Engineering for International Development

George Mason University's
Engineers for International Development
Director: Matthew J. Doyle, PE, CCM

Update Report

- We were busy last year…
  - Industry Professional Meetings
  - Friends of Trees Award
  - Elizabeth Furnace Bridge
  - Virginia Water Environment Association
  - 2021 WEFTEC
  - 2021 NCEES Engineering Award

Brief Introduction About EFID

Introduction to Engineers for International Development (EFID)

- A Student organization from the Sid and Reva Dewberry Department of Civil, Environmental, and Infrastructure Engineering at GMU
- Founded in the Fall of 2010
- Currently we have approximately 40 plus active members,
- 233 plus EFID Alumni Members
- Very Active in Social Media
  - LinkedIn, Facebook, YouTube, Twitter,

Example Projects

- Appalachian National Scenic Trail Bridge Projects:
  - 2018 Antietam Creek Bridge, PA
  - 2019 Toms Brook Bridge, VA
  - 2021 Elizabeth Furnace Bridge, VA

Example Water Projects

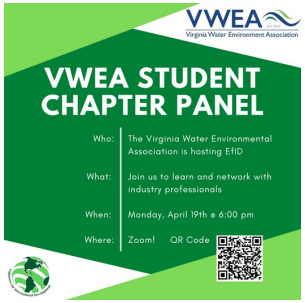
- 2018 Orphanage Water Distribution System, Puerto Cabezas, Nicaragua
- 2016 Water Distribution Elementary School Puerto Cabezas, Nicaragua
- 2015 Water Distribution Verbo Feeding Center in Puerto Cabezas, Nicaragua
- 2014 Water Storage and Distribution System, Sabana Grande, Nicaragua
- 2013 Water Quality Project Las Mesas, Honduras
- 2011 Water Distribution System in San Isidro, Peru

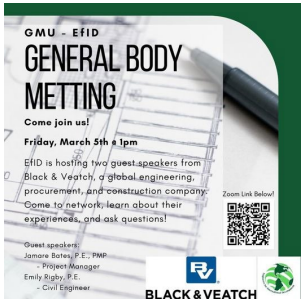
Other Activities/Projects

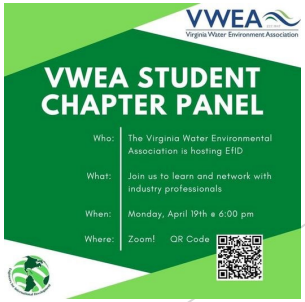
- Managua Housing Development
- Various Student Engineering Competitions
- Crushed Glass Research
- Tree Planting
- Stream Clean Up

Various Meetings

- Get to know us with Industry Professional
- Interviewing Basics,
- General Body Meetings
- Project Meetings







LOCAL PROJECTS AND AWARDS

Fairfax County Government Friends of Trees Award

- EfID was awarded the 2021 Friends of Trees Award by the Department of Land Development Services
  - Countless hours over the years for planting trees in Fairfax County.

Virginia Water Environment Association

VWEA Student Design Competition

- 18th Annual, VWEA Student Design Competition
  - Multiple Virginia Engineering Schools Attend
  - Judged by Local Wastewater Professionals
  - Held in April 2021
    - Paper, Presentation, with a follow-up Q/A from judges
  - Two Competitions
    - Wastewater Competition
    - Environmental Competition
  - We entered both competitions
    - Roanoke WWTP Digester and Biogas Production
    - Piney Run Tributary Stream Restoration

VWEA Student Design Competition

- The Wastewater Team (First Place)
  - Roanoke WWTP Digester and Biogas Production
  - Site Visits to Roanoke
  - Interview Roanoke staff
  - Interview national experts from
    - Carollo Engineers and CDM Smith
  - Team Members Included
    - Caleb Hanneman - Co Project Manager
    - Katharine Simpson - Co Project Manager
    - Martin Henke - Technical Lead
    - Nicolas Tenorio - Technical Lead
    - Ivan Gonzales-Maguina - Technical Lead (non-presenter)
    - Chris Mata - Technical Lead (non-presenter)

Fourth Year in a Row!

VWEA Student Design Competition

- The Environmental Team (First Place)
  - Piney Run Tributary Stream Restoration (Lamplighter Way)
  - Site Visits to Piney Run
  - Interview Fairfax County Staff
  - Interview National Experts from
    - Michael Baker Corporation
    - Dewberry Engineers
    - Wetland Studies and Solutions Inc.
  - Team Members Included
    - Jonathan Parker, Project Manager
    - Romelia Belteton - Technical Lead
    - Grace Morrissey, - Technical Lead
    - Camille Fulton - Technical Lead
    - Nasima Sadr - Technical Lead

VWEA Student Design Competition

- Both Teams advanced to WEFTEC in Chicago
- Both Teams were awarded Prize Money
- Both Teams received a Plaque
- Both Teams presented at WaterJam
- Both Teams were highly recognized at WaterJam

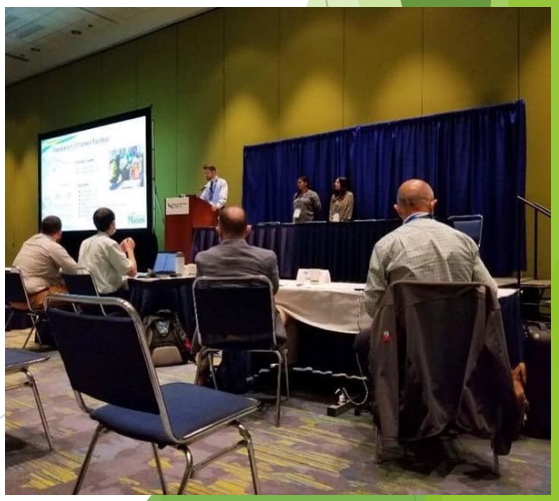
2021 WaterJam Presentation

- Caleb Hanneman was selected to present at WaterJam
  - September 2021
  - Current Ecuador Water Project

2021 WEFTEC

WEFTEC International Competition

- 23 Elite Student Engineering Teams
- 5 Different Countries.
- GMU was the only school to have both teams attend
- Both Teams Presented in October 2021
- Environmental Team (Second Place)
  - Grace Morrissey - Project Manager
  - Jonathan Small - Technical Lead
  - Crystal Bowers - Technical Lead

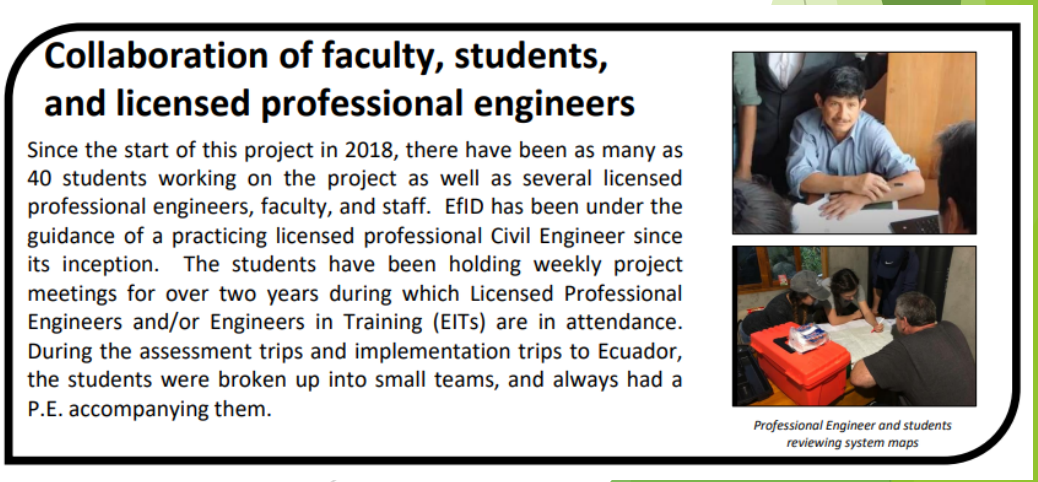


Only the third time in history a Virginia Engineering college has reached the top three podium winners. (2014 and 2016 VMI)

National Council of Examiners for Engineering and Surveying (NCEES)

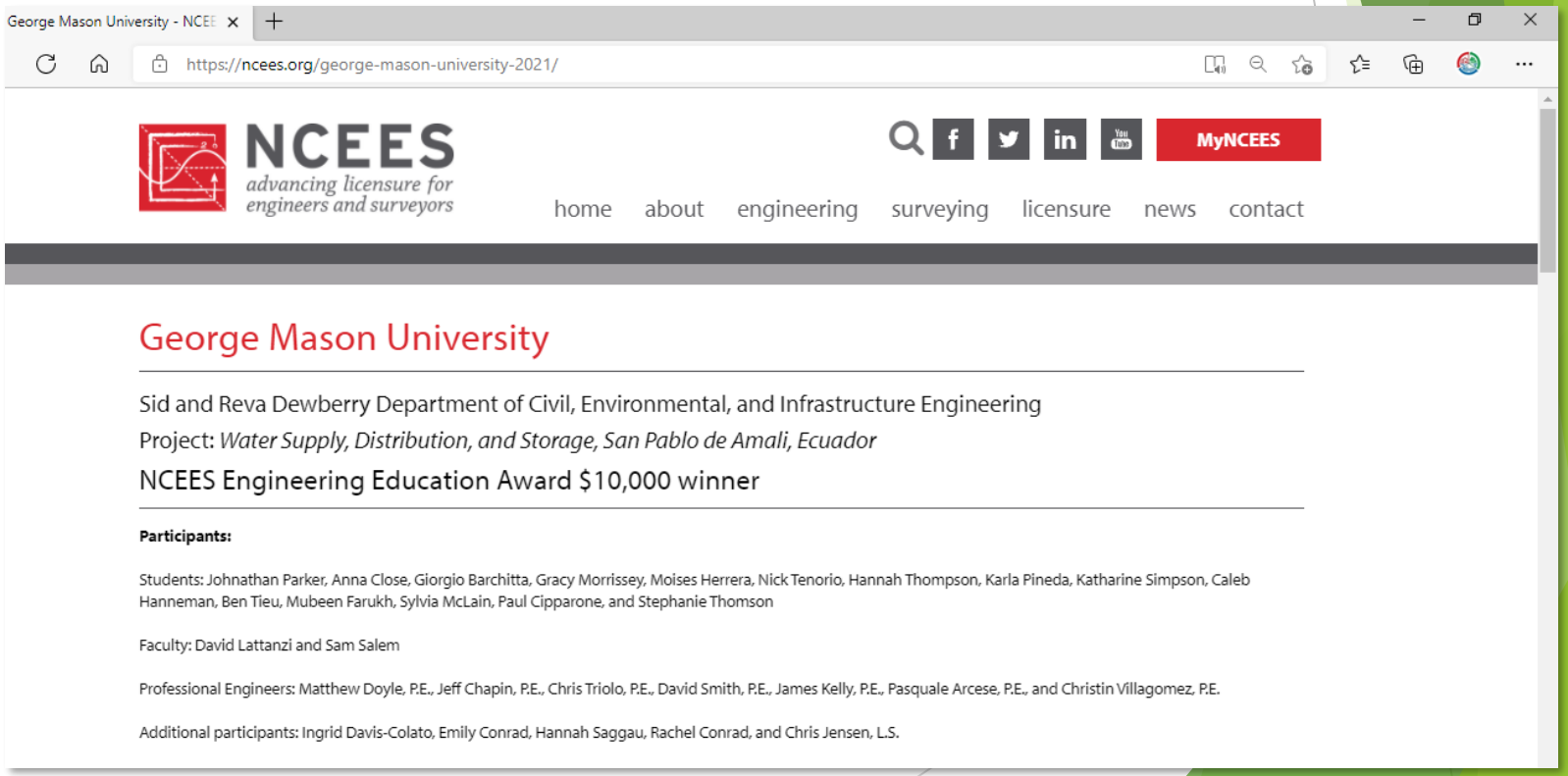
2021 NCEES Engineering Education Award

- The Competition:
  - Entry in April 2021
  - Grade Prize is $25,000 and Second Place is $10,000
  - Twenty-Six Entries
  - Include an Abstract, a Display Board and a Paper
  - The goal is to promote students work with Professional Engineers



2021 NCEES Engineering Educat Award

- We earned Second Place !!!
- Plague and $10,000


George Mason University - NCEE

https://ncees.org/george-mason-university-2021/

NCEES
advancing licensure for engineers and surveyors

MyNCEES

home about engineering surveying licensure news contact

George Mason University

Sid and Reva Dewberry Department of Civil, Environmental, and Infrastructure Engineering

Project: *Water Supply, Distribution, and Storage, San Pablo de Amali, Ecuador*

NCEES Engineering Education Award $10,000 winner

Participants:

Students: Johnathan Parker, Anna Close, Giorgio Barchitta, Gracy Morrissey, Moises Herrera, Nick Tenorio, Hannah Thompson, Karla Pineda, Katharine Simpson, Caleb Hanneman, Ben Tieu, Mubeen Farukh, Sylvia McLain, Paul Cipparone, and Stephanie Thomson

Faculty: David Lattanzi and Sam Salem

Professional Engineers: Matthew Doyle, P.E., Jeff Chapin, P.E., Chris Triolo, P.E., David Smith, P.E., James Kelly, P.E., Pasquale Arcese, P.E., and Christin Villagomez, P.E.

Additional participants: Ingrid Davis-Colato, Emily Conrad, Hannah Saggau, Rachel Conrad, and Chris Jensen, L.S.

2021 NCEES Engineering Education Award

- Second Place Finish !!
- $10,000 Prize award
- Recognized on the NCEES Website

Students Involved:

- Johnathan Parker,
- Anna Close,
- Giorgio Barchitta,
- Gracy Morrissey,
- Moises Herrera,
- Nick Tenorio,
- Hannah Thompson,
- Karla Pineda,
- Katharine Simpson,
- Caleb Hanneman,
- Ben Tieu,
- Mubeen Farukh,
- Sylvia McLain,
- Paul Cipparone,
- and Stephanie Thomson

Faculty:

- David Lattanzi
- Sam Salem

Professional Engineers:

- Matthew Doyle, P.E., (DPWES)
- Jeff Chapin, P.E., (DPWES)
- Chris Triolo, P.E., (DPWES)
- David Smith, P.E., (Baker)
- James Kelly, P.E., (Baker)
- Pasquale Arcese, P.E., (Baker)
- Christin Villagomez, P.E. (Ecuador DPU)
- Chris Jensen, L.S. (DPWES)

Additional Participants:

- Ingrid Davis-Colato, (Baker)
- Emily Conrad, (Peace Corp)
- Hannah Saggau, (Peace Corp)
- Rachel Conrad, (Peace Corp)

Elizabeth Furnace Bridge

Elizabeth Furnace Bridge

- Existing Bridge
  - Allows access to the Massanutten National Trail
  - Structurally Unsafe
  - Existing Safety Hazard
  - 1/2 Mile into the woods

Elizabeth Furnace Bridge

- Detailed Design
  - US Forest Service Standards
    - Heavy Timber Design
    - Heavy Steel Reinforcement Brackets
  - QA/QC by Dr. David Lattanzi
  - Submitted to the US Forest Service for review and approval

Elizabeth Furnace Bridge

- Construction
  - Construction Oversight and Safety by Ingrid Davis-Colato
  - Demolition of the Existing Bridge
  - Carried debris back out of wood 1/2 mile away.

Elizabeth Furnace Bridge

- Construction
  - Placed Timber Foundations
  - Provided three 12” Stringers

Elizabeth Furnace Bridge

- Construction
  - Provided decking and Railings

Elizabeth Furnace Bridge

- The 800 lbs Stringers were moved using a system of pulleys and a mechanical motors.
- The project were fully managed and executed by students with the help of Park and Recreation volunteers and EfID advisors.

Elizabeth Furnace Bridge

- Construction
  - Funded through a grant from the National Wilderness Stewardship Alliance
  - Substantially Complete August 28, 2021
  - 1,051 Work hours
  - 322 Travel hours
  - Zero Injuries

Elizabeth Furnace Bridge

- Award Winning Bridge
  - Recognition in the Appalachian Trail Newsletter
  - Plaque Installed on the Bridge
  - PATC Award Banquet on Nov 16, 2021

George Mason Engineers for International Development Replace Elizabeth Furnace Bridge *Article and photos by John Stacy*

Members of George Mason Engineers for International Development completed construction of a replacement bridge in the Elizabeth Furnace Day Use Area of the George Washington and Jefferson National Forest. The work was done in cooperation with Potomac Appalachian Trail Club via procurement, tools, onsite support, and lunches by District Manager **John Stacy**, **Stephanie Danahy**, and trail maintainer **Glenn Palatini**. The work trip reports show 1051 work hours and 322 travel hours over 10 GMU/PATC days and 12 more PATC days in 7 weeks. There were several additional support days with Forest Service assistance for dead tree felling and utility terrain vehicle transport. As a standard Forest Service design, the bridge is built with large, heavy wood components (many custom-milled), heavy steel reinforcements, and hardware purchased to formal specs. The bridge location is 0.4 miles from the nearest vehicle parking. So each step was significantly harder than many bridge efforts. Despite these challenges, all problems were solved with enthusiasm and thoughtfulness. The end result is strikingly impressive. The work is funded through a grant from the National Wilderness Stewardship Alliance, through direct support from the Forest Service, and by the PATC trails budget. There were also support hours through welding work at George Mason University.

The work accomplished these goals as noted in the proposal:

1. The bridge enables access to the 71 mile Massanutten National Recreation Trail, the 250 mile Tuscarora Trail, a local 8 mile loop hike, and a 5 mile summit hike.
2. It maintains bridge access to trail mileages of 5 to 250 miles.
3. It eliminates backlog substantially in excess of $21,737. The work took far more hours and cost more than anticipated, but these challenges were overcome.
4. It involved more than 20 volunteers.

The old bridge

GMU EfID team during construction

Members of the GMU EfID team on the new bridge

The new bridge

San Pablo de Amali, Ecuador Water Project

San Pablo de Amalí Ecuador

- Small Farming Community
- Population Approximately 200
- Location Central Ecuador
  - At the base of the Andes Mountain Range
- The community has three regions:
  - Upper, Lower and Central

Student Learning Objectives

- Planning
- Detailed Design
- Logistics
- Construction

At the Beginning

- In 2018 EFID was contacted via a mutual friend from the Peace Corps,
- Before it was popular, we held several zoom calls with the community to understand the issues and generally get to know the community.
- We were introduced to:
  - Rachel Conrad
  - Emily Conrad
  - Hannah Saggau

2019 Assessment Trip

- In 2019 we made two assessment trips to the Community.
  - We assessed the existing water system and its facilities and collected data to analyze for design
- Intake Screening (Plastic Bottle with Holes)

2019 Assessment Trip

- 2” HDPE Intake Supply Piping
  - Numerous Repairs using Electrical Tape / Bicycle inner tubes
- Existing Sand Filter System
  - Was not working and by-passed for quite some time

2019 Assessment Trip

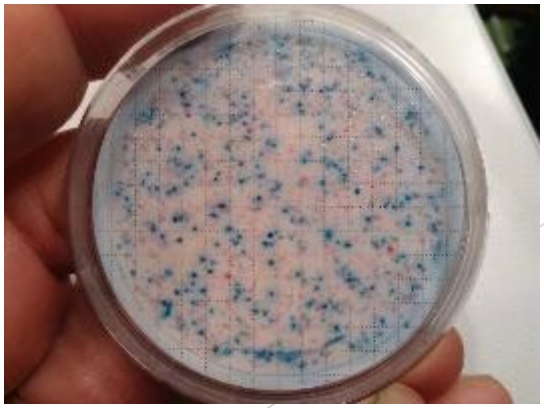
- Disinfection and Storage
  - Disinfection was not working and by-passed
  - 500-gallon Concrete Storage Tank was failing

2019 Assessment Trip

- Distribution Piping
  - Various Small pipe diameters (1/2”, to 2” Diameters)
  - Some houses were at the HGL without pressure
  - Valves that did not seat
  - Various Repairs
  - Failed Flow Meters

2019 Assessment Trip

- We looked at four different water source to find the best source of water.
  - Location to the Community
  - Stream Stability
  - Bacteria Testing
  - Turbidity Testing
  - Selected the Limon River



2019 Assessment Trip

- Additional assessment trip activities:
  - The community's tools and construction skill sets
    - Welders, Concrete, Brick layers, Plumbers, Hardware Stores
  - Met with the Community
  - We collected GPS data
  - Assessed Soil Conditions

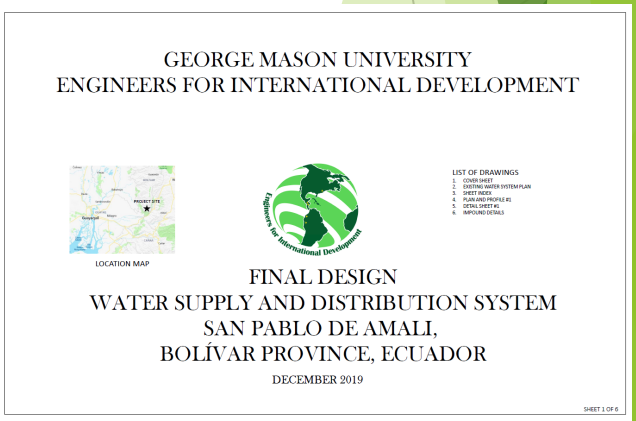
San Pablo de Amalí Ecuador

- Planning
  - Understanding the Clients needs
  - Interviewing the End-users
  - Interviewing the Local Public Works*
  - Modeling the Existing System (EPA Net)

San Pablo de Amalí Ecuador

- Detailed Design
  - Prepare Design Plans
  - Submit to Community for by-in
  - Submit to Bolivar Public Works for approval *
  - Interviewing the End-users
  - Interviewing the Local Public Works
  - Modeling the Existing System (EPA Net)

* The Bolivar Public Works have adopted our previous design for all new small scale water distribution piping and water storage tanks.


GEORGE MASON UNIVERSITY
ENGINEERS FOR INTERNATIONAL DEVELOPMENT

LOCATION MAP

LIST OF DRAWINGS
1. COVER SHEET
2. EXISTING WATER SYSTEM PLAN
3. SHEET INDEX
4. PLAN AND PROFILE #1
5. DETAIL SHEET #1
6. IMPOUND DETAILS

FINAL DESIGN
WATER SUPPLY AND DISTRIBUTION SYSTEM
SAN PABLO DE AMALI,
BOLÍVAR PROVINCE, ECUADOR
DECEMBER 2019

SHEET 1 OF 6

San Pablo de Amalí Ecuador

- Logistics
  - Procure materials in US
  - Identify Ecuador Purchases
  - Identify Travel Team (6-8 Students)
  - Prepare Travel Arrangements (Airfare, Lodging, and Ground Travel)
  - Prepare Project Schedule
  - Prepare Project Budget

San Pablo de Amalí Ecuador

- Construction Phase
  - Install Two New Water Storage Tanks in the upper region
    - Higher in elevation to create more pressure
  - Install a new 300-micron Intake Screen
  - Install new about ½ mile of 2” Piping
  - Install UV Disinfection Unit for treatment

40,000 Gallon Impound with 4’ High Dam

(2) 500 Gallon HDPE Water Storage Tanks
Plus an 8’x8’ Concrete Pad

¼ Mile of 2” PVC Sch. 40 Distribution Piping

Successful Project !

Thank you