Repairing a Graywater Treatment System in Rural Northern Honduras

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This summer, I served as one of the Honduras project leaders with Duke Engineers for International Development (DEID). My five teammates and I traveled to a village called El Pital, near the northern coastal city of La Ceiba, to repair a graywater treatment system that was backed up and causing minor flooding in the village. Over the course of our month-long trip, we identified the problems afflicting the system, built stronger and more robust grease traps for the water, and worked with the local water board to enable them to continue our work and expand the water system in the future.

El Pital is located along the Cangrejal River, in a mountainous region in the north of Honduras, and unfortunately suffers from difficulty in developing strong infrastructure. In October of 1998, Hurricane Mitch struck Honduras and caused devastating damage to most of the country. Houses were destroyed, roads were flooded, and small towns like El Pital were cut off from the nearby cities for many days. Although there have been multiple efforts to recover from the damage, the geography itself poses a challenge. El Pital, like most villages in the river valley, lacks ample flat ground. Most of the homes have a small yard, if any, and then simply face a short cliff that leads to the Cangrejal. In addition, the soil is rocky, which makes digging any large space difficult. Several foreign groups, however, have attempted to implement projects to improve the quality of life in the region.

DEID is one of such groups. Our relationship with El Pital is now in its third year. In 2015, the first graywater treatment system was built. Graywater consists of waste water that is dirty, but has not come in contact with fecal matter. It includes water from bathroom sinks, kitchen sinks, showers, and laundry basins, but not toilets. The purpose of DEID's first treatment system was to remove cooking grease and other particles such as food scraps and hair from the water before it flowed back into the Cangrejal. In addition, it would prevent water from pooling in people's backyards and providing a breeding ground for malaria-transmitting mosquitoes. The first system was built in two locations, each with a grease trap and a percolation bed, colloquially referred to as a "resumidero." The grease trap was built from a plastic barrel, and essentially provided the water with a place to sit for about a day, allowing the cooking grease and soap to float to the top of the barrel and be easily skimmed off. The water then passed to the resumidero, which consisted of a layer of gravel, sand, and then soil on the bottom, to allow the particulates to be filtered out through the different layers. The first system was damaged in the spring of 2016 when a storm flooded the river and washed away the top layers of the resumideros. DEID's project in the summer of 2016, therefore, was to repair and expand the existing system. I was a member of this team, and we redid the two damaged resumideros, and dug two more at additional sites in the village. In addition, we built more grease traps, so that each resumidero was serviced by two grease traps rather than one, as originally planned. This second version of the system worked well at first, but after about a month or two, the water board informed us that the water was not draining properly through the resumideros. Eventually, the houses were disconnected from the system because the grease traps were too backed up. My co-leader and I then aimed to correct this new problem during the summer of 2017.

During the preceding school year, we discussed with the water board several potential issues that could be affecting the system. Ultimately, we concluded that the grease traps were

not big enough to control the volume of water being used, and that grease was passing into the resumidero and clogging it. We researched industrial grease traps, and after reading a manual published by the United States EPA, designed a concrete grease trap much larger than the barrels that DEID teams had used in the past two years. Our hope was that the increased volume would mean that all of the cooking grease would remain comfortably in the grease traps and not clog the resumideros and cause floods. We traveled to Honduras optimistic that we had a solution to the observed problem.

Once in country, we began construction of our first new grease trap. Before completing it, we dug up the top layer of pipes in the resumidero to assess the damage and clean them out. We observed that the pipes were packed full with a solid black sludge, unlike anything we had anticipated passing through the system. While cleaning, we noticed many pieces of hair, and realized that the solid particles in the water system were not being contained by the grease traps as we originally thought. We decided to add a mesh filter to the top of the grease trap, so particulates could be detained before entering it, and would not pass through to the resumidero. Once the grease trap was completed and connected to the water coming from the houses, we observed the filter to see what type of particles it would trap. We were surprised to notice a large amount of beans and rice sitting on the surface of the filter, and realized that food waste was a large component of the black sludge clogging the pipes. However, we were pleased to see that the addition of the filter would have a noticeable impact on the effectiveness of the grease trap.

We observed the behavior of the first grease trap while building the foundation of the second, at another resumidero. Once we saw that the first grease trap was effectively trapping the solid waste and that clean water was flowing from the outlet of the resumidero, we finished building the second grease trap, using the same design as we used for the first. We took samples of the water at three separate points – before any treatment, after passing through the grease trap but before being filtered by the resumidero, and after exiting the resumidero – and showed them to the water board during a meeting to demonstrate the effectiveness of our system. Our team was overall very pleased with the amount of filtration we could observe in the different water samples.

After finishing the second grease trap, we spent the last few days in country observing the performance of the two grease traps and resumideros, and fixing small sections of pipe that had been damaged over the past few years. On the day we left, both resumideros were working well, and we anticipate that this stronger system will continue to work effectively. Our team's next step is to create a manual for the water board, in Spanish, that will detail the process of building a grease trap. With this resource, our hope is that they will be able to take the lead on the graywater treatment project and organize the construction of grease traps at the third and fourth resumideros. In this way, our project not only provides an immediate solution of the graywater problem at two resumideros, but also provides the means for the water board to make their own decisions and improvements to the system as they expand it to include the next two resumideros. I am very proud of the work my team completed this summer, and look forward to hearing from the water board how the water treatment project progresses in the future.