C2.02 – Runoff Biogarden

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Project Sponsor: City of San Marcos

Project Summary

This biogarden is designed at **Crockett Elementary School** in San Marcos, Texas in the **Edwards Aquifer Transition Zone**

The biogarden will be in the grass medium in the middle of the drive loop located at the front of the school.

Project Objective

Problem: Excess water on grass, streets, and sidewalks creating safety hazards

Solution: To improve **infiltration** of water with native plants, mulch, and gravel.

Main Goal: To **educate** people of all ages about **sustainable** infiltration practices.

Group Photo

Figure 1: C2.02 Members

System Design

Biogarden Components:
Length = 42 ft
Width = 22 ft
Depth = 10 in
-Mulch Top Layer = 2.5”
-Smart Gravel Layer = 3.3''
Pipe Length = 36 ft
-Gravel Layer = 3.2”
-Geotextile = 36 CF
5 Native Plant Species

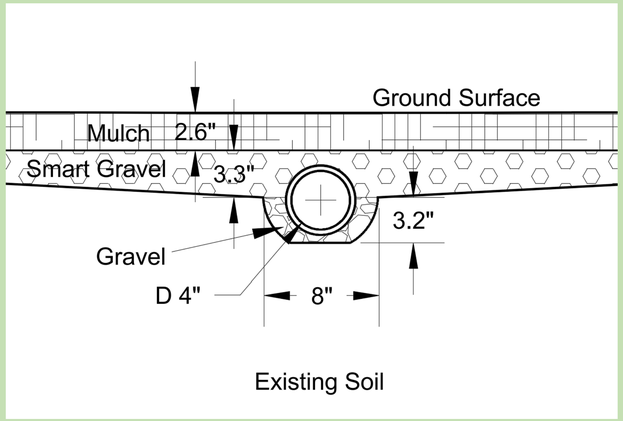


Figure 2: Biogarden Cross-Section Design

Elements Design

Soil Classification

Results: Silty Clay Loam

Importance:

- Evaluates lack of infiltration of the existing soil
- Determines hydraulic conductivity to find pipe flow and pipe diameter

Hydraulic Conductivity (k) – 0.13

Perforated Pipe

Results: 4” diameter with three rows of 3/8” holes along the top half of the pipe

Importance:

- To allow water to escape in a timely manner to prevent flooding
- Handles extreme weather conditions (10-year storm)

Figure 3: Biogarden Drainage Area Consideration

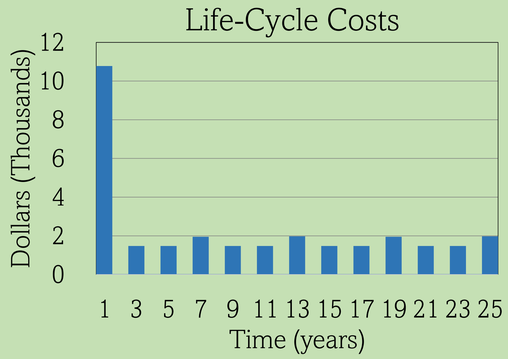
Element	Value	Unit
Pipe Diameter for daily prec.		
Daily Average Prec.	2.92	in/day
Runoff Volume	8718.2	gal
Pipe Flow	0.45	cfs
Pipe Water Loss	0.0056	cfs
Pipe Diameter	4	in
Pipe Diameter for 10 inch storm		
10-year storm Prec.	2.92	in/hr
Chance of occuring in 25 yrs	93	%
Peak Flow (10-year storm)	0.6	cfs
Pipe Diameter	4	in
Volumetric Flow	4.41	cfs

Table 1: Element Values

Constraints

- 6” – 12” allowable depth
- Surrounding Vegetation
- Soil Quality
- 48-hour maximum storage time
- No allowed subgrade compaction
- Requires full or partial sun
- 10 feet minimum distance from building

Cost Analysis



Total 25-yr Life-Cycle Cost = $30,750

Sustainability

Envision: Low-maintenance Biogarden

GOLD 40%

Score Improvements: Mulch, Smart Gravel, Gravel, and Perforated Pipe

References & Acknowledgments

- San Marcos Green Infrastructure-LID Practices
- MosquitoNix Service Organization
- Harmony in the Garden
- ASTM D 2434 Standard Method for Permeability of Granular Soils

Thank you to the Ingram School of Engineering Faculty