

CVEN 5306 Computer Aided Design

Project 1: Design of a Stormwater Detention Basin

Date Out: Sept. 11, 2025 – Date Due: Sept 25, 2025

A watershed, approximately 8 sq. miles is mostly forested with 10% urbanization and is underlain by soils with poor drainage capacity (SHG C/D). A large mixed use urban development project is being planned. The contributing drainage area of this development is 5 sq. miles. At least 80% of the developed area will be paved. Assuming the development is near Spring, TX. Design a stormwater detention system to capture excess runoff from a 100 year storm of 6 hour duration.

The following design specifications are provided:

1. There needs to be sediment forebay, with a bottom width of at least 6' - 10'. The depth of the stored water in the fore bay cannot exceed 8' in height.
2. The outflow from the forebay is sent into the detention basin via a sharp crested weir.
3. The detention basin width parallel to the flow direction cannot exceed 60' due to space constraints
4. The outflow from the detention basin is controlled using two orifices. The first orifice (smaller) is placed at the bottom of the outflow wall and the diameter of this orifice cannot exceed 6". Another orifice is to be placed at the top is to be sized such that the outflow from the basin cannot exceed pre-development peak flow.
5. The sediment fore bay can be built using pre-cast concrete, while the detention basin is assumed to be trapezoidal prism with a 2:1 slope
6. A thin layer of concrete is used to line the slopes to prevent erosion. A rip-rap bed is to be placed at the inlet of the forebay and the detention basin to dissipate energy. Assume the riprap is 12' thick and comprises of stones of 6" median diameter. Extend the rip-rap about 1' into the basin. Place a geotextile (non-woven polypropylene) is to be placed under the riprap.
7. Use similar setup at the outlet as well.

Scope of Work:

1. Compute the pre-, and post-development hydrographs for 100 year 6 hour storm duration and 50 year 6-hour storm duration (use Python)
2. Write and solve the material balance equations for the sediment forebay and the detention basin.
3. Use the material balance to size the detention basin and the forebay.
4. State all your assumptions.
5. Use any CAD software to draw the top view (plan) and cross-sections of the system components (with details and dimensioning)

6. Optional: Make a 3D Sketch using any software to visualize the system.

Each component is worth 12% of your overall grade. The remainder 40% is for the report.

Write a Report providing the rationale, design methodology and drawings. Include task performed by each member of your group. This must be attested by all members as being true and accurate. The team will receive a grade of zero if this task acknowledgment is not included.

Your report should include all pertinent equations for simulating the hydrologic and hydraulic design components.

Make sure your report is professional, with page numbers, a list of Figures and Tables and references. Use heading structures appropriately and include a table of content.