Monitoring Runoff Water Quality around the Science Learning Center

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INTRODUCTION:

The Science Learning Center (SLC) , opened in fall 2016, represents a new source of roof runoff. With a roof of approximately 4,200 m^2, the SLC may produce 4,700,000 liters of runoff in a year. Roof drains can channel this water, but a large amount will pour into surrounding areas with a potential to become runoff. This runoff can transport sediments and other particles from the soil into nearby water bodies, negatively impacting water quality. However, the SLC was constructed with sustainability in mind: it features specially constructed rain gardens and terraces to combat stormwater drainage problems.

Figure 1. The Science Learning Center (2016). Photo credit: Rick O'Quinn

OBJECTIVE:

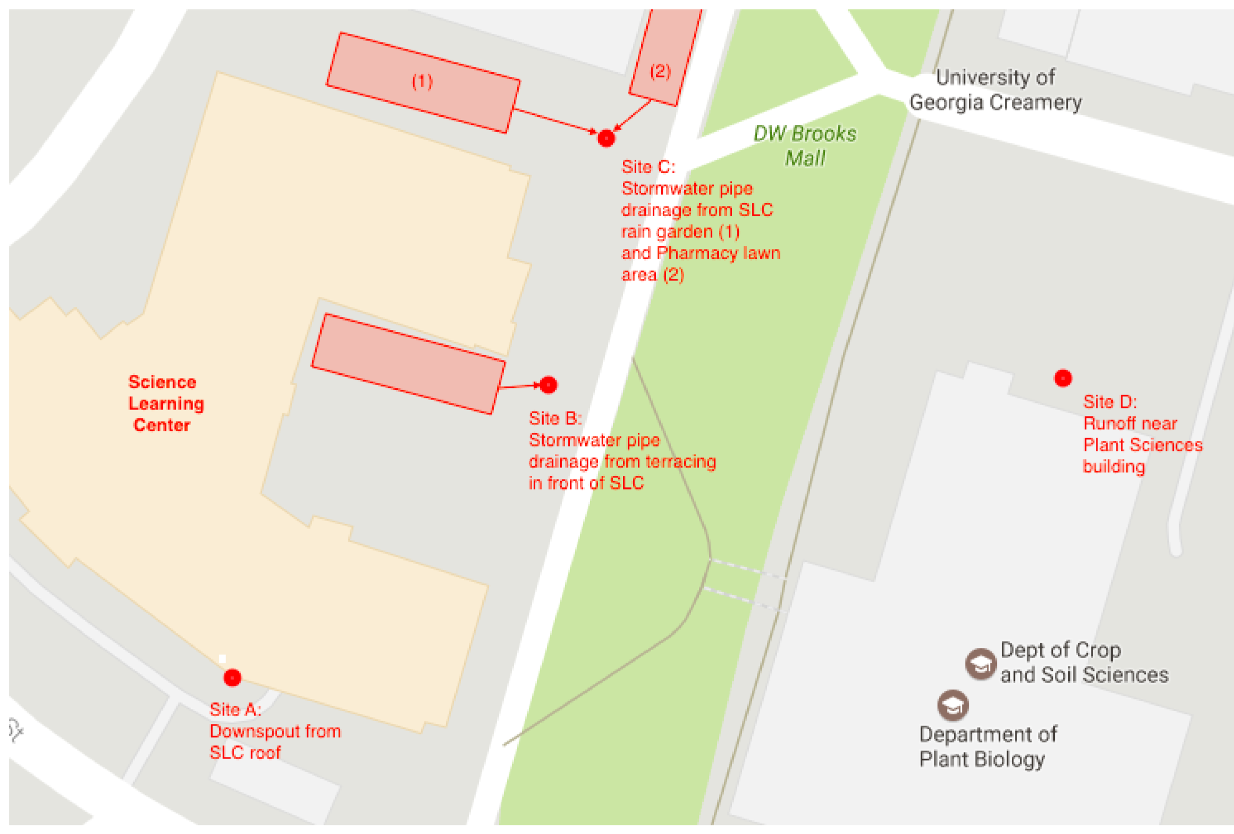
Our goal is to quantify levels of turbidity in runoff from locations around the Science Learning Center. Runoff was subjected to differing levels of water filtration at each site, so we expected to find variation in turbidity level based on these differences (with levels in rain gardens being lowest). The secondary objective of this study was to evaluate other general water quality indicators of runoff from each site.

METHODS:

Site Selection: Drains were visually located around the SLC on the UGA campus. Pipe flow direction was diagrammed in order to estimate the source of the from each pipe. Drains were chosen based on their proximity to the Science Learning Center, RC Wilson Pharmacy, and DW Brooks Mall. Additional data was taken from SLC roof drainage pipes. See site map for sample locations.

Water Sampling: Five water samples were taken on March 1, 2017 during a rain event for an initial comparison of sites. Not all pipes identified for study were transporting water. A LaMotte Water Quality Monitoring Kit was utilized to evaluate turbidity, alkalinity, nitrate content, and phosphate content. Results were compared among sites.

SAMPLING SITE MAP:



RESULTS:

Sample	Turbidity	Nitrate	Phosphate	Alkalinity
A	2.5 JTU	2.2 ppm	0.0 ppm	8 ppm
B	2.5 JTU	2.2 ppm	0.1 ppm	6 ppm
C1	2.5 JTU	6.6 ppm	0.8 ppm	42 ppm
C2	4.0 JTU	< 1 ppm	0.2 ppm	4 ppm
D	12.5 JTU	2.2 ppm	0.2 ppm	17 ppm

Turbidity was measured in Jackson Turbidity Units.
Nitrate was measured in parts per million Nitrate.
Phosphate was measured in parts per million Orthophosphate.
Alkalinity was measured in parts per million $CaCO_3$.

Turbidity in rain garden samples B and C1 was be 2.5 JTU, which was the lowest of all five samples *and* equivalent to the turbidity level in sample A (taken directly from roof runoff). Sample C2, which filtered through a lawn prior to drainage, had higher turbidity than the previous samples. Turbidity in sample D was much higher than in any other sample at 12.5 JTU, which can likely be attributed to the fact that it underwent no filtration through either a rain garden or lawn.

Figure 2. Rain garden next to the Science Learning Center

DISCUSSION:

Runoff that filtered through the rain gardens prior to drainage had very low turbidity levels (comparable to the runoff sample taken directly from the roof). Though we will be able to make stronger inferences after further data collection, the current data does support our hypothesis that runoff filtered through rain gardens would yield the lowest turbidity levels.

In the SLC rain gardens, surface substrates (rocks, mulch, and vegetation) discourage sediment erosion, and deeper substrates filter sediments out of draining water. In traditional lawn areas, the soil tends to be highly compacted, causing water to enter surface drains with little to no filtration.

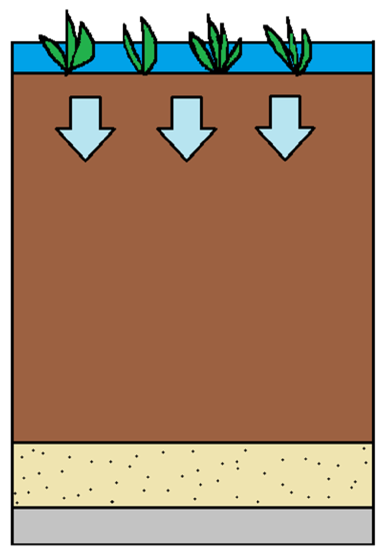


Figure 3. Diagram of typical rain garden design. The blue layer represents pooled water, which absorbs into the soil layer underneath. The bottom two layers represent sand and rock.

Runoff from this area of campus eventually drains into Lily Branch Stream, which empties into the North Oconee River. Turbidity, our primary indicator of concern, can have serious effects on stream health. Suspended particles can block light penetration, hampering plant growth and thus disrupting aquatic food webs. These particles can also interfere with fish spawning beds and decrease survival rates.

It is important to periodically evaluate runoff water quality indicators like turbidity. Demonstrating that the University's efforts to implement sustainable features are effective could pave the way for more sustainable campus innovation in the future.

Figure 4. Native vegetation acts as a filter for rainwater in a rain garden next to the Science Learning Center

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