



## **BUREAU OF WATERSHED MANAGEMENT PROGRAM GUIDANCE**

### **RUNOFF MANAGEMENT POLICY AND MANAGEMENT TEAM Storm Water Management Program**

Wisconsin Department of Natural Resources  
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## **Interim Municipal Phosphorus Reduction Credit for Leaf Management Programs**


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*This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.*

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APPROVED:

  
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Bureau of Watershed Management

  
Date

## **A. Introduction/Statement of Problem Being Addressed**

Permitted Municipal Separate Storm Sewer Systems (MS4s) will be subject to an annual average reduction for the discharge of a pollutant of concern to a surface water that has an approved TMDL. Recent studies indicate that phosphorus loads in stormwater in the fall of the year may be reduced by frequent leaf collection followed by street cleaning. Many municipalities are currently developing plans to meet TMDL limits and wish to include fall leaf management efforts in their plans.

While additional research is needed on a broader range of conditions and management methods, sufficient data is available to determine a preliminary phosphorus reduction credit for the most common municipal land use type. This credit is limited to the specific conditions and methods for which data is available. No credit has been quantified for other land uses, tree canopies, or collection programs but it is the Department's intent to expand the applicability of the guidance to more conditions and programs as additional studies are completed. This expansion is dependent on availability of funding for further data collection and evaluation.

## **B. Objectives**

This guidance identifies a percent phosphorus reduction credit which may be taken by municipalities as part of TMDL planning and the conditions required to take that credit.

## **C. Background and Definitions**

Urban trees provide a host of benefits to the residents and workers within a community, such as energy savings, aesthetics, airborne pollutant reduction, noise reduction, and providing bird habitat. Trees are also an important part of the hydrologic cycle. However, without adequate management of leaf litter, they also contribute to the nutrient loading in urban stormwater. Each tree species contributes a different amount of phosphorus to the stormwater, but since a diverse set of tree species is beneficial to long-term maintenance of a healthy canopy this effect is not being addressed at this time.

While there are many sources of phosphorus in urban stormwater, a primary contributor is organic detritus, especially in areas with dense overhead tree canopy (Duan et al, 2014; Hobbie et al, 2014; and Kalinosky et al, 2014). Measurement of end-of-pipe phosphorus concentrations has demonstrated that phosphorus loads in urban stormwater vary seasonally in certain medium density residential areas, with higher concentrations coinciding with leaf accumulation on streets (Selbig, 2016). As phosphorus discharges in stormwater can vary from year to year depending on timing of rainfall events, seasonal phosphorus loads were modeled over a twenty-year period with WinSLAMM to determine the average proportion that is discharged in the fall. From this information, it is estimated that on average 43% of the annual phosphorus load is discharged in the fall.

A variety of public works programs are already in place to collect leaves from the streets and properties in the fall, but until recently, little was known about the phosphorus reduction potential of different leaf collection programs. Over the last four years, the United States Geological Survey (USGS) conducted a study to characterize reductions of total and dissolved forms of phosphorus in stormwater through a municipal leaf collection and street cleaning programs in Madison, Wisconsin, USA. Some credit for phosphorus reduction is warranted based on the information.

To estimate the efficiency of leaf collection, leaves were collected three to four times at the test site and collected only once at the end of the fall at the control site. A small vehicle was used to push the leaves from the terrace into the street and then the leaves were pushed into garbage trucks. Within 24 hours of leaf collection, remaining leaf litter in the street was collected using mechanical street cleaners. Eight end-of-pipe phosphorus concentration measurements were compared at the test and control sites during the fall of 2016. Water quality data collected indicate that the collection and transfer method resulted in a 40% reduction of total phosphorus discharge in the fall at the test site versus the control site.

#### **D. Guidance Content**

A municipality may assume the specified reduction from no controls phosphorus loads provided all of the conditions are met. Further evaluation is required to determine how leaf collection methods may reduce loading to structural best management practices (BMPs) such as ponds. Therefore, this credit may not be taken in addition to phosphorus reductions from other BMPs in the drainage area at this time.

#### **Transfer Plus Street Cleaning Method of Leaf Collection**

Municipalities may assume 17% (40% reduction due to collection efforts x 43% of annual phosphorus load occurring in fall) Total Phosphorus annual load reduction for the leaf collection effort in the Medium Density Residential No Alleys (MDRNA) land use for this option. If the credit is desired for an area containing MDRNA and other land uses, the annual load reduction must be modified by the percent of the total phosphorus load from the area that is from the MDRNA. For example, the phosphorus load from a MDRNA might represent 60% of the load from the entire area. The new annual percent reduction for the area would be 10% (17% X 60%). Municipalities may apply the leaf credit to a subset of their MDRNA area if other BMPs are providing more phosphorus reduction for the remaining area. At this time credit for leaf collection is not available for other land uses or lower-density tree canopies. The Total Phosphorus annual load reduction for this option may be assumed if the following conditions are met:

1. Medium Density (2-6 units/acre) Residential (Single-family) land use without alleys. Medium Density Residential with alleys land use may be included if the alleys receive the same level of leaf collection and street cleaning as the streets.

2. Curb and gutter with storm sewer drainage systems and light parking densities during street cleaning activities.
3. An average of one or more mature trees located between the sidewalk and the curb for every 80 linear feet of curb. Where sidewalk is not present, trees within 15 feet of the curb may be counted toward tree cover. Generally, this equates to a tree canopy over the street (pavement only) of 17% or greater. Field investigations or aerial photography may be used to document the tree cover.
4. The municipality has an ordinance prohibiting residents from placement of leaves in the street and a policy stating that residents may place leaves on the terrace in bags or piles for collection.
5. Municipal leaf collection provided at least 4 times spaced throughout the months of October and November. Leaves may be pushed, vacuumed, or manually loaded into a fully enclosed vehicle, such as a garbage truck or covered dump truck. No leaf piles are left in the street overnight.
6. Within 24 hours of leaf collection, remaining leaf litter in the street must be collected using street cleaning machines, such as a mechanical broom or vacuum assisted street cleaner. A brush attachment on a skid steer is not an acceptable equivalent.

**It is anticipated that additional scenarios will be added as research is completed.**

## **E. References**

- Duan, S., Delaney-Newcomb, K., Kaushal, S.S., Findlay, S.E.G., Belt, K.T., 2014. Potential effects of leaf litter on water quality in urban watersheds. *Biogeochemistry* 121, 61–80. <http://dx.doi.org/10.1007/s10533-014-0016-9>.
- Hobbie, S.E., Baker, L.A., Buyarski, C., Nidzgorski, D., Finlay, J.C., 2014. Decomposition of tree leaf litter on pavement: implications for urban water quality. *Urban Ecosyst.* 17 (2), 369–385. <http://dx.doi.org/10.1007/s11252-013-0329-9>.
- Kalinosky, P., Baker, L.A., Hobbie, S., Bintner, R., Buyarski, C., 2014. User support manual: estimating nutrient removal by enhanced street sweeping. Report to the Minnesota Pollution Control Agency (available at: <http://larrybakerlab.cfans.umn.edu/files/2011/07/Kalinosky-et-al.-2014.-Street-Sweeping-Guidance-Manual-final-9-24-2014.docx>, (accessed April 11th, 2016)).
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