Stormwater Solutions for the University of Delaware's North Campus: Hydrologic Modeling in the Piedmont Watershed

Jillian Allen, Tim D'Agostino, Hannah Diehl
UD Watershed Action Team for Ecological Restoration (UD WATER)

1. Introduction

Stormwater runoff is an increasing problem for the health of water quality and water supply in the White Clay Creek National Wild and Scenic River. The Laird campus, in the Piedmont, at the University of Delaware contains a large amount of impervious cover which increases runoff and pollutant loads detrimental to the White Clay Creek (Fig. 1). Reduction of impervious cover through best management practices such as rain gardens and reforestation will reduce the detrimental impact of stormwater on the quality of White Clay Creek.

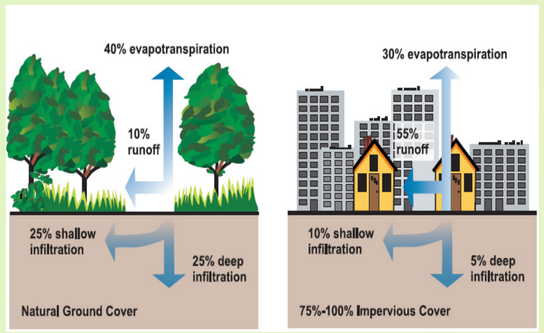


Fig. 1: Effect of impervious cover on runoff and infiltration rates in urban areas.

2. Research Objectives

To reduce runoff and pollutant loads, develop a watershed model to determine how changes in the stormwater system will improve water quality and reduce flooding in: (1) Fairfield Run, (2) Blue Hen Creek, (3) a gully system tributary to White Clay Creek

3. Methods

Each watershed was modeled using an EPA hydrology/hydraulics program called SWMM (Storm Water Management Model). The SWMM model was developed according to the following methods:

Task 1 - Delineate the watersheds (Fig. 2) into appropriate sections according to topography (contour lines) and the stormwater network using GIS data This was done using GIS data and for time and convenience sake was prepared for us.

Task 2 - Create a backdrop map for the SWMM model that includes the subcatchments, pipes, and outfalls that convey the stormwater runoff.

Task 3 – Input nodes (manholes) and outfalls to create the framework of the SWMM model (Fig. 3).

Task 4 – Connect the nodes and outfalls using links (stormwater pipes) as depicted in Fig. 4.

Task 5 – Define and draw the catchments on the map to complete the basic watershed model (Figs. 5, 6, 7).

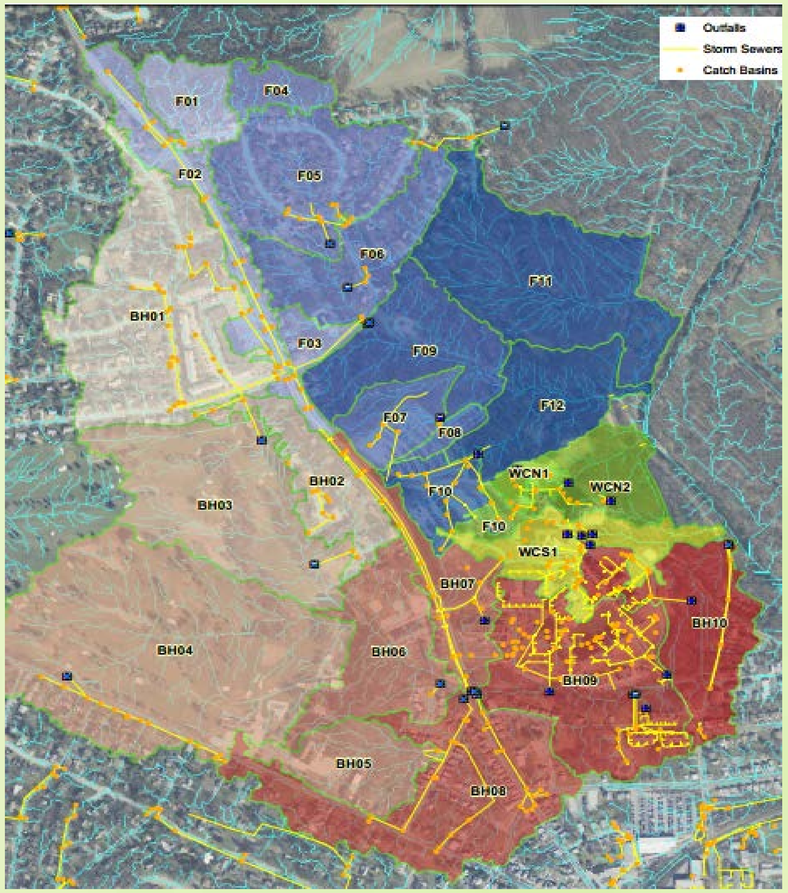


Fig. 2: Piedmont subcatchments along Fairfield Run (blue), Blue Hen Creek (red), gully system (green)

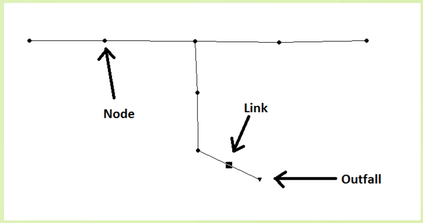
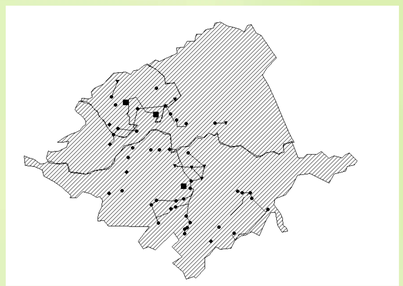


Fig. 3: Nodes, links, and Outfalls in the SWMM model

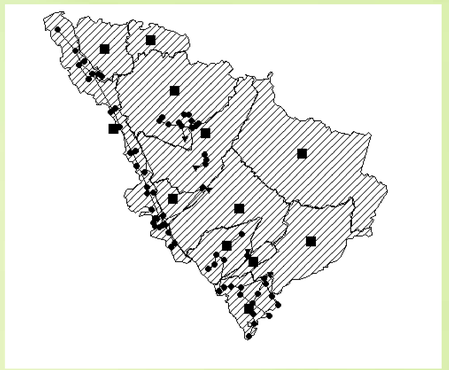
4. Results



The gully system has the following parameters:
1. Area: 14 acres
2. Links: 37
3. Nodes: 39
4. Outfalls: 7

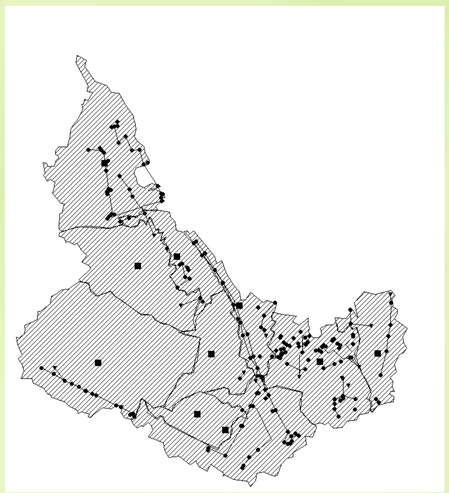
Fig. 4: Gully system SWMM model

4. Results



Fairfield Run has the following parameters:
1. Area: 139.4 acres
2. Links: 61
3. Nodes: 66
4. Outfalls: 5

Fig. 5: Fairfield Run SWMM model



Blue Hen Creek has the following parameters:
1. Area: 246.3 acres
2. Links: 133
3. Nodes: 174
4. Outfalls: 18

Fig. 6: Blue Hen Creek SWMM model

5. Future Work

1. Input rainfall data collected from the field to run the model.
2. Watershed data such as area, pipe diameter and length, and invert elevation must be put into the model.
3. Run the model with alternate inputs (such as BMPs installed).
4. Expansion of the SWMM model to include the entire University of Delaware campus and Newark.

6. Acknowledgements

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