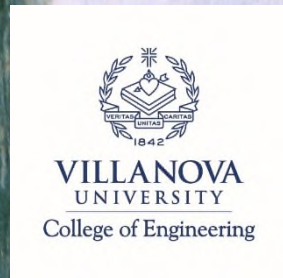




*SE District – PA AWWA  
Easter Section WWOAP  
Water Operator’s Conference  
Oct. 24, 2023*

*Villanova Project Presentations  
Center for Humanitarian Engineering and  
International Development (C4HE)*

**Introduction  
Project Presentations  
Ghana  
Dominican Republic  
Madagascar  
Q&A**





**David Yaméogo**

MS in Sustainable Engineering, 2024  
Interested in international development with focus  
on WaSH for developing countries



**Sarah Petrus**

Junior Bachelor in Chemical Engineering, 2025  
Minor in Sustainable Engineering



**Maria Saltysiak**

Sophomore Bachelor in Civil Engineering, 2026



## Research – Curriculum – Outreach

### Research

- 5 completed thesis projects
- 2 new research projects
- 4 graduating MSSE student
- 2 Journal Submissions
- 6 Conference Presentations
- 2 Funding proposals

### Curriculum

- 20 declared HE students
- 4 graduating HE students (2)
- 55 VESL students
- 12 MSSE students
- 3 Capstone Design Projects

### Outreach

- 17 Projects (ongoing)
- 3 Field Fellowships (YoS)
- 2 New Partners (NN & DR)
- 2 NGO Supported
- 3 Integrated Research

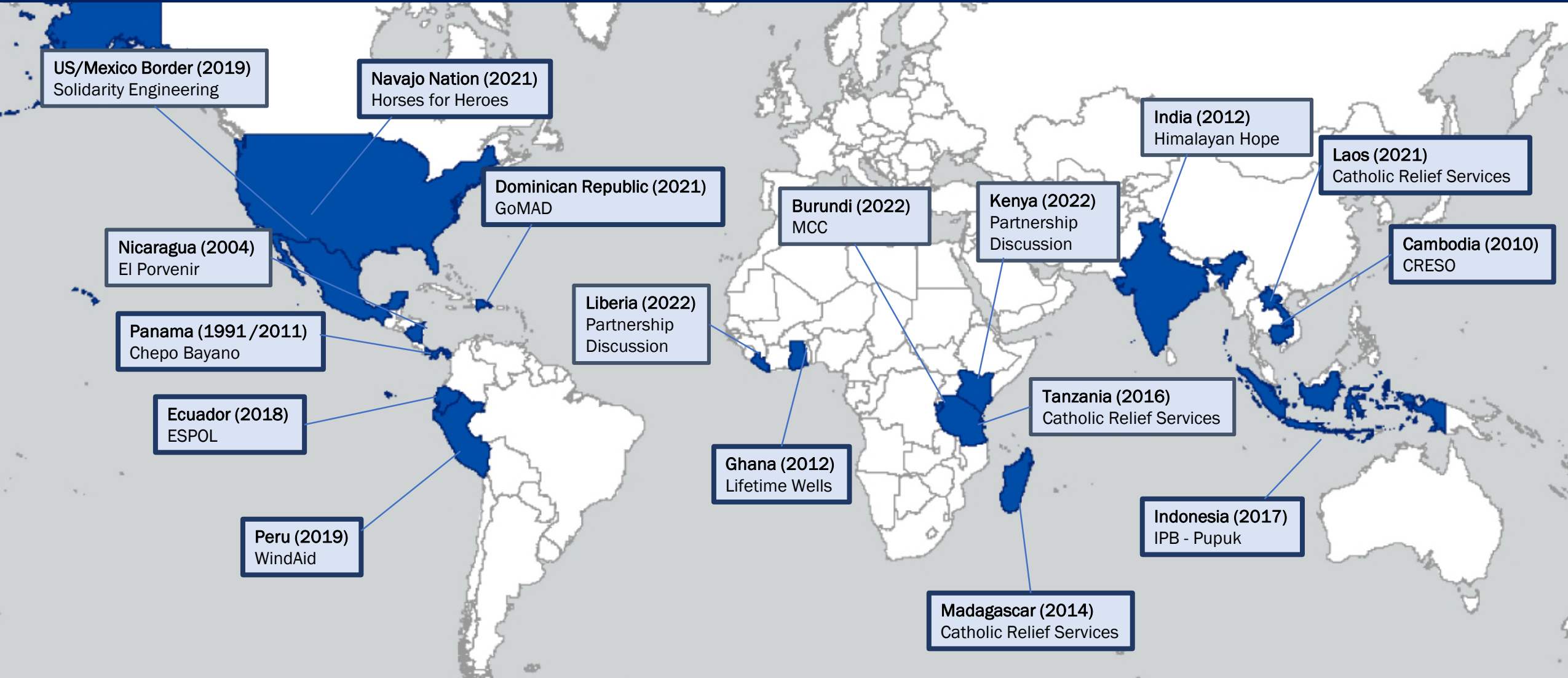
Program includes vertical and horizontal integration from Freshman to Graduate level student involvement across all five departments in engineering.

*C4HE programs are rooted in ethical engagement with project partners and communities. Fundamental to this is the belief that empowering local stakeholders is essential to creating sustainable solutions.*



# Outreach - Program Partners

*“Local Solutions for local problems”*



*C4HE programs are rooted in ethical engagement with project partners and communities. Fundamental to this is the belief that empowering local stakeholders is essential to creating sustainable solutions.*



# Ghana

*People in the world still lack access to clean water*

- In 2021, 87.7% of the populace have access to basic water supply services. In urban area, 96.4% have access to basic water supply services against 74.4% of the rural areas.
- To close the gap in rural area, government, NGOs, etc.. are constructing water infrastructures like handpumps.
- However, around 42% of handpumps fail within two years of construction.
- 90-100% of investment is in construction without post-construction support.

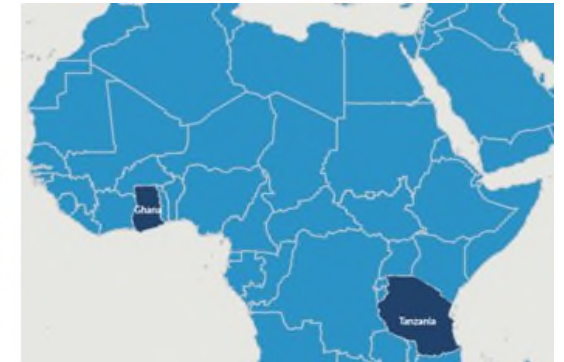




# Ghana

*Our Partner: Lifetime wells International*

- LWI has been working in Ghana since 2004, they recently started to work in Tanzania.
- LWI identifies communities in need of reliable portable water, drill, and install and support maintenance of handpumps.
- To respond to the pressing need of post construction support, LWI implemented a circuit rider (CR) model.
- The CR model consists of a small group of handpump mechanics referred to as circuit riders, routinely visit groupings or “circuits” of communities to provide maintenance and community education related to water, sanitation, and hygiene (WASH) topics.



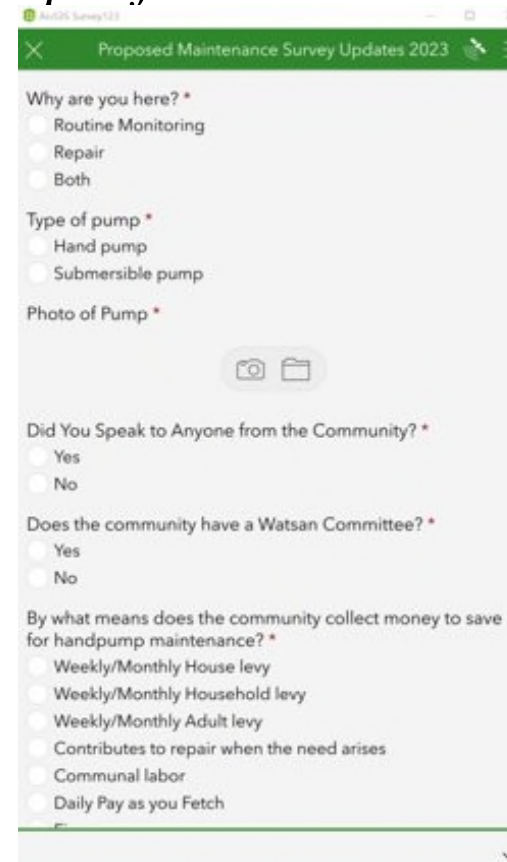


# Ghana

*Our Role:*

*Provide Support with an Asset Management platform*

- The mechanics monitor the functionality of the pumps on a maximum of 60 days.
- C4HE role is to provide technical support with an asset management platform through ArcGIS.
- This platform facilitates data collection and management before, during and after maintenance visits are carried out.
- The mechanics utilize Survey123 and the Collector App to report maintenance visits, the status of each handpump, and if parts are needed for repair



Proposed Maintenance Survey Updates 2023

Why are you here? \*

Routine Monitoring  
 Repair  
 Both

Type of pump \*

Hand pump  
 Submersible pump

Photo of Pump \*

Did You Speak to Anyone from the Community? \*

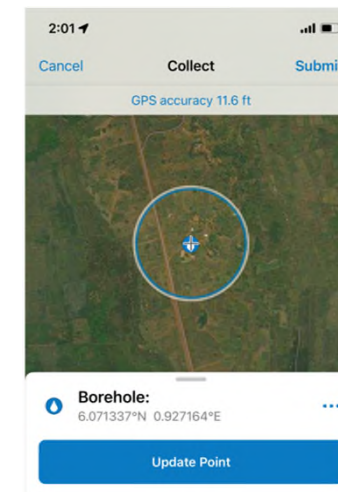
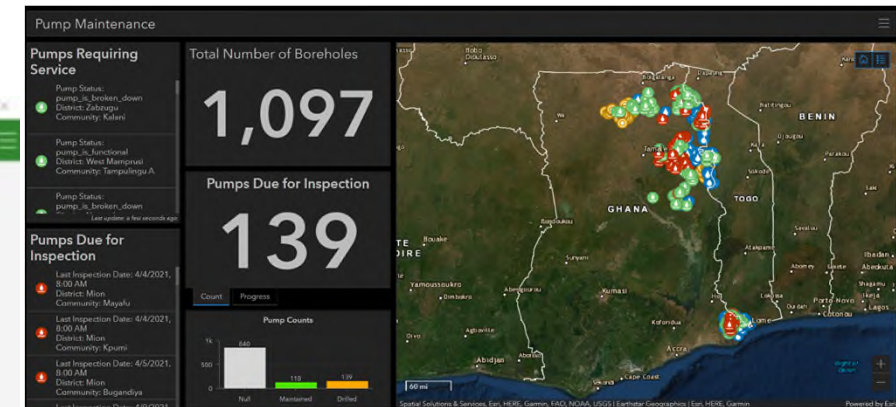
Yes  
 No

Does the community have a Watsan Committee? \*

Yes  
 No

By what means does the community collect money to save for handpump maintenance? \*

Weekly/Monthly House levy  
 Weekly/Monthly Household levy  
 Weekly/Monthly Adult levy  
 Contributes to repair when the need arises  
 Communal labor  
 Daily Pay as you Fetch





# Caraballo and Villa Ascension, Dominican Republic

Villanova Engineering Service Learning – 2023 Dominican Republic Team

Sarah Petrus – Junior Chemical Engineer

Maria Saltysiak – Sophomore Civil Engineer

# Water System Overview





# Water Quality

- Experimentally treating water from the community using locally grown moringa seeds
- Preliminary Results:
  - Lowered alkalinity
  - Lowered pH
  - Visibly less turbid
- Moving forward, more testing



Start of Experiment



2 Hours Later

# Madagascar

## *Management of rural water tank is still complicated Case of Ilaka East*

- The site of Ilaka Est currently uses two water sources: the primary is a gravity-fed system, and the secondary uses a high-pressure pump to distribute water.
- Due to the high operation cost of the pump, the gravity-fed source is used primarily, and the secondary source is only turned on when necessary.
- The local water operator currently visits the water tank three times a day — 5am, 12pm, and 5pm — seven days a week to determine if the secondary source is necessary.
- He uses an unreliable measurements from a step ladder in the tank to make this critical decision.

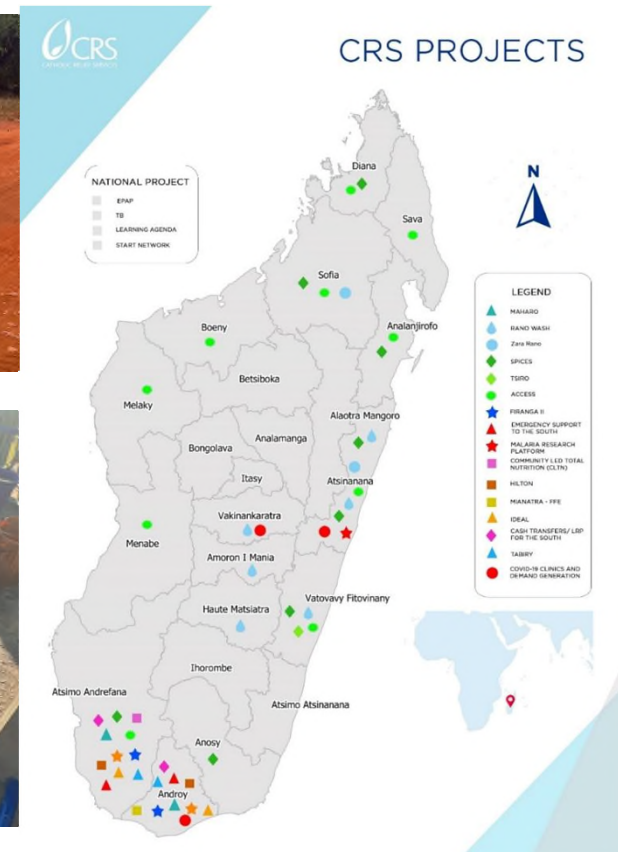




# Madagascar

*Our Partner: Catholic Relief Services\_Madagascar*

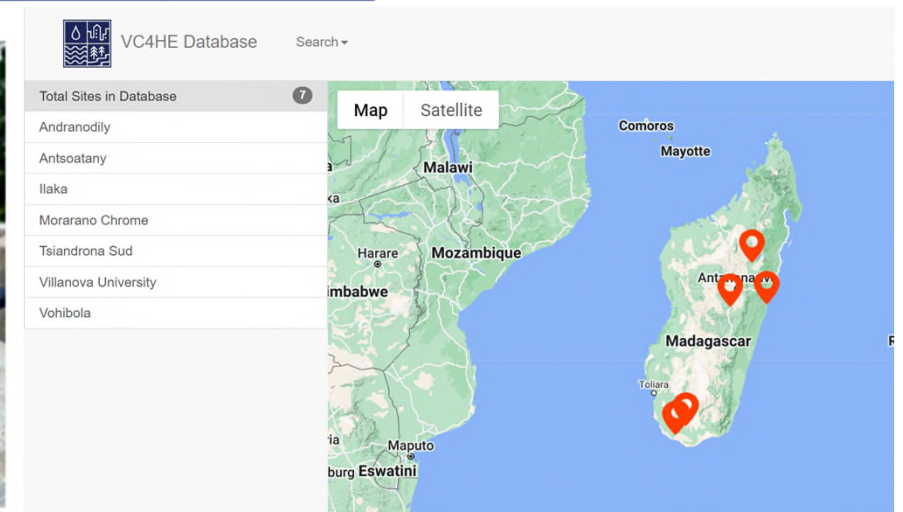
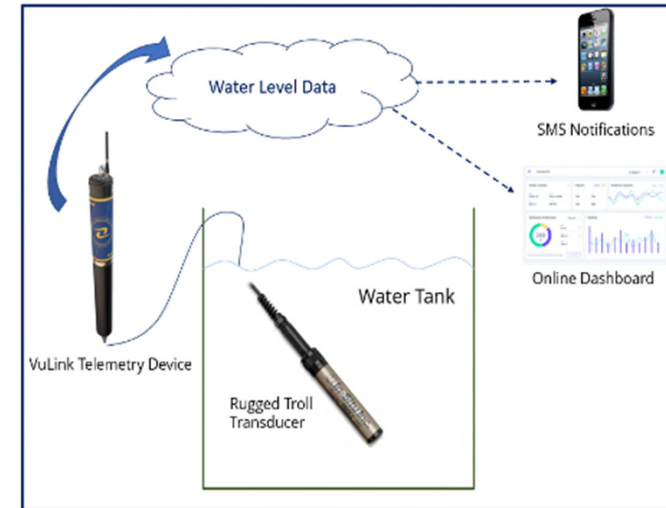
- Catholic Relief Services (CRS), a nongovernmental organization (NGO) founded in 1943 which aims to promote human development globally through providing assistance in the wake of emergencies and implementing projects to fight disease and poverty.
- CRS has operated in Madagascar since 1962 with an initial mission of implementing food and nutrition programs for underprivileged communities
- Villanova engineering has had a partnership with CRS in Madagascar since 2015.



# Madagascar

*Ongoing project: Remote monitoring of water infrastructures*

- A solution to Ilaka East issue was to create low-cost remote monitoring of water tank levels to improve management and preemptively address water shortage .
- Use combination of commercially-available products and propriety materials developed by Villanova to optimize functionality while minimizing costs.
- This technology has been installed in Ilaka Est, Maranaro Chrome, Antsoatany, and Vahibola.
- We also conducted water quality test, with high level TOC, turbidity and conductivity across all samples.
- <https://vc4he.villanova.edu/index.php/sites/map>

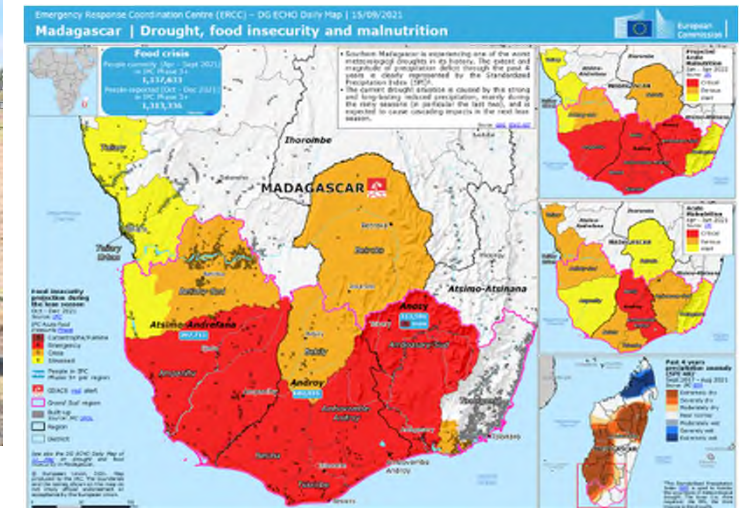




# Madagascar

## *Other Initiatives*

- MIANATRA – RACHEL briefcase project working on increasing access to WASH education in schools in the south
- New research initiative on Climate change impacts on groundwater resources and adaptation-strategies to ensure sustainable and resilient food production in southern Madagascar
- In the south of Madagascar: continuous to install telemetry systems to monitor water level and quality (conductivity), install weather stations (temperature, humidity, atmospheric pressure, precipitation)







**This work is done by young undergraduate students, teenagers or in the early 20<sup>th</sup>, supervised by a graduate student in the late 20<sup>th</sup>, early 30<sup>th</sup> and guided by a faculty member.**





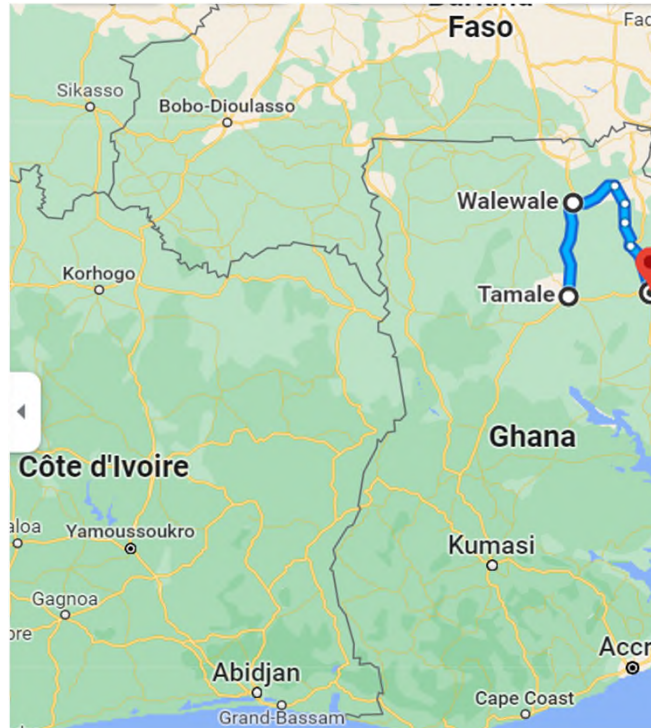
Thank you!

Q & A

# Ghana



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# Lifetime Wells Ghana – Handpump Asset Management



ArcGIS Survey123

Maintenance Survey 2020

Are you here for Routine Monitoring or to Make a Repair? \*

Routine Monitoring

Repair

Photo of Pump \*

Is the Pump Functioning? \*

Yes

No

How Many Strokes Before Water Flows?

How is the Quality of the Water?

Mechanic Tracker

Pump Mechanic Michael

Pumps Inspected: 75

Due for Inspection: 4

Functional Handpumps: 45

Maintenance Required: 34

Mechanic Map Legend

Recent\_Pump\_Inspection

Inspection Symbology

- Inspection Up to Date
- Inspection Required

Drillers Survey 2020

Stage

- Drilled
- Installed

Pumps Due for Inspection

Community Name	Last Mechanic	Assigned Mechanic	District	Region	country	Last Inspected	Community Contact Info	Function
Agormor	Michael		Akatsi North	Volta	Ghana	3/2/2022, 7:00 AM		No
Agordza	Michael			Volta	Ghana	6/19/2022, 8:00 AM		Yes

Last update: 17 seconds ago

Due for Inspection | Maintenance Required





## Lifetime Wells International

In Ghana, there is often not access to clean and safe drinking water, that results in diseases, bacteria, and even deaths. Lifetime Wells International is a company that installs pumps to deliver clean water to communities in Ghana since 2004. More recently, they have expanded their work to Tanzania. They install hand pumps, as well as electric pumps. Since 2004, there has been over 2,750 water wells installed in communities in Ghana and Tanzania.

## Background

Once Lifetime Wells started installing pumps, there monitoring and evaluation system for gathering data on the pumps was not efficient. They tried using the "paper pencil" method that was prone to error. Eventually they transitioned to the online platform





# VILLANOVA UNIVERSITY

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College of Engineering



**Partner**

**Project**

**People**

**Personal**

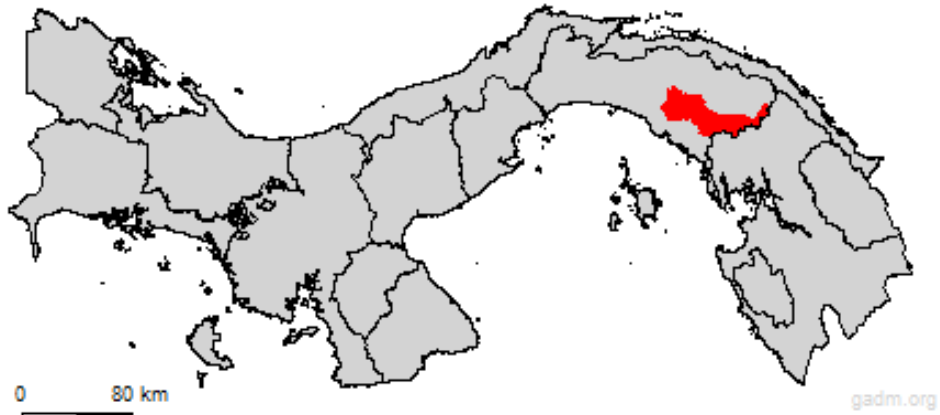


# Panama



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Tortí, in Chepo District, Panamá



Partner

Project

People

Personal





Partner

Project

People

Personal





**Partner**

**Project**

**People**

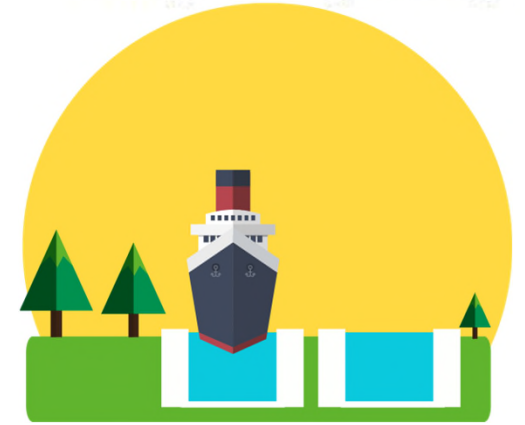
**Personal**





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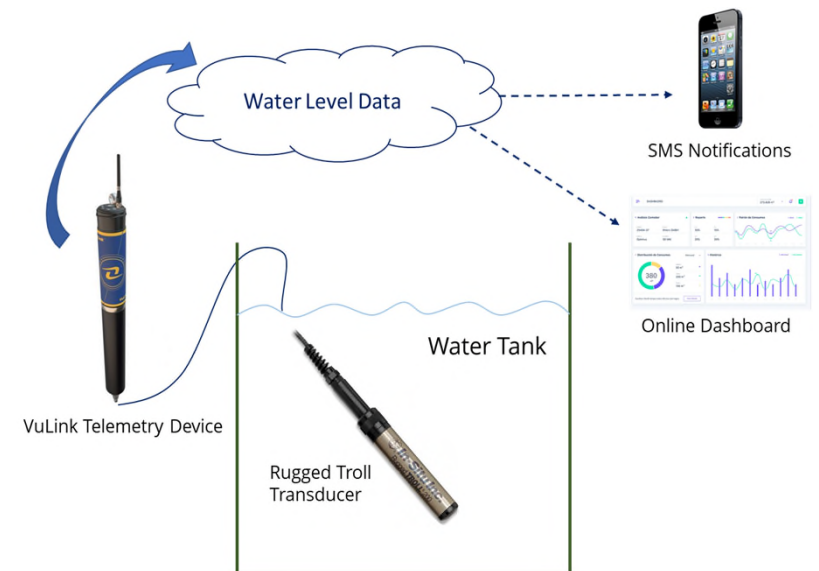
# Madagascar Project Team Leaders



**Hannah Brigham**  
Graduate Student Leader  
MS Sustainable Engineering  
RPCV Madagascar



**Jamie Silk**  
Graduate Student Leader  
MS Sustainable Engineering





# Research as a Service to Partner Organizations

## *Social Justice Issues Related to Monitoring Sustainable Development Support Local Management of Water Services*

*Metrics Matter – Terminology Matters – Local Stakeholders Matter*







Total Sites in Database	7
Andranodily	
Antsoatany	
Ilaka	
Morarano Chrome	
Tsiandrona Sud	
Villanova University	
Vohibola	

The map shows Madagascar with several red location pins. The pins are located in the northern and southern regions of the island. The map also shows surrounding countries like Malawi, Mozambique, Zimbabwe, and Eswatini, as well as the Comoros and Mayotte islands.

# Madagascar





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