Sustainable UD water

WATERSHED ACTION TEAM FOR ECOLOGICAL RESTORATION

Reducing Nonpoint Pollution from Stormwater Runoff:

The UD WATER Project

UD West Campus II

Samantha Loprinzo and Tom Sims

College of Agriculture and Natural Resources

DWRC Delaware Water Resources Center

Introduction and Objectives

The University of Delaware's WATER (Watershed Action Team for Ecological Restoration) Team is undertaking a project to develop a watershed management plan for the Cool Run Tributary of the White Clay Creek. The proposed plan will be used to improve the quality and reduce the quantity of storm water runoff entering the creek. Six undergraduate interns worked together with a team of faculty and professionals to develop this plan using the "A through I" watershed management approach of the U.S. Environmental Protection Agency

The watershed of Cool Run tributary of the White Clay Creek (a wild and scenic river) is located on the UD campus. Divided into six sections, the watershed contains urban areas, above the railroad tracks, and agricultural areas, below the railroad tracks. The lower west fork (CW2), and the focal point of this study, contains the majority of the UD farm. This area is of particular interest since it is mainly used for the teaching, research, and extension programs of the UD College of Agriculture and Natural Resources (CANR) yet feels the effects of urban storm water runoff. At its northern edge the creek receives runoff from the main campus which has urban land use and large areas of impervious surfaces while at its southern end the creek predominantly drains the College of Agriculture's dairy farms and forested areas. Focusing on this section of the watershed, the goal of this project was to minimize nonpoint source pollution from the cropland and farmsteads, as well as develop new best management practices to protect and improve water quality on the UD Newark farm.

Methodology

EPA "A through I" Criteria

A. Identification of pollutant sources and existing loads
B. Estimate of load reductions from Best Management Practices
C. Identifying Best Management Practices to be implemented
D. Estimates of technical and financial assistance needed
E. Information/Education component to educate the public and encourage their participation in the project
F. Schedule for implementing the management measures
G. Milestone measurements to determine if goals are being met
H. Performance criteria to evaluate whether load reductions are being met over time
I. Monitoring to evaluate effects of methods implemented over time

Source: EPA Handbook for Developing Watershed Plans to Restore and Protect Our Waters

Following the EPA "A through I" criteria above, the first step taken in this project was identifying the point and nonpoint sources located in the CW2 sub-watershed of the Cool Run Tributary. The pollutants and likely sources in CW2 are shown below.

Sources of Nonpoint Pollution in CW2

Pollutant type	Major Sources
Sediment	Erosion from crops, pastures, urban runoff, stream channels
Nutrients	Fertilizers, manures, soil erosion
Metals	Streets, roofs, parking lots

Estimating Pollutant Loads from Land to Water in Stormwater Runoff

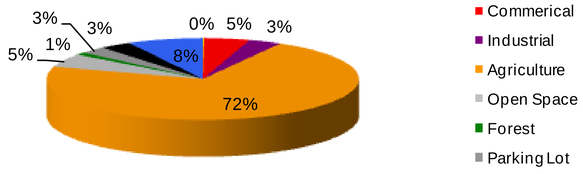
Land Use Categorization: Once the sources were identified, pollution loads from land to water via stormwater runoff were estimated. Base maps, containing the designated boundaries, aerial views, and impervious surface distinction for the Cool Run Tributary were already available. Using these maps and ArcGIS to calculate areas, the 132 acres in the CW2 sub-watershed were divided by land use, according to categorization in the *Urban Stormwater Retrofit Manual*. The area was comprised of land classified as industrial, agriculture, open space, forest, parking lot, street, and landscaping (as seen in the graph below).

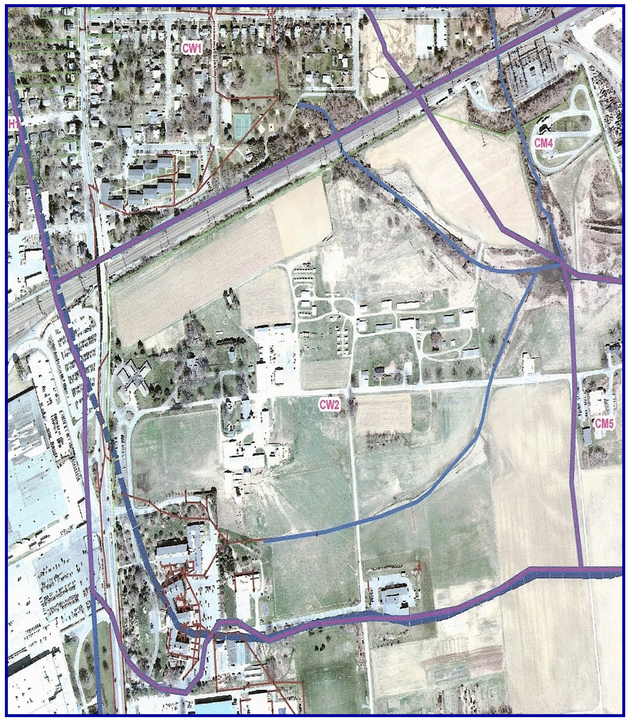
Pollutant Load Calculation: The Simple Method from the Urban Storm Water Retrofit Manual provided a way to estimate pollutant loads from the land use types in CW2. The equation used to estimate pollutant loads is based on the watershed area, mean annual precipitation, runoff coefficient, and event mean pollutant concentration to estimate loads of Total Suspended Solids, Total Dissolved Solids, Nitrogen, Phosphorus, Copper, and Zinc.

L = (A) (P) (R) (C) (0.2260)

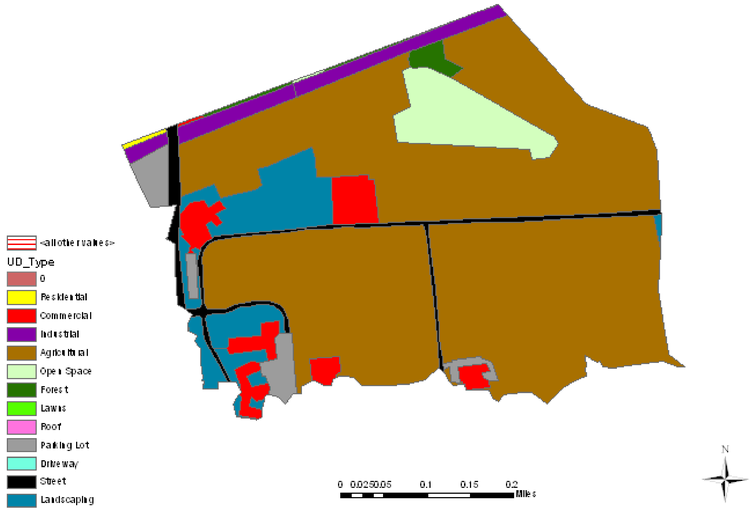
Where:
L = annual pollutant load, lb/yr.
A = watershed area, acres.
P = mean annual precipitation, in. (In northern Delaware this is 41 inches at Wilmington Airport)
R = runoff coefficient, % impervious, for various land uses
C = event mean pollutant concentration, mg/l or as listed

Land Use in the CW2 Sub-Watershed of the Cool Run Tributary on the UD Campus





Land Use Distribution in the CW2 Sub-Watershed, Cool Run Tributary of the White Clay Creek



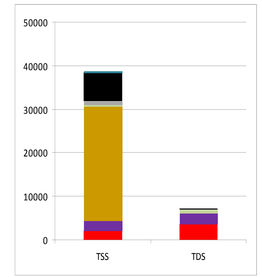
Results

The estimated loads of sediment (TSS, TDS), nutrients (N, P), and metals (Cu, Zn) were calculated for the lower west subwatershed and are shown below in mg/l. Each pollutant is broken down by load per land use area.

Estimated Total Annual Pollutant Loads (Lbs/sub-watershed/yr)

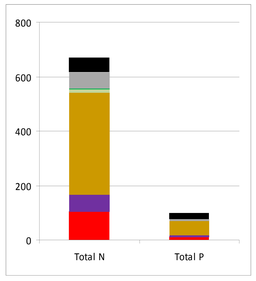
Sediment

Land Use	TSS	TDS
Residential	27	40
Commercial	2117	3545
Industrial	2376	2522
Agriculture	26181	87
Open Space	310	808
Forest	12	1
Parking Lot	857	32
Street	6510	38
Landscaping	355	10



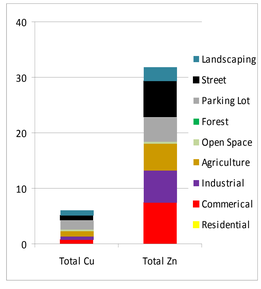
Nutrients

Land Use	Total N	Total P
Residential	1.2	0.2
Commercial	103.4	10.8
Industrial	61.6	7.3
Agriculture	375.3	52.4
Open Space	14.9	2.0
Forest	0.7	0.1
Parking Lot	60.3	4.8
Street	53.0	20.8
Landscaping	0.0	0.0

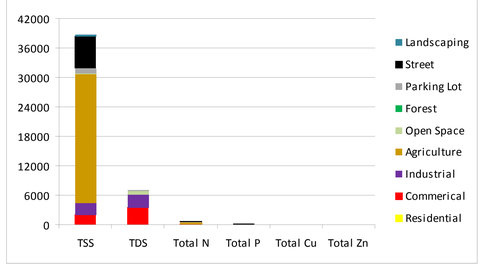


Metals

Land Use	Total Cu	Total Zn
Residential	0.01	0.04
Commercial	0.84	7.386
Industrial	0.62	5.84
Agriculture	0.96	4.85
Open Space	0.23	0.26
Forest	0.00	0.01
Parking Lot	1.62	4.41
Street	0.95	6.55
Landscaping	0.91	2.52



Total Pollutants



Best Management Practices for Nonpoint Pollution Control

Current	Recommended
Nutrient management plan	Improve control of farmyard runoff
Winter cover crops	Cover crops (increase acreage)
Buffers/filter strips	Wetlands to filter runoff (increase)
Stormwater management	Stream channel restoration
Compost/export manure	Manage/replace invasive species