Design of a Bioretention Pond to Mitigate Parking Lot Pollution

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THE PROBLEM

The Benedictine Sisters of St. Scholastica in Fort Smith are looking a sustainable solution to their stormwater management problem.

Figure 5: The current monastery for the Sisters of St. Scholastica

THE PROJECT

After research, the team discovered that parking lots create a majority of the pollution in impervious areas[1]. Therefore the team decided to design a bioretention pond, which is a retention pond filled with engineered soil that allows for dense plant growth[1]. These plants take up nutrients, such as hydrocarbons and heavy metals found in the polluted runoff[1]. The goal of this project is to reduce runoff flow rate and pollutant loads for small storm events.

SOIL DESIGN

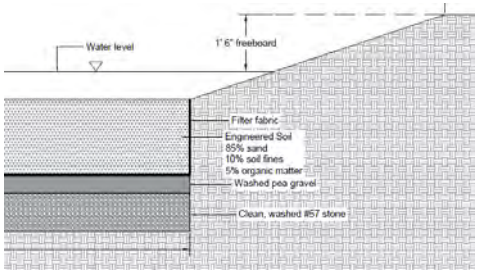

Figure 4: A cross section of the soil and drainage layer

FINAL DESIGN

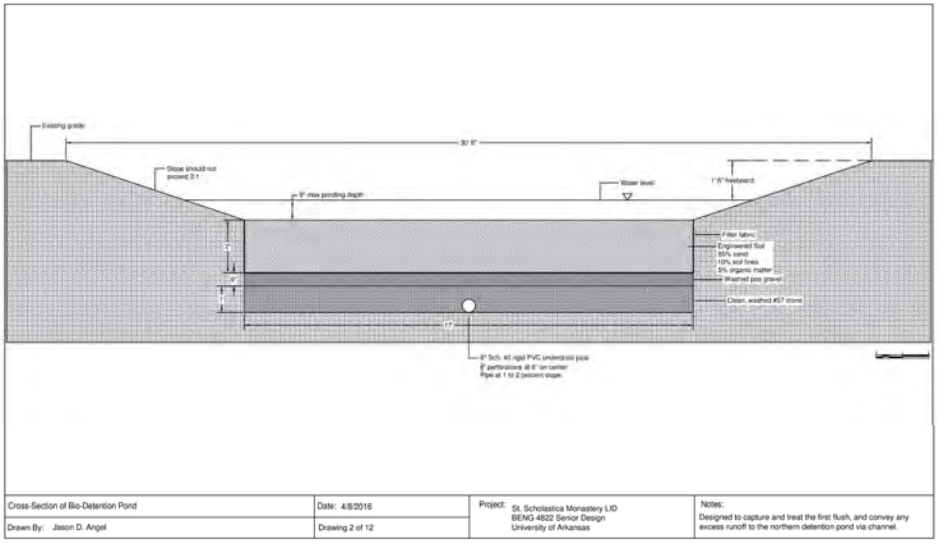

Figure 1: A side view of the final bioretention pond design that shows soil composition, drainage layers, and max ponding depth

OVERFLOW CHANNEL

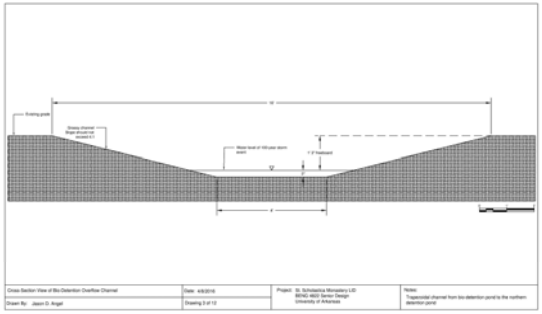

Figure 2: A side view of the overflow channel structure with maximum water depth

CONCEPTUAL MODEL

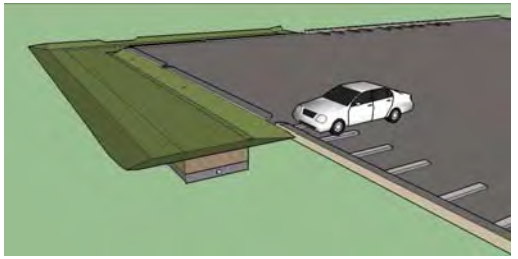

Figure 3: A conceptual model of the layout between the parking lot and bioretention pond

POTENTIAL PLANTINGS

A variety of native plants and grasses could be used for a mix of form and function[2]. These could include:

- Switchgrass
- Blue-Eyed Grass
- Royal Fern
- Narrowleaf Sunflower

SUSTAINABILITY

According to Davis et al. (2006), this bioretention pond could remove up to 83% of nitrate, 47% of phosphorus, and 60% of heavy metals (ref). Additionally, the Virginia Department of Environmental Quality reports that bioretention ponds can reduce annual runoff by up to 80%. This data suggests that this bioretention pond will meet both goals of this design project.

Further than just extrinsic results, the bioretention pond allows for education on the importance of stormwater management. With a functional Low Impact Development system for their parking lot, the Sisters of St. Scholastica can continue their stewardship of the Earth.

During this project, the large scope of sustainability became very apparent. Through every step of the design process, an unsustainable aspect of the design or construction process become noticeable. This led to many iterations and a true understanding of the difficulty of achieving full sustainability.

REFERENCES

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2. UAEX. Rain Gardens and Storm Water. FSA9533. Fayetteville, AR.: University of Arkansas Agriculture Extension Service.
3. VADEQ. 2011. Bioretention. In *Virginia Stormwater Design Specification No. 9.* Richmond, VA.: Virginia Department of Environmental Quality. Retrieved from http://www.vwrrc.vt.edu/swc/NonPBMPSpecsMarch11/VASWMBMPSpec9BIORETENTION.html

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