



# Improvements to the Water Supply, Wastewater Disposal and Solid Waste Management Systems for the El Parque Community in Aguada, Puerto Rico



Community Development Engineering

Civil and Environmental Engineering Senior Design Project WI-16 and SP-17

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## Abstract

Non-PRASA communities are known for their limitations to connect to potable water and sewer systems from the Puerto Rico Aqueduct and Sewer Authority (PRASA). These types of communities normally operate in conditions that challenge their opportunity of compliance with the Environmental Protection Agency (EPA) National Drinking Water Regulations. The Community Development Engineering (CDE) team worked on the improvements for El Parque, a rural community located in the Cerro Gordo ward in the Southeast of Aguada, which consists of 102 households and 6 commercial areas. The community extracts its drinking water through a well system located 492 feet above sea level.

Wastewater management in the El Parque Community is an issue because the households do not have adequate septic tanks. Instead, untreated wastewater infiltrates into the soil and could be compromising the quality of the drinking water well.

In terms of solid waste management, CDE evaluated several ways to diverge generated waste from landfills and reduce the cycle of disproportionate generation and disposal.

The alternatives that have been selected were focused on the wellbeing of the community, the environment, the feasibility of implementation of the project, and the economic factors that are attached to the project itself.

## Water Supply Design

### Water Distribution Tank

The existing distribution tank is going to be demolished after the construction of the new tank, in a different location, is completed. The dimensions of the new tank were determined to be 23ft 5in wide, 22ft 4in long, and 17ft high; all the dimensions include the necessary thickness of each element. The new tank will have a capacity of 44,886 gallons, which is enough to supply the community. The chlorination system will be located on the lid of the tank, and will use calcium hypochlorite tablets. The capital cost is \$169,996.

### Filtration

The filter to be installed is the Harnsco® LT2 Pleated Microglass Cartridge which complies with the EPA Safe Drinking Water Act. It consists of two filtration stages: cyclonic filtration to remove big particles, and then the water is filtered by the cartridge.

- Filter pore diameter: 1 µm
- Pre-filtration unit pore diameter: 5 µm
- Capital cost: \$6,720

### Water Distribution Network

The installation of a new water distribution network of 4in diameter of PVC material is proposed. By installing a new water distribution network with pressure relief valves the community will have less breakage on the water distribution reducing service interruptions.

Table 1: New Water Distribution Network Details

Pipeline Sections	Pipe Material	Pipe Diameter	Total Length	Pressure Relief Valves
21	PVC	4"	11,469 ft	5

- Capital cost: \$101,009

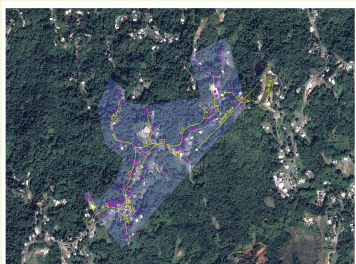


Figure 3: Water Distribution Network

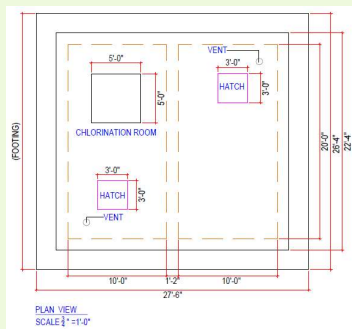


Figure 2: Top View of New Water Distribution Tank

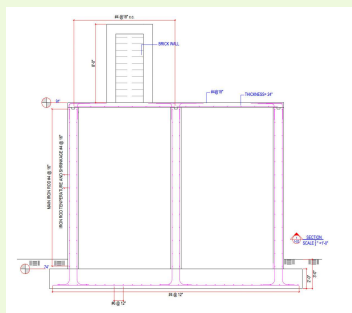


Figure 3: Section View of New Water Distribution Tank

## Water Supply Project Schedule

The total construction time for water supply improvements is 92 days.

Task Name	Duration	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>1 El Parque Aguada</b>	<b>92 days</b>												
1.1 Permit Submittal	1.1 mos												
1.2 Construction of Distribution Tank	69 days												
1.3 Demolition of Existing Distribution Tank	3 days												
1.4 Construction Debris Collection	3 days												

Figure 4: Water Supply Project Schedule

## Objective

To design improvements to the current drinking water system, wastewater management system, and solid waste management for the El Parque Community in Aguada, Puerto Rico.

## Wastewater Management

The wastewater management design was done using the International Private Sewage Disposal Code. Each household will have a 1,094-gallon double compartment septic tank with two interconnected EnviroFin™ infiltration systems. The tanks' material will be precast plastic, and the infiltration system consists of fibers and textiles that promote biological treatment for the wastewater.

- Capital cost: \$8,080 per household

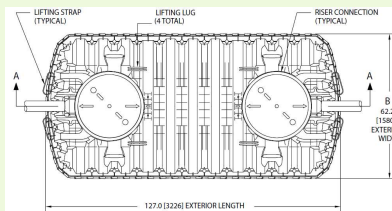


Figure 5: Top View of Septic Tank

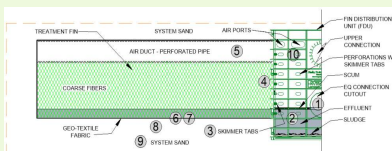


Figure 6: Ten Stages of Treatment of EnviroFin™

## Wastewater Project Schedule

The total construction time for wastewater management for the community is 71 days.

Task Name	Duration	Jan	Feb	Mar	Apr	May
<b>1 El Parque Aguada</b>	<b>71 days</b>					
1.1 Permit Submittal	1.1 mos					
1.2 Decommission of Existing Tanks	35 days					
1.3 Installation of Septic Tanks with Infiltration System	30 days					
1.3.1 Excavation/Soil Conditioning Preparations	4 wks					
1.3.2 Installation of Dual Camera Septic Tanks and EnviroFin Infiltration	6 wks					

Figure 6: Wastewater Management Project Schedule

## Conclusions

The final alternatives were the following: construction of a new distribution tank in a different location, with filtration and chlorination systems to ensure potable water distribution for the community; double compartment septic tanks with the EnviroFin infiltration systems for the wastewater management of each household, and an integrated plan for solid waste management that includes an aerobic compost program, a recycling program, and the improvements of waste collection routes. The chosen alternatives allow the fulfillment of the project's purpose, which was to provide designs that will have high viability for solving existing civil and environmental engineering problems at the El Parque Community. These alternatives will improve the quality of life of the residents without affecting the quality of the existing natural resources of the community.

## El Parque Community

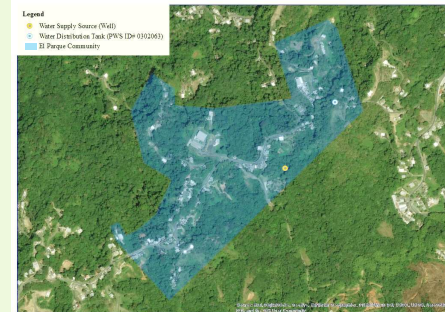


Figure 1: Top View of the El Parque Community

## Solid Waste Management

The community's solid waste generation is 3,003 lb/day.

### Aerobic Composting

- Diverged waste with aerobic compost program: 1,051 lb/day
- Capital cost: \$2,256

### Recycling

- Diverged waste with recycling program: 1,171 lb/day
- Materials to be recycled: polyethylene plastic, paper, cardboard, and scrap metal.
- Capital cost: \$3,871

### Improvements to Waste Collection Routes

The number of waste collection zones to accommodate the waste generated by various households in the community is 10. The capital cost is \$800.

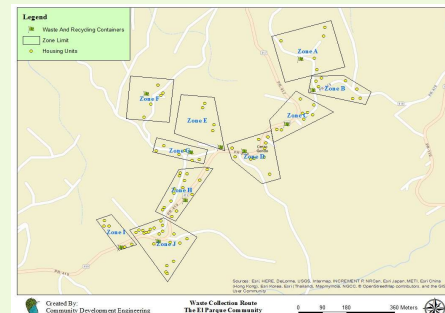


Figure 7: Solid Waste Collection Zones

## Acknowledgements

Puerto Rico Department of Health – Drinking Water Division  
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