Green Infrastructure Performance in Stormwater Quality

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I. Introduction

The purpose of this study is to evaluate the performance of Green Infrastructure (GI) in improving stormwater quality. Green infrastructure design has been advocated by the U.S. Environmental Protection Agency as an ecological way to manage stormwater for better water quantity and quality. This new drainage design paradigm focuses on maintaining the natural hydrologic cycle and suggests treating runoff on-site. Current literature suggests the performance benefits of GI design; however, there is a regional disparity, in respect to number of GI projects reported, level of sophistication in design, available design guidelines and policy endorsement. This study looks to fill a gap in case-studies within the arid west region. Our study site is the 4,100 acre Master-planned community of Daybreak in South Jordan.

This development uses a variety of techniques to manage all of its stormwater on-site, including canals, dry wells, constructed wetlands, bioswales and infiltration basins with no impacts on or connections to the municipal storm sewer system. Two adjacent sub-watersheds were chosen to compare the relative effectiveness of different stormwater management techniques. One watershed incorporates GI strategies including a series of vegetated bioswales to filter runoff. The other watershed utilizes traditional stormwater management methods and uses stormwater drains to direct runoff into a detention basin. This site is of interest not only because of the extensive use of GI, but its adjacency to Bingham Copper Mine.

II. Methods

A sampling station was set up at the outlet of each watershed where the stormwater samples are collected. Each station has a solar powered automated ISCO 6712 sampler to collect runoff after storm events. The ISCO pump is activated by a sensor placed within the culvert that signals the pump to draw samples. As long as the sensor detects sufficient flow the sampler collects water at predefined intervals and stores them in plastic bottles within the apparatus. Samples are collected that reflect the first flush and the flow-weighted pollutant. Research assistants monitor precipitation forecasts in order to retrieve samples within 24 hours of a rain event and return the samples to Logan to be analyzed by The Utah Water Research Laboratory. Samples are analyzed for a variety of contaminants including total suspended solids, heavy metals, nitrogen and phosphorus concentrations.

III. Results

Preliminary results are very favorable to GI, showing the bioswale watershed outperforming the traditional detention basin system in removing every pollutant measured (see Figures 4 & 5). However, the most significant finding being the removal of heavy metals, in particular Copper as this is notoriously hard to remove from water. The first flush shows 90% fewer suspended solids, 85% less total Nitrogen, 90% less total Phosphorus, 95% less Zinc & Lead and 80% less Copper than the traditional stormwater system.

VI. Conclusion

Not only are GI systems effective at reducing pollutants in stormwater runoff, they are sensitive to the existing hydrology of the site. If similar systems were implemented throughout the state it would greatly increase stormwater quality and reduce reliance on costly municipal stormwater systems.

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