

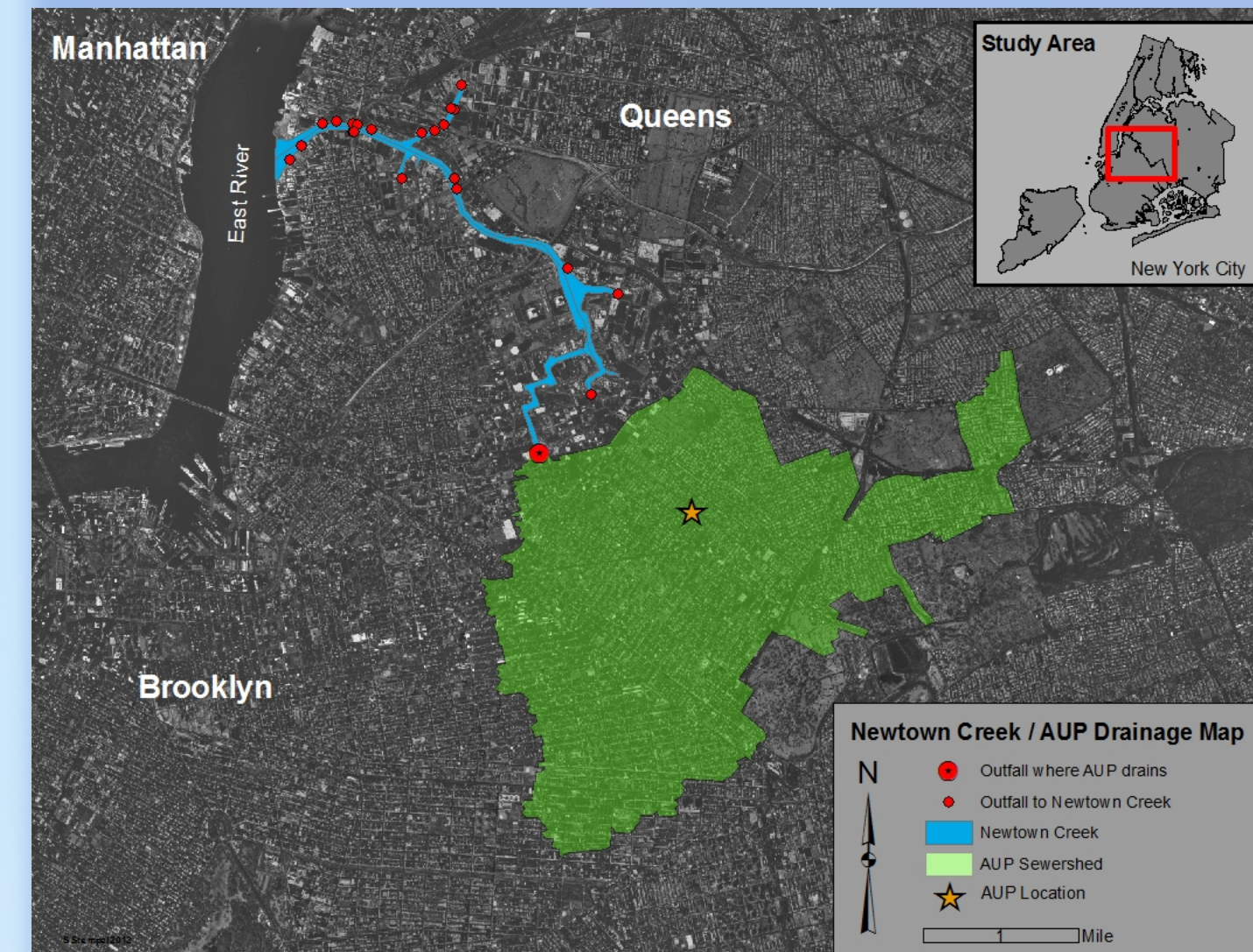
# FACTORS AFFECTING THE QUANTITY AND QUALITY OF STORMWATER RUNOFF AROUND THE ACADEMY OF URBAN PLANNING CAMPUS, BUSHWICK, NY

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## ABSTRACT

In urban areas, run-off water from storms can cause flooding, sewage overflows, and pollution of local waterbodies (NYC, 2008). Students investigated this issue on a local scale by conducting a stormwater survey of their campus. Spatial mapping techniques, physical calculations, and laboratory procedures were used to determine how the types of surfaces and pollutant sources around their school contributed to both the quantity and quality of local stormwater. Results showed that over 50% of the school campus was impervious, which would lead to nearly 200,000 gal. of runoff water during a typical storm (as based on the NY state stormwater design manual). One of the main pollutants associated with stormwater around the campus was yard waste, which was found to contribute excess nitrogen and phosphorous to runoff water. Students will use this information to look for opportunities for best management practices such as rain gardens, rain barrels, and litter control around their campus.

## BACKGROUND

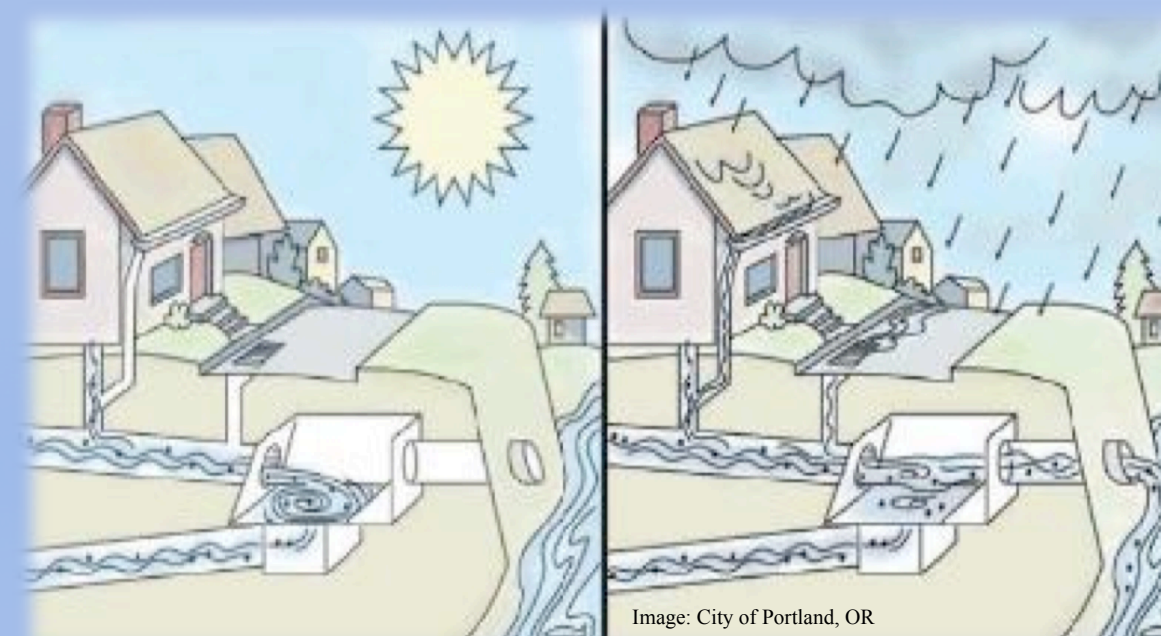


**Figure 1:** Academy of Urban Planning (AUP) drainage map. The campus stormwater drains into a combined sewer overflow (CSO) located at the head of a tributary for Newtown Creek.

**Research Questions:** How does stormwater flow run off our campus? What types of pollution are on our campus and how do they affect stormwater?

**Hypothesis:** Our campus contributes to Newtown Creek stormwater runoff pollution because the AUP campus is mostly impermeable.

- Combined sewer overflows are a big problem in New York City because during storms the stormwater runoff and sewage carry pollutants into local waterbodies (NYC, 2008)
- Global climate change could have a large impact on NYC's stormwater plan because of the prediction that there will be more intense and/or frequent storms occurring in the area (Emmanuel, 2005)
- Water from the Academy of Urban Planning (AUP) drains to Newtown Creek, which is a polluted Superfund Site (USEPA, 2010)

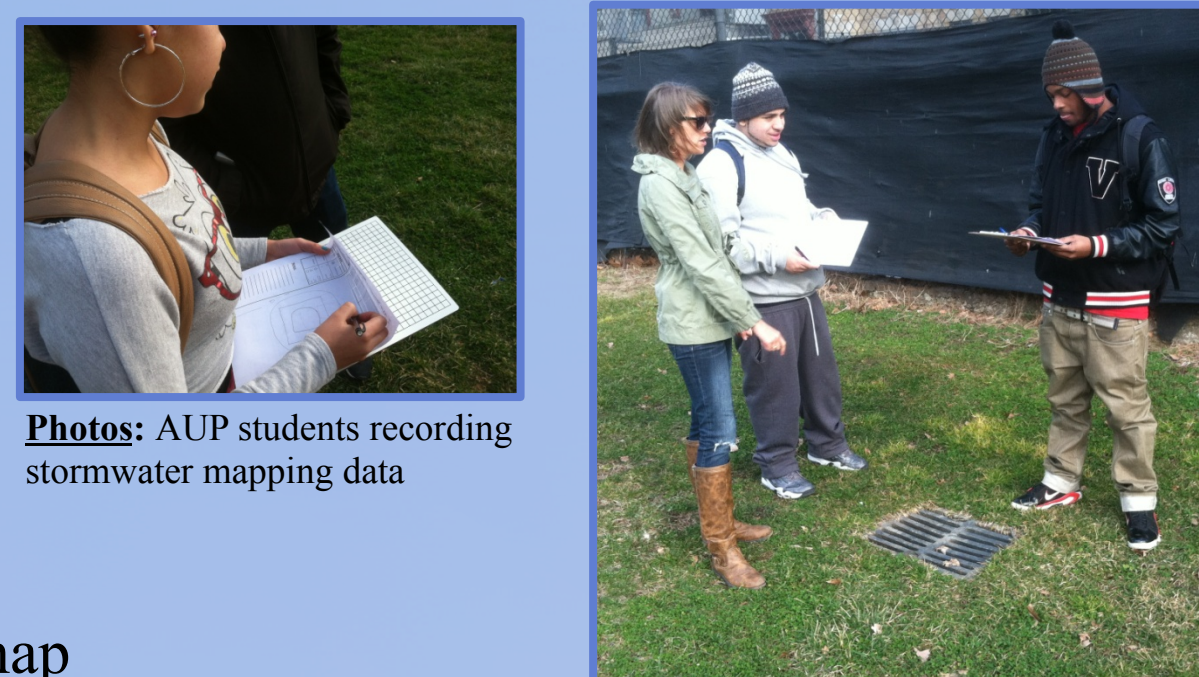


**Figure 2:** Diagram of how a combined sewer (CSO) system works differently in a dry time vs. a rain storm.

## METHODS

### (1) Stormwater Flow Map of the AUP Campus

- Divided campus into sections
- Groups from each class mapped different sections looking for:
  - Permeable vs. Impermeable Surfaces
  - Direction of Water Flow
  - Sources of Stormwater Pollution
- Each field map was drawn into PowerPoint and then layered to create a digital map



**Photos:** AUP students recording stormwater mapping data

### (2) Storm Event Scenario Calculations:

The mapping results were used to calculate the total area of the school as well as the percent of the campus that was permeable and impermeable. This information was used to calculate runoff and infiltration volumes for three model storm events (from NYDEC,2010):

90% Storm	1-Year Storm	10-Year Storm
1.3 in/ 24hrs.	2.8in/ 24hrs	5in/ 24hrs

*Calculation Example (for 90% storm):*

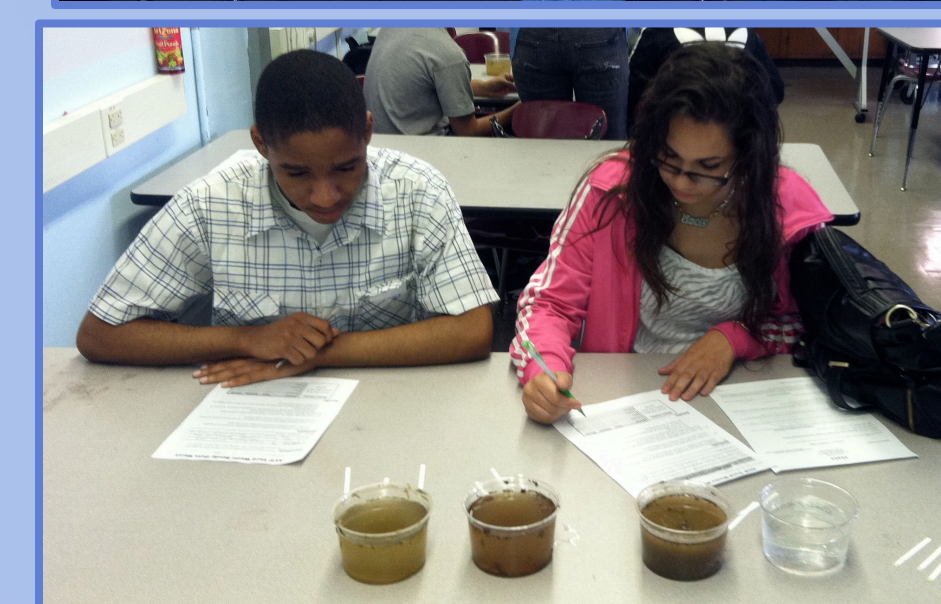
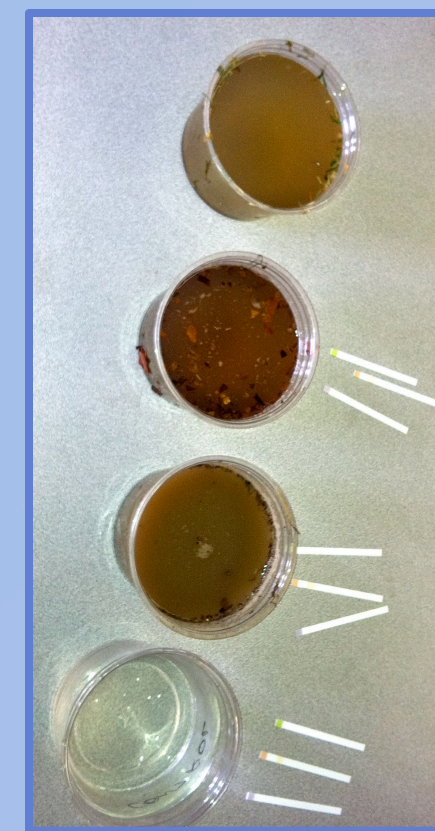
**How Much Rain Falls Over the School:**  
0.33m rain x 28,967m<sup>2</sup> (campus area) = 955.937 m<sup>3</sup> = **252,531 Gal. of rain over the campus**

**How Much Water will Run off the Campus:**  
955.937m<sup>3</sup> of rain over the campus x 0.662 (impermeable ratio) = 633.59 m<sup>3</sup> = **167,376 Gal. of runoff**

**How Much Water Will Infiltrate into the Ground:**  
955.937m<sup>3</sup> of rain over the campus - 633.59m<sup>3</sup> of runoff = 322.35 m<sup>3</sup> = **85,155 Gal. of infiltration**

### (3) Effect of Yard Waste on Stormwater Quality

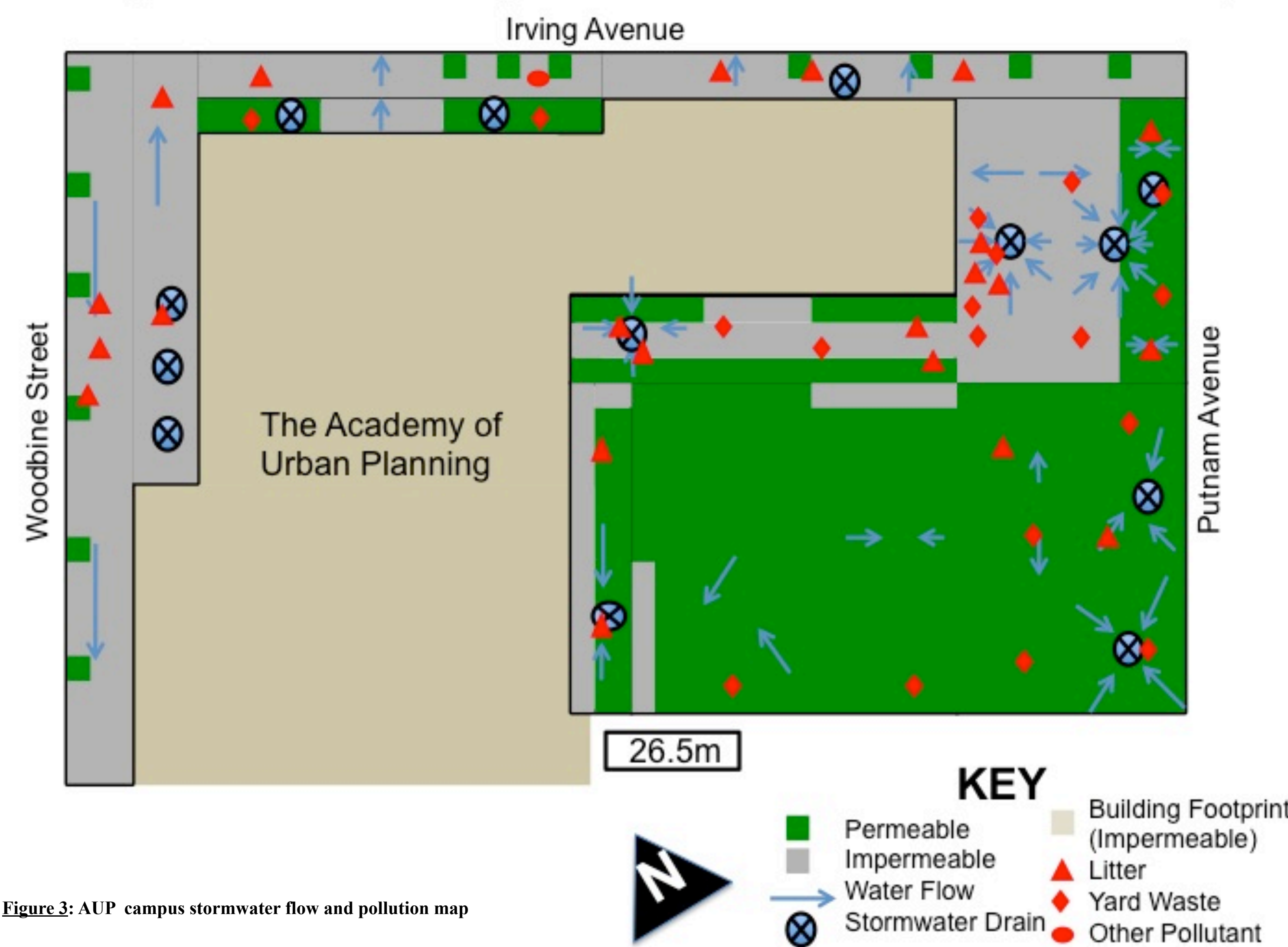
- Collected yard waste (dirt, grass, leaves) from school yard
- Soaked yard waste in water for 24 hrs.
- Tested water for Nitrate, Nitrite, and Phosphorous using water quality test strips
- Visually assessed water clarity
- Used clean water as a control group



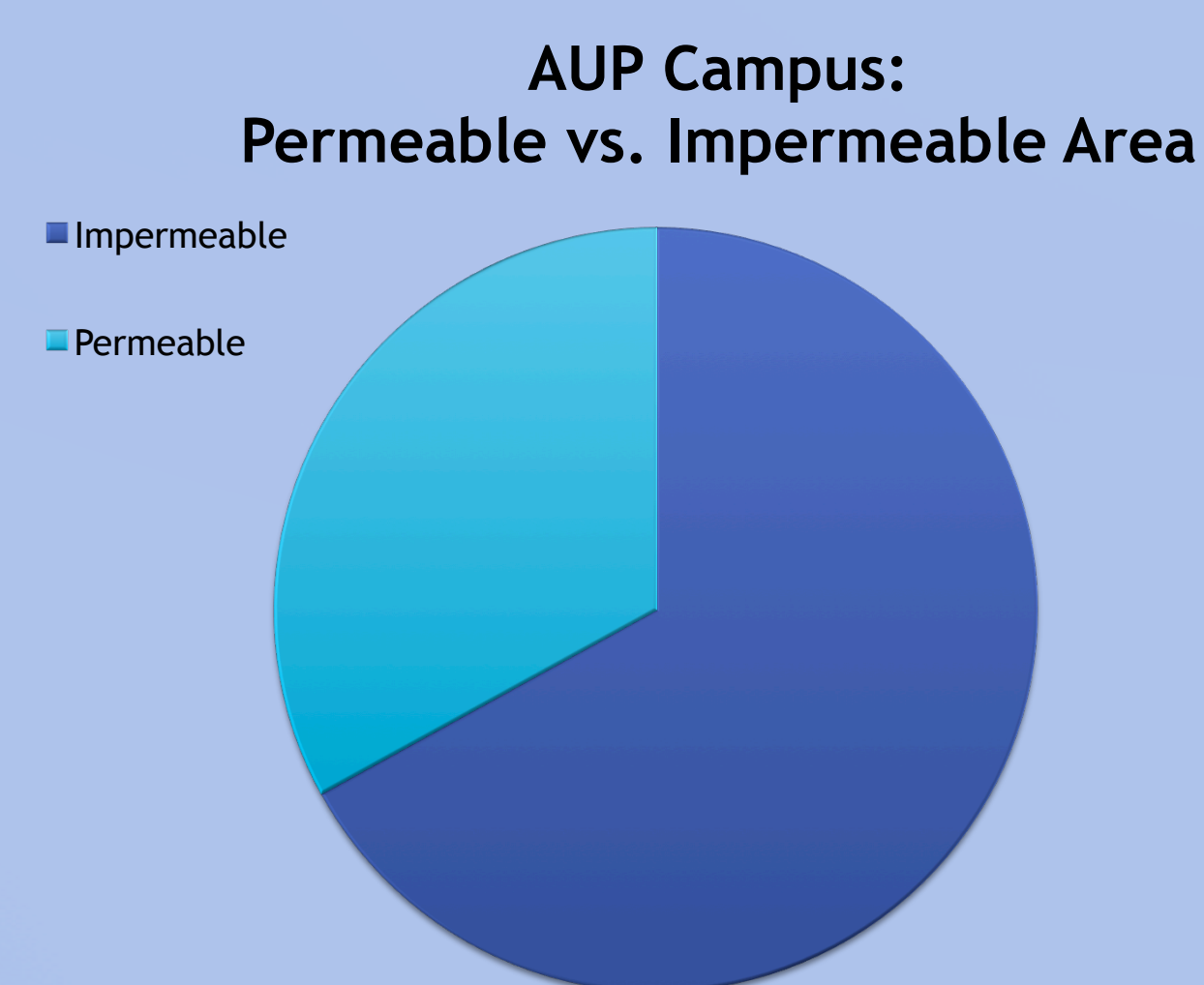
**Photos:** AUP students during yard waste nutrient testing

## RESULTS AND DISCUSSION

### Academy of Urban Planning: Stormwater Flow and Pollution Map

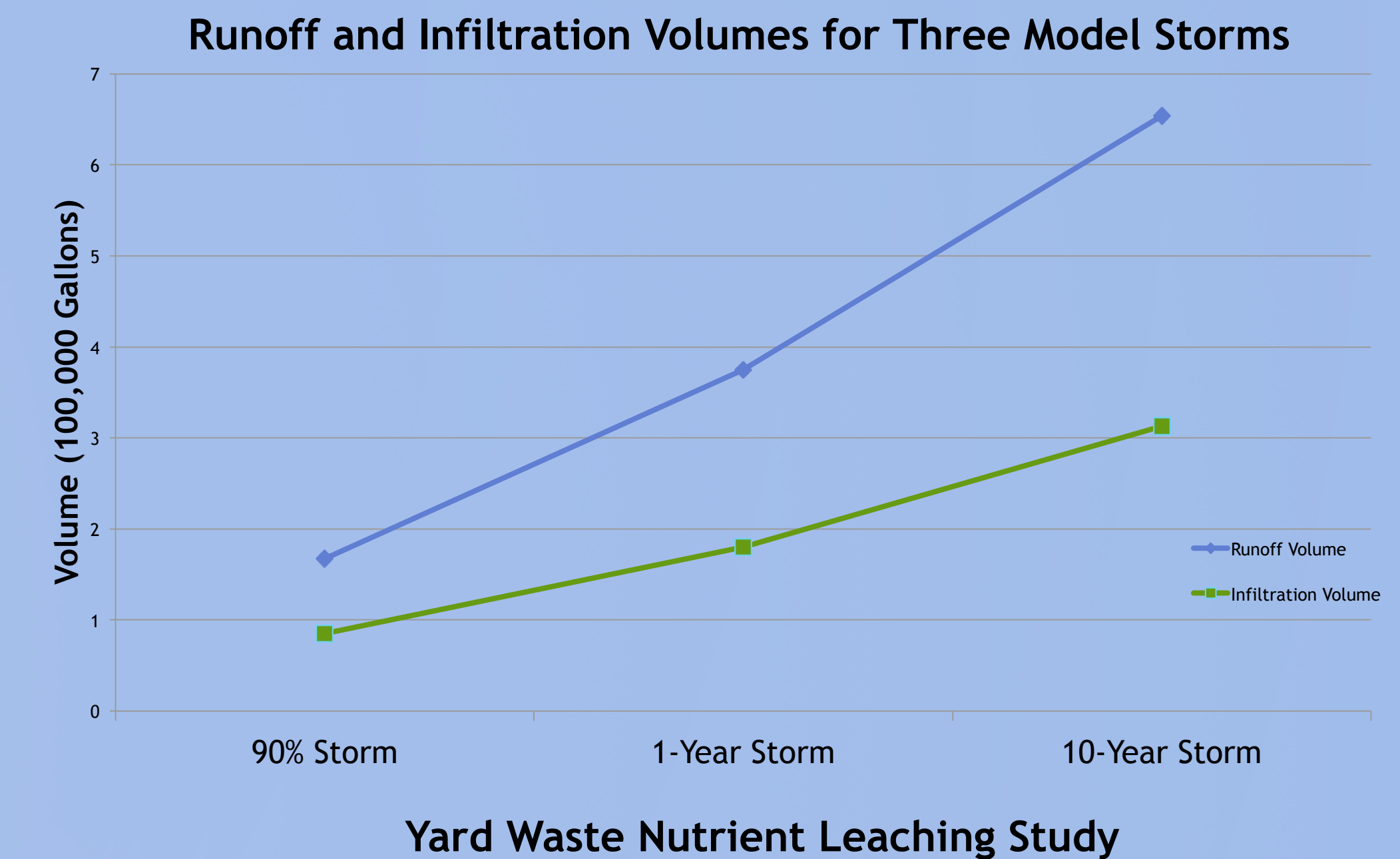


**Figure 3:** AUP campus stormwater flow and pollution map

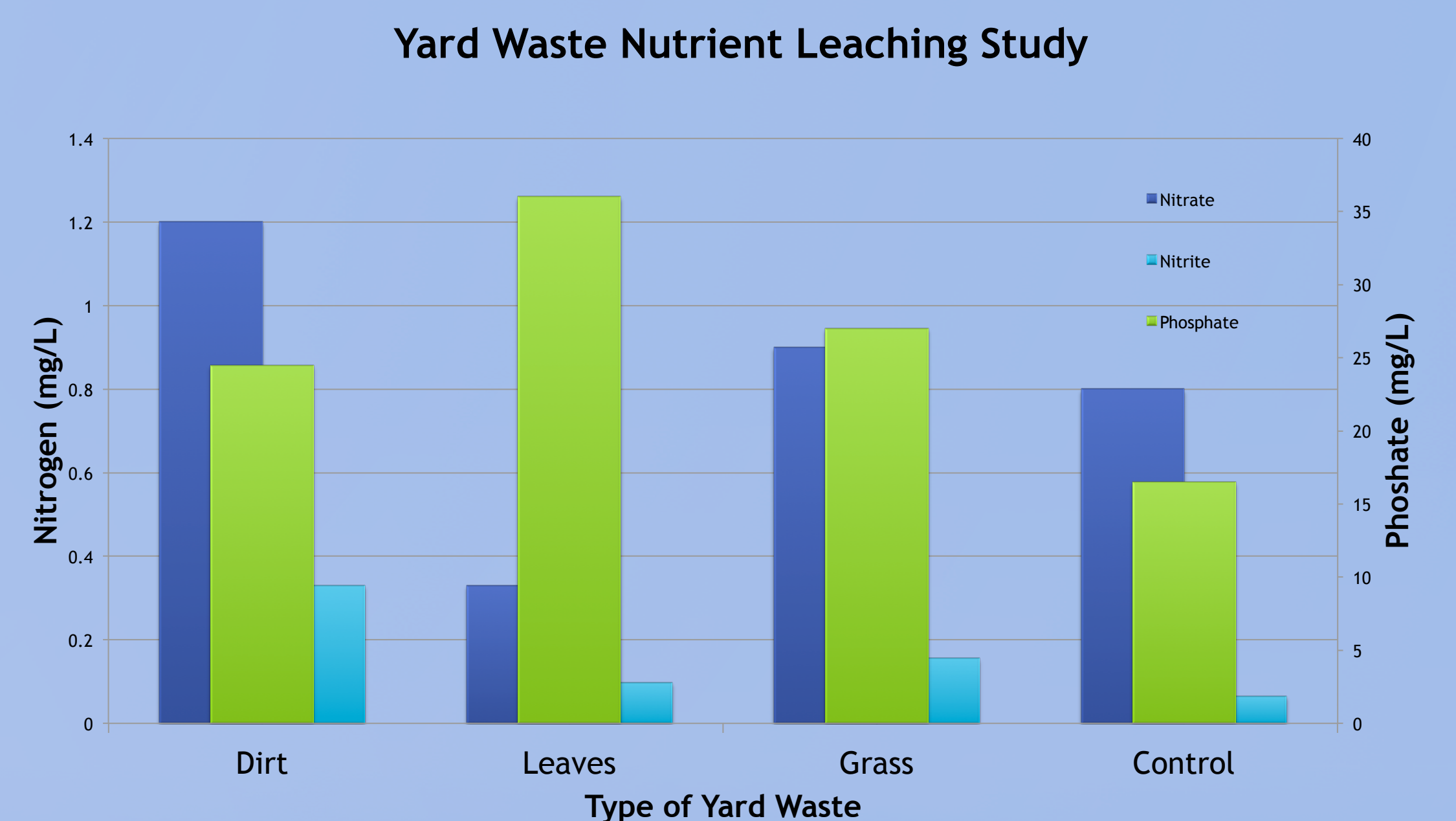


**Figure 4:** AUP campus percent permeable and impermeable pie chart

The AUP Campus is mostly impermeable. The more impermeable surfaces there are, the more runoff there will be. There are many sources of pollution around the AUP Campus, mainly litter and yard waste. When it rains water can pick up the pollutants and drag them down a storm drain into local waters such as Newtown Creek. Some of the storm drains around AUP are clogged with litter and yard waste, this can lead to flooding.



**Figure 5:** AUP Campus runoff and infiltration volumes for 3 model storms.



**Figure 6:** AUP campus yard waste nutrient leaching study.

Much more water runs off the AUP campus than infiltrates into the soil. This is because of the high levels of impermeable surfaces. Runoff water can carry pollution into local waterbodies. Yard waste around the AUP campus contributes nitrogen, phosphorous, and turbidity to Newtown Creek. Newtown Creek is a superfund site so this additional pollution from stormwater may be adding to the problem.

## CONCLUSIONS

- AUP May be contributing stormwater pollution to Newtown Creek**
- This is a problem that can be reduced with some student actions:**
  - Volunteer student group to clean up litter and compost yard waste
  - Collect runoff water from a gutter in a barrel and reuse the water (NYC, 2010)
  - Create a green roof or sidewalk planters to reduce impermeable surfaces (NYC, 2010)
- The results of this project point to future studies:**
  - Determine the types of soils that are around our school and figure out what their infiltration rate would be during a storm
  - Examine how pollution from the campus could effect other water quality tests such as dissolved oxygen, coliform bacteria, and algae growth
  - Examine the effect of combined pollutants on the stormwater leaving our campus
  - Extend data from other sites around NYC and compare to our school

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