

Evaluation of a Leaf Collection and Street Cleaning Program as a Way to Reduce Nutrients in Urban Runoff

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Organic detritus and particulate matter can be major sources of phosphorus (P) and other nutrients in the urban environment, especially in areas with dense overhead tree canopy. In order to meet impending regulation to reduce P loads, Wisconsin cities will require information on structural and non-structural Stormwater Control Measures (SCMs) that target organic detritus and particulate matter. Implementing a city-wide leaf collection and street cleaning program is one way to reduce organic detritus and particulate matter in urban areas before it becomes entrained in runoff. Non-structural SCMs may have advantages over structural SCMs because most Wisconsin cities already conduct some level of leaf collection and existing street cleaning programs, thus may benefit from increased phosphorus reduction with minor changes to existing practices; however, few studies have quantified the water-quality benefits of such a program.

The U.S Geological Survey measured the water-quality benefits of a municipal leaf collection program coupled with street cleaning in Madison, WI during the months of April through November of 2014 and 2015. The calibration phase of the study (2014) characterized nutrient concentrations and loads in runoff from two paired basins (each less than 15 acres) without leaf collection or street cleaning. During the treatment phase (2015), street cleaning was done in the test basin by city personnel on a weekly basis from April through September with leaf collection in October and November. Additionally, prior to each precipitation event, USGS personnel removed as much organic debris from the street surface as reasonably possible. The control remained without street cleaning or leaf collection for the entire monitoring period.

During the spring and summer months, street cleaning alone did not significantly decrease concentrations of nutrients in runoff. During the fall, leaf collection and street cleaning was able to remove the increased amount of organic debris from the curb and street surface which resulted in statistically significant ($p < 0.05$) reductions in concentrations of phosphorus, nitrogen and organic carbon. Total and dissolved P concentrations were reduced by 80 and 84 percent, respectively. Similarly, total and dissolved organic carbon was reduced by 76 and 77 percent, and total and dissolved nitrogen was reduced by 31 and 39 percent, respectively. In the control basin, 60 percent of the annual phosphorus load occurred in fall (winter excluded), the majority of which was dissolved as orthophosphorus, compared to only 16 percent in the test basin.

While the leaf collection practices adopted during this study may surpass those used by other municipal programs, results from this study suggest a significant reduction of nutrient loads in urban stormwater is feasible when leaves and other organic detritus are removed from streets prior to precipitation events.