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BEST MANAGEMENT PRACTICES:

A Community-Based Approach to Construction and Installation

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ABSTRACT

The Wabash River Enhancement Corporation (WREC) is a nonprofit organization dedicated to improving both the health of the Wabash River and the surrounding terrestrial areas. In an effort to improve water quality, their urban cost-share program focuses on supporting green projects within a critical region surrounding the Great Bend of the Wabash River. In this essay, a Purdue student describes his experience as leader of a six-member group who worked with WREC to locate a suitable site within this critical area and implement a green project. They selected the Lighthouse Baptist Church, located in Lafayette, Indiana, since it was experiencing high amounts of runoff on its property after storm events, which eventually carried pollutants into the Wabash River. To address this issue, the group collaborated with WREC to implement a design involving best management practices (BMPs), particularly three rain gardens and a bioswale. In addition to WREC, the project is part of Purdue's Engineers for a Sustainable World (ESW), an organization that works on various sustainability-related projects. The student discusses the experience's impacts on him, WREC, and the community.

KEYWORDS

best management practices, rain garden, bioswale, native plants, sustainability, Wabash River Enhancement Corporation

INTRODUCTION

In October 2014, the Purdue organization Engineers for a Sustainable World (ESW) selected my project proposal of constructing best management practices (BMPs) on Purdue's main campus or in the surrounding local community. The project intended to increase the visibility of ESW and positively impact the community and the environment. Initially, the focus was on deciding where to locate the project. The project team preferred a church in the local community since many people congregate at churches on a regular basis. It is an ideal location to increase the visibility of both ESW and sustainable stormwater management. Around the time this decision was reached, as the team leader, I was introduced to Sara Peel, director of watershed projects for the Wabash River Enhancement Corporation (WREC), by Dr. Lindsey

Payne, an assistant professor in environmental and ecological engineering who provided support throughout this project.

WREC is a nonprofit organization dedicated to improving the health of the Wabash River and the surrounding community. Located in Lafayette, Indiana, it was founded in 2004 through an agreement between the cities of Lafayette and West Lafayette, Purdue University, and Tippecanoe County. Its mission is "to enhance the quality of life in the Wabash River corridor by providing sustainable opportunities to improve health, recreation, education, economic development, and environmental management" (WREC, n.d.b).

Figure 1 (banner image, above). Completed bioswale installed at the Lighthouse Baptist Church. The large and small rocks slow the water coming from the parking lot.

In fulfilling their mission, WREC faces a few challenges. By the time the Wabash River reaches Greater Lafayette, it reflects the runoff and inputs from a quarter of the watershed—impaired by high nutrient levels and low dissolved oxygen concentrations. This leads to damaged biotic communities (Peel, 2011). Unfortunately, there is widespread ignorance about major water impairments and associated practices to address these issues. In a 2009 survey conducted by WREC and Purdue University, 49% of the Greater Lafayette community indicated that the river's condition is so poor that they do not feel safe participating in water-related activities (WREC, n.d.a). Nonetheless, 83% of survey respondents indicate a desire to improve the river's conditions (WREC, n.d.a). Despite these challenges, WREC attempts to achieve their mission through a variety of programs. One program is an urban cost-share program, which gives urban landowners the opportunity to improve the water quality of the Wabash River by installing BMPs such as rain gardens and permeable pavement. Through this program, WREC will fund up to 75% of the design and installation. More information can be found at <http://www.wabashriver.net/costshare>.

DESCRIPTION

The ESW project became a part of WREC's urban cost-share program, and the project team performed site visits at 11 churches located within the critical region to find the best site. An inventory assessment form was used when inspecting possible locations for the project. Particularly, qualitative site observations (e.g., identifying open areas where BMPs could be placed, and noting how the property was sloped) were made on the form. In addition, photos were taken of each site for later reference and discussion. The Lighthouse Baptist Church (Lafayette, Indiana) was ultimately selected. The property suffered from erosion due to high runoff volumes after storm events. In addition, it had open space that was just turf grass, which can be resource-intensive and can contribute to water quality issues due to the runoff of fertilizers. A face-to-face meeting was conducted with the pastor, Bill Murdock, concerning the possibilities of performing a BMP project at his church. He agreed to the project, informing the team that there was ponding of water in certain areas after storm events. Moreover, he encouraged the team to develop and present a design plan.

Tests were performed to determine porosity of soils in the area, finding that the soils had high infiltration rates. This complies with the Web Soil Survey operated by the USDA Natural Resources Conservation Service (2016), which stated that the church's property contains

both Miami and Richardville silt loam; these soils drain moderately well and well, respectively. In addition, stakeholder meetings were conducted concerning native plant selection. Throughout the process, numerous challenges were encountered. For instance, the proposed location of the BMPs had to be adjusted numerous times as we learned about various planned additions to the property (e.g., a gymnasium in the northwestern portion).

Ultimately, the design plan consisted of three rain gardens and a bioswale. The site preparation and initial construction were completed by the landscaping firm Greenvision LLC in April of 2016. An aerial overview of the property after construction can be seen in Figure 2. Rain gardens are planted depressions that allow stormwater runoff from impervious urban surfaces to be absorbed into the ground. They can also serve as water filtration devices since the mulch and root systems of the plants can remove pollutants. For this project, they were primarily intended to be infiltration devices, receiving runoff from the church's roof and parking lot. Bioswales are sloped vegetated channels that convey stormwater runoff. The bioswale used in this project replaces a concrete channel and transports runoff to one of the rain gardens. Educational signage was placed by one of the rain gardens and the bioswale to aid WREC in achieving their mission.

COMMUNITY IMPACT

This project will help WREC achieve their mission in two ways. First, the bacterial community residing among the extensive native plant root systems in the installed BMPs will remove pollutants such as hydrocarbons, heavy metals, and nutrients from the stormwater, helping improve the water quality of the Wabash River (StormwaterPA, 2006). Figure 1 shows the native plants in the bioswale. Particularly, rain gardens can remove up to 90% of nutrients and chemicals and up to 80% of sediments (Old Dominion University, 2015). Furthermore, the shallow configuration of the constructed rain gardens combined with the berm along the outer perimeter of each one allows for the capture and infiltration of stormwater. The BMPs installed in this project can remove 2 pounds of nitrogen per year, 1.2 pounds of phosphorus per year, and 257 pounds of sediment per year. In addition, they divert 269,466 gallons of stormwater per year. To ensure the long-term environmental effectiveness of these BMPs, a maintenance manual was provided to the church. It contains information about and pictures of the native plants in the installments, tips and instructions for maintenance (weeding, watering, mulching, etc.), plant layouts, checklists, and pictures of common weeds.

Figure 2. Aerial overview of the church property after initial construction. The three rain gardens are labeled A, B, and C respectively. The bioswale is labeled D and is connected to rain garden C through a below grade pipe. Source: Google Earth.

Second, this project serves as a WREC community education and outreach effort in urban communities, making Greater Lafayette residents more knowledgeable about the Wabash and its issues. For example, the project culminated in a planting event where many of the collaborators, including 7 Purdue students and 25 members of the church, worked together to plant over 1,600 native seedlings (see Figure 3). The project will also provide habitat for wildlife and help improve the movement of water throughout the property.

STUDENT IMPACT AND REFLECTION

As the leader, I was largely responsible for the advancement of the project. The project's team members and

church stakeholders depended on me to make the project successful by providing direction and organization. It was a stressful experience, and there were certainly overwhelming moments, particularly when the design plan expanded from a single rain garden to three rain gardens and a bioswale. In response, the project was divided into small, manageable tasks while still focusing on the big picture. These tasks included: (1) site selection, (2) site inventory and analysis, (3) development of a specific design plan, (4) construction, (5) planting the native seedlings, and (6) creating the maintenance manual. By focusing on these tasks individually and establishing goals, it became easier to make measurable progress. In addition, creating a specific timeline at the beginning of the project was crucial in making sure that everything was on schedule.

This experience was my first major leadership role. I found I wanted to do all the work myself and did not trust other people to do a quality job. Sara and Dr. Payne encouraged me to assign responsibilities to group members and ensure that the members knew what they are supposed to do and when. As such, deadlines were provided and occasional updates were requested to monitor progress, which kept members vested in the project while also spreading out the work and making it a team effort. Perhaps the most important thing I learned is that I cannot do everything on my own—the work of others is invaluable.

With WREC's guidance, I have further developed my leadership, communication, and organization skills through this project. Particularly, Sara encouraged me

Figure 3. Church members and Purdue student volunteers planting native seedlings in one of the rain gardens.

to think critically about project-related problems and solutions, especially those concerning the placement and design of the gardens. I now possess more knowledge concerning BMP design principles. Due to my experiences with WREC, I believe nonprofits have great potential for improving the environment. They can be drivers of environmental progress through frequent interactions with a variety of entities at the federal, state, and local levels, as well as the public. Therefore, I would like to start my own environmental nonprofit organization or work for one at some point in my career.

CONCLUSION

This project involved environmental topics such as hydrology, soil science, and sustainability. Students interested in these areas have opportunities to work with WREC by identifying potential locations within the critical region and conducting their own BMP projects. These types of projects are complex, and effective communication is critical for success. My advice is to establish a working relationship with the staff members at WREC so they can help with the various phases. While stressful at times, it was highly satisfying to see the project go from words on a proposal to a reality. With the help of WREC, you can be a part of something that benefits both the community and the environment.

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AUTHOR BIO SKETCH

Nathanael J. La Breche is a senior in environmental and ecological engineering at Purdue University. After attending graduate school, he intends to pursue a career in water quality engineering. At some point, he wishes to work for an environmental nonprofit organization and eventually design sustainable golf courses. La Breche has been involved with Engineers for a Sustainable World and the Purdue Student Sustainability Council for three years, participating in green projects and volunteering for environmental programs.

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