate

Why Now?

Feastimat

Market Size

$52
Billion

Food Contracting Industry
Expected to grow to $56B by 2024

63
Percent

Largest Industry Contractors
Aramark
Sodexo
Compass Group

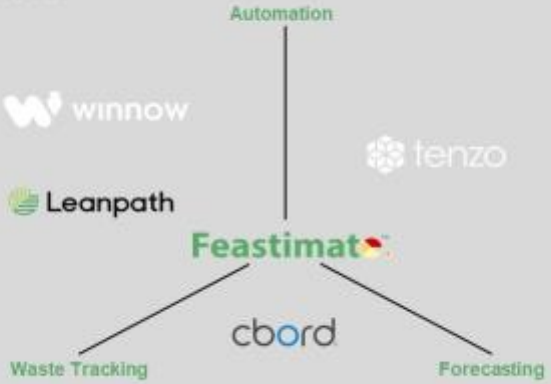
28
Percent

Educational Institutions
2nd largest market segment

WWW.IBISWORLD.COM

Feastimat

Competition



Feastimat

Competitive Advantage

First to Market
for automated food demand tracking and forecasting system in dining halls

Customer Incentive
for the reputation of a college as a sustainable institution

Seamless Integration
with the existing software used to track food wastage

Ease of Use
access all your data in one place and automatically generate forecast reports

Feastimat

Product

Unintrusive system of sensors

Provisional Patent Application Filed

Feastimat

Product

Collect data
How Much Was consumed?
What was the Weather?
Were there any special events?

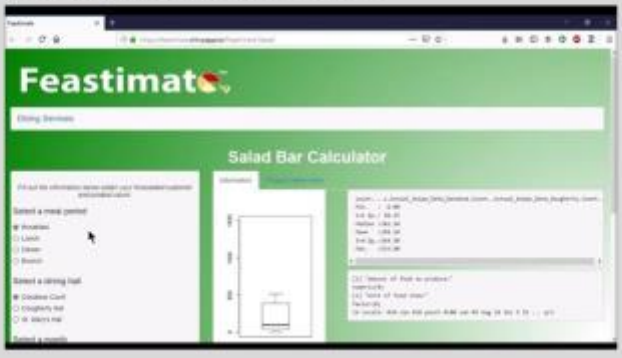
Send data
Automatically and wirelessly

Data Analysis
Without user input

Feastimat

Product

Forecasts how much food should be ordered



Feastimat

Business Model

$20
Thousand
For first customers per year of service subscription

$150
Per Sensor
Estimated average of 25 sensors per university

$$$
Contractors
Ultimate goal is to transition to licensing to food contractors

Feastimat

Go to Market Strategy

Stage 1 – Refine Prototype
Improve UI/UX and accuracy of sensors
Prepare for pilot study at Villanova
Patent Filing

Stage 2 – Pilot Study
Perform Pilot Study at Villanova
Test Hypotheses
Quantify Results
Pivot when necessary

Stage 3 – Data Validation
Continue testing at Villanova
Establish connections with other universities
Share results with other universities

Stage 4 – Deployment
Begin working with other universities
Finalize marketing campaigns for launch
Finalize development before deployment

0-3 months | 3-6 months | 6-9 months | 9-12 months | Launch!

Feastimat

Market Adoption

Colleges and Universities

Feastimat

Team

Aldo Pierini
Business Development

Engineering
Entrepreneurship Minor,
Sustainability Minor

Anthony Etim
Hardware Development

Electrical Engineer,
Computer Science Minor

Barbara Fiedorowicz
Software Development

Mathematics,
Computer Science Minor,
French Minor,
Honors Minor

Rahul Thapa
Software Development

Computer Science,
Physics Minor,
Mathematic Minor

Feastimat

Financials

Year 1:

Funds
$3,775 secured
$15,000 in future competitions

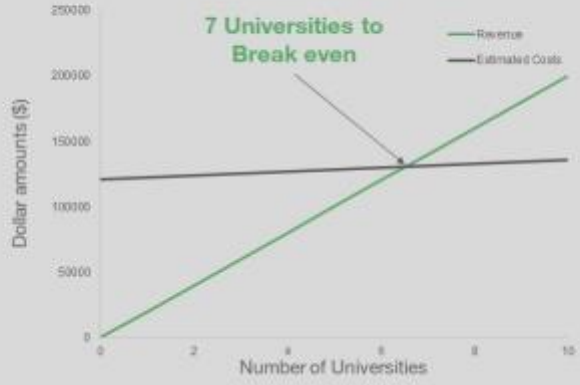
Pilot Testing
$3,500
(Net Revenue)

Patent Application
$20,000

Feastimat

Financials

Year 2:



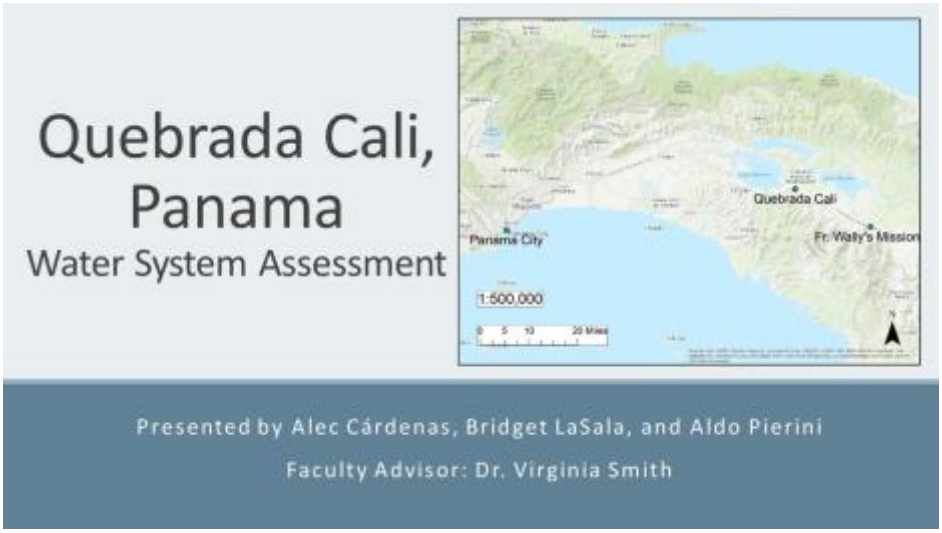
Global/Multicultural Experience

As a student in the Mid-Atlantic region of the United States, I spend much of my time thinking how nice it is to have warm weather all year long. Starting Sophomore year, this took the form of traveling to Panama on the Villanova Engineering Service Learning (VESL) trips that I had already been interested in for over a year. These trips not only remind me of home because of how similar both countries are, but also provide the opportunity to learn from people and create relationships with them that allow me to better understand the context of a problem.

This last point is probably more important than knowing math and science since there is no value in designing a solution to a problem you do not understand. A challenge I faced when I went on my first trip was comprehending that I was not going to be able to solve all the problems in a community within a week. As obvious as it may sound now, when you are just a Sophomore and you are told that you will be designing a water tower in India for your Mechanics I class, you begin to believe that solving problems in Panama cannot be that hard.

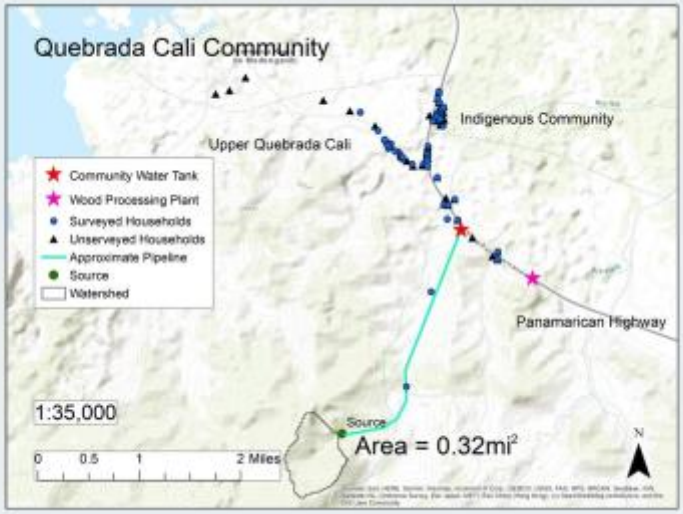
I was, at first, disappointed at how "little progress" we had made on that trip in an entire week. However, since that time, I realized that my real role was not about me or Villanova saving these communities, it was about opening our eyes to a different reality. It was about us doing our best to assist them in developing their own solutions for their own problems.

I began to look forward to these trips every semester. My work in water systems varied from climbing into water tanks, to calculating a rainwater harvesting system for a school, and hiking 7 kilometers down a mountain following a water main to find local high points. While I have not provided anyone with access to water myself, I contributed to advancing their water safety and supply and learned that I was part of greater projects. Getting to know the people I worked with along the way was far more meaningful than coming back to the United States to talk about how much better I had made their lives, because in reality I think the impact they had on mine has been greater than anything I could have done for them.



Overview

Community | Hydrology | Water System



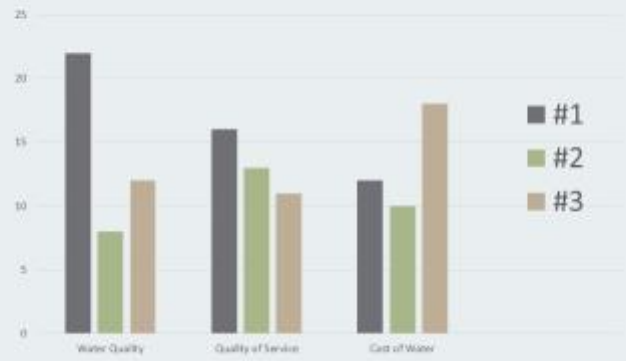
Surveys

Survey Format

- Survey123 was the application used
- 69 homes surveyed
- 380 people represented
- 43% said the water service was poor
- Chocolate color water during rainy season

	Test	Conclusion
Water Supply	Bucket Test	Enough water during dry season
Water Quality		Unsafe for human consumption

Important Rankings of Water System Characteristics



Water Service

Supply
(Bucket Test)

20 liters / 9.38 sec
= **2.13 liters/sec**

2.13 liters/sec x 86,400 sec/day
= **184,000 liters/day**

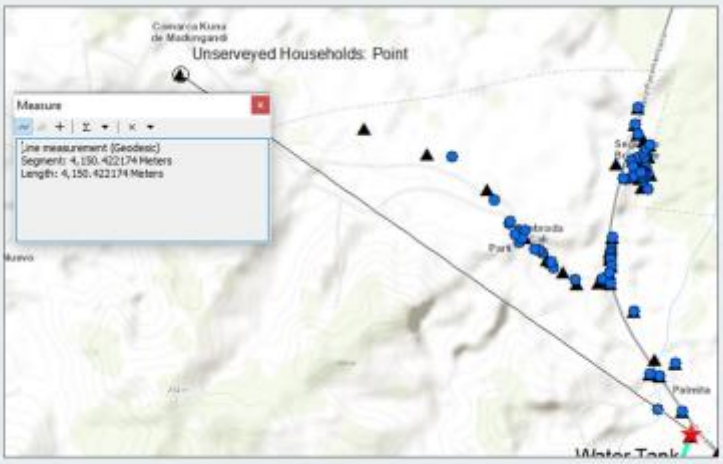
Demand

500 people x 100 liters/person/day
= **50,000 liters/day**

Losses in the System

Suspended Pipeline

Wood Processing Plant Tank



Recommendations

Find losses

Increase fee of wood processing plant

Meter the community

Meters

- Charge people by the gallon
- Discourage excessing water consumption
- Improve service records
- Eliminate need to alternate service days between Upper and Lower Quebrada Cali

Water Treatment

Possible Alternatives

1

Original Collection Tank Retrofit

Restore existing large tank below current catchment to remove sediments

2

Restore Existing Collection Box

Repair existing collection box to increase its capacity to separate suspended solids from water.

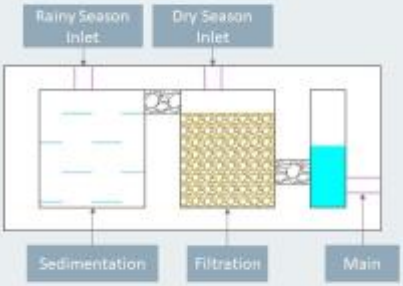
3

Filter Assessment

Install existing filters and add a sand separator to reduce demand on the filters / buy new filters

Original Collection Tank Retrofit

Former Collection Structure



Concept's Side View

Restore Existing Collection Box

Outside of Collection Box

Inside of Collection Box

Recommendations

Repair in-line chlorinator

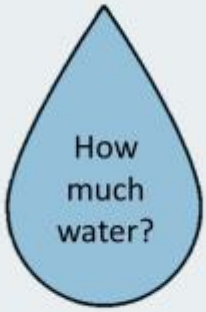
Restore collection box

Assess filter reinstallation

Water Education

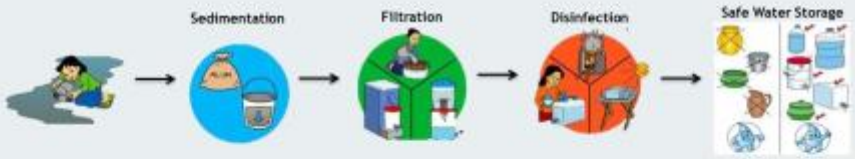
- Water Usage
- Water Quality
- Water Treatment

Water Usage



Water Quality

Water Treatment



Sustainability

Develop sense of ownership for the system

Meter households to monitor losses and demand

Increase fee for those exceeding a defined demand

Looking Forward

Service:

- Gauge willingness and means to purchase water meters

Treatment:

- Assess feasibility of sand separator with guidance from Aqua America
- Assess need for dedicated sedimentation tank

Education:

- Ensure key health concepts are understood by adults and children in Quebrada Cali

Thank You

Dr. Virginia Smith,
Villanova Engineering Service Learning,
Villanova's Department of Civil and Environmental Engineering

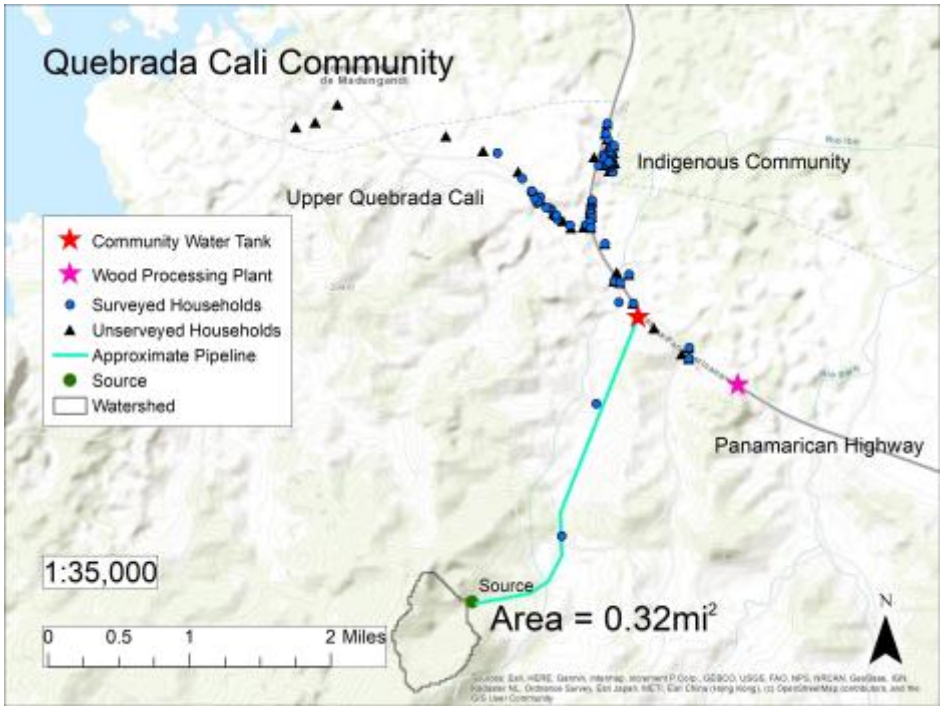
Social Consciousness

From being involved in the Panama VESL trips, I found the opportunity to work with some of my fellow VESL members on an independent study. We decided to take a deeper look into Quebrada Cali, one of the communities we had visited in October 2019. With this independent study, we focused on helping them improve their water system quality and supply. While the population of the village is barely 500 people, their water system struggles to provide enough water for the community during the dry season. This has forced the water committee to alternate water service every other day between two sectors of the community. However, we estimated that even during the dry season, the amount of water going into the tank was over three times the daily demand of the community, so we thought there must be an engineering solution. Added to this supply problem, we found that a complete lack of water treatment had the community drinking water with sediments and bacteria.

To establish a plan of action, we needed to understand what the community's priorities were, as well as what had caused them to stagnate in the process of having a fully functional system. From social surveys we performed at every household and conversations with community members, we found that the government had tried to work with the community on these issues, but eventually retreated from the issue. It turned out that the community could not agree, and the government did not want to decide, whether the indigenous population (almost half of the community) should receive access to water. This was a surprising discovery for our project team, because there was plenty of water for the entire community, including the indigenous population. This cultural barrier had stopped the progress of a project that could have provided clean water to a community over three times the current size during a dry season. Realizing this barrier allowed us to learn that we were dealing with a social and water

education problem and not necessarily an engineering challenge, which is more often than not the way we simplify things. We think as engineers that math and money will solve a problem but do so without taking into account that the root of the problem may be something entirely different.

As simple as this situation might seem, it gave me a new perspective to look at things and realize that this is not inherent to rural Panama. These situations occur everywhere. Having a mindset as the local villagers did that helping others is going to hurt you only results in everyone being hurt. Before jumping into doing the math to calculate the size of a sedimentation tank, it is worth doing your homework before you learn that your solution didn't change anything.



Creativity/Research

After enjoying working on projects in Panama, I could not allow myself to work on anything less fun for my senior Capstone project. Even though I have not been able to travel back to Panama, four other seniors and I are working on designing an auditorium with new cafeteria and bathroom facilities for the Amigos de Jesús school in Santa Bárbara, Honduras. This school is a home and school for boys and girls, and currently does not have a location to host any large events. The goal of the team is to design an open-air auditorium able to produce it's own electricity and not depend on the main water supply for the rest of campus. I am specifically tasked with working on the water management system.

This project is the Capstone of my Civil Engineering degree, but also the final step in this Grand Challenge. Here I am the designer of the entirety of the water system that requires me to remove the dust from old course notes while also constantly think about everything I have done in Panama to put things into a more realistic context and to make sure it can be built, function, and maintained.

This system should be able to meet the water demand of 400 people by storing rain water, treating the water and supplying it through the bathrooms and kitchens. Any overflow, as well as excessive runoff, will be captured by using Green Stormwater Infrastructure. Additionally, the wastewater will be taken to a newly designed septic tank because the existing one does not have the capacity to handle the new auditorium.

However, not everything is about finding the best size for the different tanks. Since rain is not always reliable, a way to reduce its impact on the system is either finding another source of water (increase supply), or reducing the demand. Given that another source would be an extra cost that this structure would unlikely justify, the best option would be to reduce the demand. If there is anything that my entrepreneurial time taught me, it is that there is always a way to use problems as an opportunity. This is exactly what I found when figuring out ways to reduce demand, the solution just came to me. I found toilet tank lid replacements that serve the function of a sink. Not only are they less expensive than a regular sink, but also run water as the toilet is flushed so that hands can be washed before draining this water into the toilet tank for the next use. While this alternative does not sound ideal, when you put it next to some of the original alternatives (latrines) this is a luxurious yet still 100% feasible option that reduced by 25% the estimated water demand.