

# **Thesis Project Portfolio**

## **Meadowcreek Golf Course 17<sup>th</sup> Hole Redesign**

(Technical Report)

## **How Emerging Technologies such as BIM, Drones or 3D Printing Impacts Sustainable Practices, as well as Waste Reduction**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2025

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## **Executive Summary**

### **Introduction**

From construction projects to golf courses, sustainability and environmental health are at the forefront of the focus of this paper. The capstone project tackles the task of addressing ongoing stormwater management drainage, erosion, and sediment control issues at the 17th hole of Meadowcreek Golf Course. These combined issues were leading to significant flood events on site, as well as exponential algae growth which destroys the dissolved oxygen for the already present aquatic life in surrounding ponds. For the technical project, I am researching the topic of technology within the construction industry. The goal is to analyze how emerging technologies such as BIM, drones or 3D printing impacts sustainable practices, as well as waste reduction. This is important because as technology continues to develop, monitoring how the technology affects environmental impacts is just as valuable as the purpose of the technology itself. Both projects, though distinct in focus, share a common thread in their emphasis on sustainability and environmental health. The Meadow Creek Golf Course's stormwater management issues highlight the urgent need for more effective infrastructure solutions that address water quality, sedimentation, and erosion problems.

### **Capstone Rationale and Methods**

The capstone project has broader implications for the Chesapeake Bay, as there are limitations on the amount of sediment, nitrogen, and phosphorus that can be discharged into the bay. The existing stormwater infrastructure at Meadowcreek is not designed to manage these issues effectively, leading to overland bypass worsening the erosion and sediment problems. The core pieces of the scope includes: Preliminary investigations to confirm drainage pathways and site conditions, Watershed assessment and hydrologic/hydraulic (H&H) modeling, Develop

schematic design drawings and accompanying technical specifications, Address permitting concerns and Finalize schematic design packages for client review.

### **Capstone Discussion and Conclusions**

The capstone project came up with three potential designs to address these issues and will present them to the clients (Meadowcreek Golf Course and the city of Charlottesville), as well as provide recommendations. The three designs are: Replacing the current dismantled drainage pipe, creating a dry swale, and creating a step pool system. Each option has their benefits and drawbacks. The challenge is that each stakeholder prioritizes different aspects, for the team to take into consideration during the recommendation period.

### **STS Rationale and Methods**

In a world where technology is advancing at an exceptional rate, utilizing the technologies to improve surrounding communities in terms of sustainability and environmental health is critical. By researching and studying recent implementations of these technologies and their impacts, further advancements can be made in improving sustainability within the construction industry.

### **STS Results and Discussion**

The adoption of Building Information Modeling (BIM), drones, and 3D printing is a significant step toward making the construction industry more sustainable and resource-efficient. This study demonstrates that each of these technologies individually contributes to reducing waste, optimizing material use, and improving construction processes. When used together, their cumulative impact significantly enhances environmental outcomes and creates a more streamlined and cost-effective construction process.