Water Supply, Distribution and Storage San Pablo de Amali, Ecuador

Project Description:

The Peace Corp reached out to the Engineers for International Development (EfID), a student organization comprised of forty student engineers, to provide a completely new drinking water supply for the San Pablo de Amali community. Their existing water system failed leaving them with no access to clean drinking water. The scope of work for the project included finding a new clean source of water, new intake screening, impoundment, piping, storage, distribution piping, and direct connections to multiple houses. To complete the project, EfID provided the assessment, planning, design, and construction of a new reliable water system for the 200 people who live in San Pablo de Amali. Funding came from 2.5 years' worth of student fundraising events. What cannot be captured in photos or enough words is how this project significantly changed the lives of the 40+ student engineers and professionals who helped to complete the project. If EfID wins the NCEES award, 100% of the award money will go towards the second phase of the water project in San Pablo de Amali, Ecuador.



A Community Member fixing a leak in the

Knowledge or Skills Gained

Communication is a key component while problem solving, especially in the field. Along with communication amongst the students and professional engineers, the team realized how important it is to communicate with the community to ensure the product is what was expected. The significance of a client-partner relationship with the community positively impacted the students and facilitated the understanding that although a perfect design may be constructed, if it does not meet the "client" or intended usage needs, it is a worthless effort. Knowing that the clients' needs are the top priority is an invaluable skill that these students' will be able apply in their futures as engineers.



Multidiscipline and/or allied profession participation

Environmental **Engineering**: During assessment trip, students collected and analyzed water samples on site. They took samples for turbidity, bacteria, and pH. The team also brought back water samples to the U.S. and worked together with their local municipality to compare the data against the U.S. EPA's maximum contaminate levels.

Principles and Practice of Surveying: By consulting with a licensed Land Surveyor, the students selected a sturdy handheld GPS receiver to collect needed topography. During the assessment trip, the students collected thousands of GPS data points and countless measurements of the existing water system. The data was downloaded and imported into ArcMap for further analysis.



Geotechnical Engineering: Using existing land

features the students sited a 40,000-gallon

drinking water reservoir. They worked with

P.E.s to develop a six-foot-high, compacted,

composite earthen dam. The dam included a

soil base, geomembrane core and it was

topped with very large imbricated stone. To

protect the dam, the team also installed an

adjustable emergency overflow standpipe.



Results of the Bacteria Test

A P.E. and a student testing water sample





Student collecting GPS data

3-D Model of the Existing Water System

Civil: Water Resources Engineering: While working with multiple Civil Engineers, the team developed both schematics and detailed design of the entire new water system. The system included service connections, several miles of water lines, water storage, a well, and a well pump. The design had fifteen technical memorandums which detailed every existing and proposed water feature.

One of the students listening to community leaders express their expectations. (Left to Right: Community President, Professional Engineer and Chillanes Director of Public Works, Chillanes County Mayor, and one of the Mechanical Engineering students.

Collaboration of faculty, students, and licensed professional engineers

Since the start of this project in 2018, there have been as many as 40 students working on the project as well as several licensed professional engineers, faculty, and staff. EfID has been under the guidance of a practicing licensed professional Civil Engineer since its inception. The students have been holding weekly project meetings for over two years during which Licensed Professional Engineers and/or Engineers in Training (EITs) are in attendance. During the assessment trips and implementation trips to Ecuador, the students were broken up into small teams, and always had a P.E. accompanying them.





Professional Engineer and students reviewing system maps

Protection of health, safety, and/or welfare of the public



Construction of the Distribution Piping Designed Trench Detail



Reservoir Design Plan

Reservoir Construction



Structural Engineering: During the entire life of the project, the students had many structural features to design and install. These features included a concrete pad and pipe hangers.

Water Storage Tank Concrete Pad Design

Water Storage Tank Concrete Pad Construction

Mechanical and Control System Engineering: Working together with a P.E., the students designed and installed a level control system, flow meter, strainers and shut off valves.





Civil Construction: Prior to the days ten construction period, the team consulted a Professional Construction Manager to assist in developing a critical path method schedule, overall cost estimate, and safety plan. Due to the large volume of work that needed to be completed in the short amount of time, multi-tasking was necessary for various components of the construction. The team worked hard to finish the project on time and under budget with zero safety-related accidents.

Prior to the implementation trip in 2020, many of the community members needed to walk ¼ mile to get drinking water which was contaminated with bacteria. The community's gardens were under producing and their livestock were malnourished. The lack of a consistent water supply was a negative impact on the quality of life, community production, and public welfare. Without a consistent water supply, the community members were spending a significant amount of their time finding and collecting water rather than tending to the community.

> Nothing but smiles from the Mavor, DPW Director and Community !

	Gravel (for underneath the pad) Stones (cost comes with the transport)	1 dumptruck \$ 90 1 Truck/day \$ 60	0.00 0.00								
	Wood Forms 2.5 m x20 cm x1" Box of Wood Screws Rebar - 30 pieces 6 meters 5.5mm 5000 L tank Total tank and pad costs	Plan of Action and Milestone									
IMPOUND		Wate	r Supp	ly and	Dist	ributic	on Sys	tem			
lowest pressure rating po	os 4" PVC (6M Stick)		an Pal	ah ole	Ama	li Ecua	ador				
	4 CODO PVC (eldow 90 degrees) Plastico (2mm) 20 x 4 meters		Also	E las	6 las	7.100	0.100	O lan	10 100	11 100	12 100
	6 meters of 2" (50 mm) HDPE pipe (will use the e		4-Jan SAT	S-Jan	MON	THE	8-Jan	9-Jan	10-Jan	SAT	SUN
	Total impound costs	Dising	361	5011	MON	TOL	WLD	THIN	TIM	341	3014
FENCE		Piping			DT						
	Chain link fencing 30 meters (only 22 meters nee	Install 200M of 2" HDDE Bigs to Tank	_		PT	DT					
	Galvanized 2" Tube 6m (for chain link)	Install 200M of 2" PVC (200M/Dav)			PT	PT	DT	DT			
	Metal beams 60mm (for roof)	Install 200M of 2/A" PVC (SOOW/Day)			PT	FI	PT	PT			
	Electrodes	Install 3/4" PVC Pining on Bridge				PT	FI	FI			
	1.5" roof screws	Flush and Test System							PT		
	Large padlock	riusii uliu rest system									
	Total fence costs	Backup Day or Fun Day							ALL	A11	
TOOLS	KANGER STREET ALL DRIVE STREET	backup bay of run bay	-						ALL	ALL	
	Shovels	Travel									
	Wheelbarrows	Lanue Community at 2:00 nm								A11	
	Bucket	Sleen								ALL	
	Rone	Leave Ecuador at 5:00am								ALL	ALL
		Leave Leador at 5.000m									ALL
		ALL = All team members PT = Piping Team	Sylvia*	Ben	Ingrid						
		CT = Concrete Team	Paul*	David	Stef	Hannah					
		* = Team Leader to ensure:	Anna	GIOLEIO	wate	Antoijot					
		to Ensure PPE is used									
		Discuss safety before starting each new a	activity								
		Make sure all materials are ready to go f	or the next	t day							
		Ensure communications are kept with ot	ther team								
		Keeps the team on task and ensure they	finish the	daily tasks							
		Make sure all tools are stored/ cleaned/	charged								
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Emergency Contact Planning Documents, Cost Estimate and Project Implementation Schedule