

Introducing Engineering to Elementary School Students through Flood Mitigation in School Property

Project Synopsis: A PreK-5 school within County X was experiencing periodic flooding within its property. County X partnered with a civil engineering capstone design team at our institution to come up with a solution to alleviate flooding and modernize the county's stormwater infrastructure. County X requested that the team, (i) incorporate green stormwater infrastructure (GSI) techniques in its design, and (ii) explore educational opportunities to introduce engineering concepts to PreK-5 students and to build goodwill with the surrounding community.

The design team developed three preliminary options, evaluated them quantitatively using a decision matrix and qualitatively through discussion with the county. The team then chose a preferred alternative consisting of a tiered bioretention cell system which minimizes flooding, improves water quality, and provides multiple educational benefits to the school.

The chosen option was taken to 30% design which encompassed development of engineering drawings and cost estimation. The team also developed hands-on activities that could be incorporated into the curriculum to introduce engineering to PreK-5 students.

Professional collaboration: Two Professional Engineers from County X and two faculty members (both PEs) supervised the design team. A county employee, titled "basin steward" with a K-12 background, served as the link between the county, the PreK-5 school staff and the design team. In this role she assisted the team to, (i) develop surveys on GSI techniques comprehensible by elementary school students, teachers and administrators and surrounding neighborhood association members (ii) meet with science teachers and facilities personnel to discuss the feasibility of implementing different GSI techniques on school lot and gather input in developing educational modules. The team presented their project to several Professional Engineers at a departmental advisory board meeting, and at events organized by the county and professional organization.

Knowledge/Skills: Through this project the design team developed technical, communication and project management skills. In the technical arena they learned to use relevant design codes and guidelines, used a hydraulic model, Geographic Information System (GIS) and AutoCAD drafting software extensively. They researched literature on STEM (Science, Technology, Engineering and Math) education materials for PreK-5 students. In the area of communication, they wrote a proposal and a final report to the county; presented their project to a range of audiences; learned to work as a team in a solely remote environment due to pandemic. They honed their project management skills through scheduling, budgeting of time and resources, running business meetings, and interacting with the county personnel and other stakeholders.

Safety and Welfare: PreK-5 students' safety, and welfare were the prime foci throughout the project. The retaining walls of bioretention cells were sized so that it is of age-appropriate height, the biofiltration system was ADA accessible, and the team recommended to the county that the system be constructed in summer when the school is not in session for student safety.