TETRA TECH

MEMO

To:	Mike Trojan, Minnesota Pollution Control Agency
From:	Aileen Molloy and Jennifer Olson
Date:	June 30, 2020
Subject:	*Minnesota Street Sweeping Phosphorus Load Reduction Credit Development*

The Minnesota Pollution Control Agency (MPCA) is developing a method for crediting street sweeping that will provide credit for phosphorus removal as part of MS4 permit compliance with TMDL reductions, with eventual incorporation into the Minnesota Stormwater Manual. MPCA's goal is to provide a mass-based approach, backed by research-based empirical relationships, for the crediting program.

1.0 SURVEY OF CREDITING APPROACHES

One of the first activities undertaken as part of this effort was the preparation of a literature review that summarized the existing street sweeping crediting methods throughout the country. The purpose of this review was to identify the existing methods that are in use as background and a starting point for deciding on a methodology for Minnesota and identifying what types of data would be necessary to develop the credit and for permitted entities to report their sweeping practices and claim the credit.

The literature review[1] found that crediting methods vary by governing agency. Over 70% of state MS4 permitting agencies do not require or provide a nutrient or sediment reduction credit for street sweeping, regardless of whether there is an applicable TMDL. Generally, street sweeping is regarded as a good housekeeping measure and annual miles swept are tracked. Of the MS4 permits that do provide TMDL load reduction credit for street sweeping, these programs typically require documentation, at a minimum, of the length or area of street swept or a measurement of the materials collected with reductions calculated from established pollutant concentrations or reduction efficiencies or individual load reductions based on permittee-specific data. Some rely on weight conversions of wet or dry material to an estimated reduction of total nitrogen, total phosphorus, or total suspended sediment. Other programs credit based on lane miles swept. Some programs use advanced modeling and provide a wide array of options based on equipment used, number of times swept, and seasonal breaks.

2.0 UNIVERSITY OF MINNESOTA DATA COLLECTION AND ANALYSIS

The University of Minnesota Water Resources Center (the University) has an ongoing research project, funded by MPCA, to collect street sweeping data for multiple municipalities in Minnesota to improve the empirical relationships between street sweeping and sweeper phosphorus loads.

The approach evaluated the relationships among wet mass, dry mass, organic carbon content, and phosphorus concentrations of collected sweeper loads. Three sweeper types (regenerative air, mechanical broom, and vacuum) were used to conduct street sweeping and collection occurred throughout the snow-free season (April – November). A range of tree canopy covers with a mix of common Minnesota street trees was included in the study. Data relationships were derived from existing data from the Prior Lake Street Sweeping Study (Kalinosky et

[1] Molloy, A and J. Olson. 2019, May 21. Memo to Mike Trojan, MPCA. *Final Street Sweeping Survey of Crediting Approaches*

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al. 2014[2], Kalinosky 2015[3]) and new data collected in partnership with the cities of Minneapolis, Forest Lake, Roseville, and Shoreview, MN.

Including the Prior Lake data, samples were collected from 37 sweeping routes across the snow-free season for 2010-2012 (Prior Lake) and 2019 for the remaining four cities. This yielded 384 samples from Prior Lake and 191 total samples from remaining cities.

Samples were processed and analyzed at the University of Minnesota's Department of Ecology, Evolution and Behavior using methods developed in the Prior Lake Street Sweeping Study and described in detail in Kalinosky et al. (2014)[4]

Following sample analyses, the data were analyzed using mixed linear models to determine whether moisture content, organic content, and carbon and phosphorus concentrations of the sweeper loads vary based on factors such as canopy cover and season.

A draft report summarizing the findings of the study is under development[5]; however, the data relationships are available for use in developing the MPCA crediting methodology. The University provided two approaches for estimating dry mass (direct measure and estimation from sweeper load wet mass average moisture content. Five approaches for estimating phosphorus concentration in sweeper materials were evaluated by the University: 1) direct measurement; 2) estimated phosphorus concentration relationship to tree canopy cover and month; 3) estimated phosphorus concentration relationship to tree canopy cover and month by city; 4) estimated phosphorus concentration using the full sweeping dataset or monthly summary statistics of phosphorus concentration; 5) and estimated phosphorus concentration using the full sweeping dataset or monthly relationship between organic matter and phosphorus concentration.

2.1 SELECTION OF CREDITING OPTIONS

MPCA, Tetra Tech and the University explored various potential crediting options based on the anticipated predictive relationships that would be derived from the University's research. The group elected to explore five methods of calculating phosphorus reduction credits, expressed as pounds reduced per year from street sweeping:

- Direct measure of phosphorus content of sweeper material
- Load reduction based on the phosphorus concentration relationship to wet mass
- Load reduction based on the phosphorus concentration relationship to dry mass
- Relationship between phosphorus concentration and sweeper material volume
- Modeled results based on P8 (Program for Predicting Pollution Particle Passage through Pits, Puddles, and Ponds), or another model selected by the permitted entity

After reviewing the University's preliminary results, MPCA identified the crediting options that balance the amount of data that a permittee would need to collect and the predictive error in the statistical relationship with phosphorus concentration. The sweeper volume to phosphorus relationship initially under consideration was not explored further due to a lack of data analyses to develop this relationship. The remaining options are addressed below according to the approaches presented by the University.

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[2] Kalinosky et al. 2014. *User Support Manual: Estimating Nutrient Removal by Enhanced Street Sweeping*. Prepared for MPCA and U.S. EPA.
[3] Kalinosky, Paula. 2015. *Quantifying Solids and Nutrient Recovered Through Street Sweeping in a Suburban Watershed*. A Thesis submitted to the faculty of University of Minnesota.
[4] Kalinosky et al. 2014. *User Support Manual: Estimating Nutrient Removal by Enhanced Street Sweeping*. Prepared for MPCA and U.S. EPA.
[5] King et al. 2020. *Minnesota Stormwater Research Council Report to Inform Credit for Street Sweeping*, June 14, 2020 Draft.

2.1.1 Wet Mass to Dry Mass Conversion

First, the option of converting wet mass to dry mass was evaluated, and the overall mean error was less than 5% across all months. The data also showed a strong trend of relatively consistent moisture content across the months of March through September (mean monthly values 23-33%) and October through November (86-95%). MPCA determined that a split between the non-leaf collection and fall leaf collection seasons is a reasonable level of specificity when estimating moisture content. Direct measure will also be available to permittees who choose to follow the sampling and analysis protocols developed by the University and determine their own moisture content.

2.1.2 Estimating Phosphorus Concentration in Dry Mass Collected

The results of estimating phosphorus concentration using the various methods provided by the University were reviewed.

Approach 1: Direct Measure

As with calculating moisture content, MPCA is proposing that the permittees may choose to directly measure the phosphorus concentration of their sweeper samples, rather than use the MPCA statistically-derived values discussed here.

Approach 2: Estimated phosphorus concentration relationship to tree canopy cover and month

The linear regression of the relationship between canopy cover and month and phosphorus concentration did not show a strong correlation, except in October and November. When the lower quantile (25%) was evaluated, the relationship improved, but remained relatively weak. Most months in either regression did not show a statistically significant relationship. Given the weak predictive power and the effort that would be required for each municipality to develop tree canopy cover, this method was removed from further consideration.

Approach 3: Estimated phosphorus concentration relationship to tree canopy cover and month by city

Similar to Approach 2, this Approach 3 estimated phosphorus concentration based on a linear regression equation; however, Approach 3 also incorporated the city as a variable in the equation. While this change improved the mean error in the linear regression equation, it increased the mean error of the 25% quantile regression. Additionally, the results are not translatable to cities not included in the study. For these reasons, this method was removed from further consideration.

Approach 4: Estimated phosphorus concentration using the full sweeping dataset or monthly summary statistics of phosphorus concentration

This approach presents two options, a phosphorus concentration derived from all sweeping data from all cities in the study, and monthly phosphorus concentrations using all sweeping data from all cities in the study. When the data were separated by month, there was a clear pattern of increased phosphorus concentrations in October and November as compared to the rest of the sweeping months (March-September). The mean and median phosphorus concentration values during October and November were approximately double the values for the remainder of the year.

Approach 5: Estimated phosphorus concentration from organic matter concentration using the full sweeping dataset or monthly relationships

This approach uses only data from Prior Lake because organic matter is only available for the Prior Lake sweeping events. Regression equation relationships were developed between organic matter and all phosphorus concentration data points and organic matter and phosphorus concentrations on a monthly basis.

2.1.3 Estimating Phosphorus Reductions using the P8 Model

Tetra Tech obtained sweeping route information from the University and applied the P8 model to the sweeping frequencies and routes for a 10 year period to capture varying precipitation conditions. The results of the modeling effort are detailed in full in a separate memorandum. This option is intended for permittees that do not collect data on their street sweeping materials.

2.2 CREATING THE STREET SWEEPING PHOSPHORUS REDUCTION CALCULATOR TOOL

A calculator tool (Tool) was developed using the MPCA selected crediting options. The user can input street sweeping data related to miles swept, roadway width, dry mass, wet mass, percent organic matter, and/or percent moisture to derive phosphorus reduction credits.

The minimum data requirements are either: dry or wet mass and sweeping season, or miles swept. If a user chooses to input miles swept, the reductions are significantly less than would be expected from the methods based on the amount of sweeper material collected.

After input of available street sweeping data, the Tool uses the equations summarized below and statistical methods developed by the University to estimate the amount of total phosphorus reduced due to the street sweeping effort.

Currently, the draft Tool calculates phosphorus concentrations based on formulas using the summary statistics mean, median, 25^{th} quartile, lower 95% confidence interval to produce multiple results for the same inputs. This is intended to provide MPCA with a load reduction comparison to aid in selecting a final set of default values for wet to dry mass conversion and phosphorus concentration in dry mass.

The relationship between seasonality and phosphorus was incorporated into the Tool. Based on the data from the University, there is a pronounced difference in both moisture content and phosphorus concentration depending on the season. The Tool is designed to represent two periods of street sweeping throughout the year, fall leaf collection and non-leaf collection. The default values for the non-leaf collection period were derived from data from March through September, and the values for the leaf collection period were derived from the data from October and November.

This distinction allows permittees the ability to report with greater accuracy whether leaf collection was a major component of sweeping, and also allows the flexibility to report leaf collection when it actually occurs, rather than being tied to a specific month, e.g., if leaf drop is early one year, the leaf collection values could be applied to September collections, or if leaf drop is late, the non-leaf collection values could be applied in October. In general, any street sweeping that occurs in December through July could be assumed to be part of a non-leaf collection period.

Because the Tool is fundamentally based on the amount of street swept and the amount of materials collected, it provides municipalities the flexibility to calculate reductions on an annual basis, or on other metrics, such as monthly, seasonally or by sweeper route or date of collection. This allows jurisdictions who choose to collect more advanced data on their sweeper program to evaluate the results at a finer scale and determine the crediting method that is advantageous to their program.

The equations and methods employed in the Tool are brought forward from the University documentation. The following section details the options for data input and underlying equations.

2.2.1 Option 1: Dry Mass Data

For this method, the amount of P removed from the sweeping event is equal to the dry mass multiplied by the P concentration. The P concentration is determined as function of the season the swept materials are collected (leaf collection, non-leaf collection season). P concentration values were derived from summary statistics (mean, median, 25^{th} quartile, and lower 95% CI) from the monthly values presented in the University paper. After reviewing the results, it is anticipated that MPCA will select one of the summary statistics to present in the final Tool.

For comparison, according to error analyses by the University, the mean values overpredicted P loads, resulting a mean error of 32.8%, the median values overpredicted P loads by 14.2% and the 25^{th} percentile underpredicted P loads by 17.4%. The lower 95% confidence interval value was not assessed for error statistics, but the values are between the lower 25th quartile and the median values. These error statistics are annualized and do not reflect the breakdown between the lead collection and non-lead collection seasons.

2.2.2 Option 2: Wet Mass Data

For this method, the amount of phosphorus removed from the sweeping event is calculated with inputs of the season (leaf collection, non-leaf collection), which determines the phosphorus concentration, and the wet mass which is converted to dry mass (Dry Mass = (Wet Mass x 100) / (%Moisture + 100)). If percent moisture is known, it may be used this equation, and if it is not known, it is approximated using the mean moisture content determined in the University data, by season (leaf collection, non-leaf collection). If percent organic matter is known, it may be used to approximate a more refined phosphorus Concentration based on a regression developed by the university: P Concentration = 0.044 + 0.0018 * % Organic Matter. The regression equation has a mean error of 8.5% and an R^2 value of 0.64 when the University data are used. Prior Lake was the only municipality to collect organic matter data, therefore this regression equation is derived entirely from Prior Lake sweeping events.

2.2.3 Option 3: Miles Swept Data

If only the miles swept is known but no mass data are collected, the Tool may still be used to approximate the phosphorus load reduced. The Tool uses an assumed roadway width of 32 feet unless otherwise specified. It should be noted that this Option is the least precise method as the actual dynamics associated with street sweeping may vary widely (e.g., the width of the street sweeper, the route, the time of year, the frequency of sweeping). The equation developed as part of the P8 analysis calculates the amount of P removed = Length of Road Swept * Road Width * P Removal Rate. In this equation, the P Removal Rate is determined based on statistical analysis of data from over 20 routes modeled across 4 different municipalities[6]. Summary statistics are presented for the P removal rate, and MPCA should select one option for the final Tool.

The P8 model used to calculate the phosphorus removal rate relied on MPCA recommended default values for particle fraction size distribution and total suspended solids concentrations and results in a substantially lower removal rate that the other methods. If a permittee has more specific data, the permittee may run P8 using local data and derive a custom phosphorus removal rate. However, this analysis is subject to MPCA review and approval.

2.3 EVALUATING THE PERFORMANCE OF THE CALCULATOR TOOL USING UNIVERSITY DATA

The Street Sweeper Tool was employed to calculate the differences between load results based on data type using data from the University. Specifically, the Tool was run for each combination of data type available using the Options within the Tool itself. For these calculations, the Leaf Collection season was assumed to be October-November and the Non-Leaf Collection season was assumed to be December-September. Based on the three Options of data available listed above, the following assumptions and notes were applied to these simulations using real data.

2.3.1 Option 1: Dry Mass Data

Phosphorus removal was calculated using inputs of season and dry mass by municipality per season per year. The parameter representing dry mass was “total_dry_solids_lbs” from the University dataset.

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[6] Job, S., A. Molloy, and J. Olson. 2020, April 23. Memo to Mike Trojan, MPCA. *P8 Street Sweeping Modeling*.

2.3.2 Option 2: Wet Mass Data

Phosphorus removal was calculated using different input combinations of season, wet mass, percent moisture, and percent organic matter by municipality per season per year. Parameters representing these terms were taken from the University dataset as follows: wet mass was "sweeping_pile_weight_lbs" which included trash and ideally would not for future Tool application, percent moisture was "total_moist_perc_drywt", and percent organic matter was "total_OM_perc". Shoreville wet mass data were not available, so it was excluded from the calculations of total phosphorus load removed when this variable was required.

Prior Lake was the only municipality with organic matter data and was therefore the only municipality where these data were applied.

2.3.3 Option 3: Miles Swept Data

Phosphorus removal was calculated using inputs of total miles swept by municipality per season per year. The parameter representing miles swept was "route_distance_mi" from the University dataset. A generic roadway width of 32 feet was assumed for all municipalities/routes.

Summaries of the results for each municipality by year and summary statistic are provided in the results spreadsheet.

2.4 COMPARISON OF RESULTS WITH REQUIRED TMDL LOAD REDUCTIONS

To test the results of the phosphorus reduction credit options, potential load reductions were calculated for assumed street swept areas of TMDL watersheds in Prior Lake. This allows a comparison between the TMDL load reductions and the estimated proportion of the reductions that might reasonably be assumed to come from street sweeping.

TMDLs that apply to areas of Prior Lake were identified: Spring Lake and Upper Prior Lake[7] Since the specific sweeping information within the TMDL watersheds is unknown, the reductions from the sweeping throughout the City of Prior Lake were applied proportionally based on seasonal unit area loading to all roadways within the TMDL areas. The baseline sweeping was assumed to be one sweeping event during the non-leaf collection season and one sweeping event during the fall leaf collection season. The load reductions are presented for an enhanced sweeping program where non-fall sweeping occurs monthly for March through September (7 passes) and fall leaf collection sweeping occurs weekly through October and November (8 passes). Since one non-leaf collection sweeping and one fall leaf collection sweeping are the baseline sweeping frequency, the reductions are based on 6 non-fall leaf collection passes and 7 fall leaf collection passes. The exception is 2012, where only non-leaf collection data were available, so fall leaf collection reductions are not calculated. Table 1 and Table 2 summarize these results.

<u>Spring Lake TMDL</u>

The existing phosphorus load to Spring Lake is 10,464 lbs/year, and the phosphorus load reduction to meet the TMDL is 8,640 lbs/year. Based on land cover data, there are 54 acres of roads in the watershed, which translates to 13.92 miles, assuming 32 ft road width. Phosphorus removal for a full year of enhanced sweeping, as described above ranged from 19.56 – 48.09 lbs/year using Options 1-2 or 0.59 – 0.97 lbs/year using Option 3. All options result in less than 0.6% of the load reduction needed.

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[7] Wenck and Associates. 2011. Spring Lake – Upper Prior Lake Nutrient TMDL. Prepared for the Prior Lake-Spring Lake Watershed District and Minnesota Pollution Control Agency. 141 pp. https://www.pca.state.mn.us/sites/default/files/wq-iw7-26e.pdf

Table 1. Summary of Potential Phosphorus reductions from the Tool Options to address the Spring Lake TMDL.

Crediting Option	Year	Season	Mean	Median	25% Quartile	Lower 95% CI
Option 1: Dry Mass	**2010**	Fall Leaf Collection	21.78	21.30	14.86	20.09
		Non-leaf Collection	6.84	6.34	4.70	6.12
		Total	**28.61**	**27.64**	**19.56**	**26.21**
	2011	Fall Leaf Collection	36.71	35.91	25.04	33.85
		Non-leaf Collection	11.38	10.55	7.82	10.19
		Total	**48.09**	**46.46**	**32.86**	**44.05**
	2012	Fall Leaf Collection	-	-	-	-
		Non-leaf Collection	8.93	8.28	6.14	8.00
		Total	**8.93**	**8.28**	**6.14**	**8.00**
Option 2a: Wet Mass	**2010**	Fall Leaf Collection	21.49	21.02	14.66	19.82
		Non-leaf Collection	9.33	8.65	6.41	8.36
		Total	**30.82**	**29.67**	**21.08**	**28.18**
	2011	Fall Leaf Collection	16.31	15.95	11.13	15.04
		Non-leaf Collection	11.37	10.54	7.82	10.19
		Total	**27.68**	**26.49**	**18.94**	**25.23**
	2012	Fall Leaf Collection	-	-	-	-
		Non-leaf Collection	9.03	8.37	6.20	8.09
		Total	**9.03**	**8.37**	**6.20**	**8.09**
Option 2b: Wet Mass, Moisture Content	**2010**	Fall Leaf Collection	20.62	20.17	14.07	19.02
		Non-leaf Collection	8.78	8.14	6.04	7.87
		Total	**29.40**	**28.31**	**20.10**	**26.89**
	2011	Fall Leaf Collection	19.34	18.92	13.20	17.84
		Non-leaf Collection	10.94	10.14	7.52	9.80
		Total	**30.28**	**29.06**	**20.72**	**27.64**
	2012	Fall Leaf Collection	-	-	-	-
		Non-leaf Collection	8.69	8.05	5.97	7.78
		Total	**8.69**	**8.05**	**5.97**	**7.78**
Option 2c: Wet Mass, %OM	**2010**	Fall Leaf Collection	22.89			
		Non-leaf Collection	12.36			
		Total	**35.25**			
	2011	Fall Leaf Collection	16.31			
		Non-leaf Collection	12.66			
		Total	**28.97**			

Crediting Option	Year	Season	Mean	Median	25% Quartile	Lower 95% CI
	2012	Fall Leaf Collection	-			
		Non-leaf Collection	9.78			
		Total	**9.78**			
Option 2d: Wet Mass, Moisture Content, %OM	**2010**	Fall Leaf Collection	21.98			
		Non-leaf Collection	11.58			
		Total	**33.56**			
	2011	Fall Leaf Collection	19.39			
		Non-leaf Collection	12.18			
		Total	**31.57**			
	2012	Fall Leaf Collection	-			
		Non-leaf Collection	9.42			
		Total	**9.42**			
Option 3: Miles Swept		Annual Total	0.97	0.84	0.59	0.91

<u>Upper Prior Lake TMDL Info:</u>

The existing phosphorus load to Upper Prior Lake is 5,216 lbs/year, and the phosphorus load reduction to meet the TMDL is 2,143 lbs/year. Based on land cover data, there are 261 acres of roads in the watershed, which translates to 67.29 miles, assuming 32 ft road width. Phosphorus removal for a full year of enhanced sweeping, as described above ranged from 91.55 – 232.42 lbs/year using Options 1-2 or 2.85 – 4.70 lbs/year using Option 3. At the high end of the reduction estimates, this represents approximately 10% of the load reduction needed and at the low end about 0.1% of the load reduction needed.

Table 2. Summary of Potential Phosphorus reductions from the Tool Options to address the Upper Prior Lake TMDL.

Crediting Option	Year	Season	Mean	Median	25% Quartile	Lower 95% CI
Option 1: Dry Mass	**2010**	Fall Leaf Collection	105.26	102.96	71.81	97.07
		Non-leaf Collection	33.04	30.63	22.71	29.60
		Total	**138.30**	**133.59**	**94.52**	**126.68**
	2011	Fall Leaf Collection	177.42	173.56	121.04	163.63
		Non-leaf Collection	55.00	50.98	37.80	49.27
		Total	**232.42**	**224.54**	**158.84**	**212.90**
	2012	Fall Leaf Collection	-	-	-	-
		Non-leaf Collection	43.17	40.02	29.67	38.67
		Total	**43.17**	**40.02**	**29.67**	**38.67**
Option 2a: Wet Mass	**2010**	Fall Leaf Collection	103.86	101.60	70.86	95.79
		Non-leaf Collection	45.11	41.82	31.00	40.42
		Total	**148.98**	**143.42**	**101.86**	**136.21**

Crediting Option	Year	Season	Mean	Median	25% Quartile	Lower 95% CI
	2011	Fall Leaf Collection	78.82	77.10	53.78	72.69
		Non-leaf Collection	54.96	50.95	37.77	49.24
		Total	**133.79**	**128.06**	**91.55**	**121.94**
	2012	Fall Leaf Collection	-	-	-	-
		Non-leaf Collection	43.64	40.45	29.99	39.09
		Total	**43.64**	**40.45**	**29.99**	**39.09**
Option 2b: Wet Mass, Moisture Content	**2010**	Fall Leaf Collection	99.66	97.49	67.99	91.91
		Non-leaf Collection	42.45	39.36	29.18	38.04
		Total	**142.12**	**136.85**	**97.17**	**129.95**
	2011	Fall Leaf Collection	93.48	91.45	63.78	86.22
		Non-leaf Collection	52.89	49.03	36.35	47.39
		Total	**146.38**	**140.48**	**100.13**	**133.60**
	2012	Fall Leaf Collection	-	-	-	-
		Non-leaf Collection	41.99	38.93	28.86	37.62
		Total	**41.99**	**38.93**	**28.86**	**37.62**
Option 2c: Wet Mass, %OM	**2010**	Fall Leaf Collection	110.67			
		Non-leaf Collection	59.64			
		Total	**170.31**			
	2011	Fall Leaf Collection	82.60			
		Non-leaf Collection	61.20			
		Total	**143.80**			
	2012	Fall Leaf Collection	-			
		Non-leaf Collection	47.28			
		Total	**47.28**			
Option 2d: Wet Mass, Moisture Content, %OM	**2010**	Fall Leaf Collection	106.19			
		Non-leaf Collection	56.10			
		Total	**162.29**			
	2011	Fall Leaf Collection	93.59			
		Non-leaf Collection	58.86			
		Total	**152.45**			
	2012	Fall Leaf Collection	-			
		Non-leaf Collection	45.48			
		Total	**45.48**			
Option 3: Miles Swept		Annual Total	4.70	4.11	2.85	4.41

The results comparing the TMDL load reductions to the reductions possible using the Tool show that an enhanced street sweeping program can make a contribution to overall phosphorus load reductions, but crediting is not so high as to discourage other phosphorus reduction practices. In both case studies, the reductions are limited to about 10% or less of the required reductions for all crediting options.

2.5 NEXT STEPS

The spreadsheet calculator described above provides load reduction calculations using several summary statistics options (mean, median, 25th percentile, etc.) for nutrient and moisture to allow MPCA to compare the results and understand the impacts of using each of the summary statistics. MPCA should consider which summary statistics may be the most appropriate to use in the final crediting methodology and whether any additional uncertainty factors should be applied. The calculator Tool can then be updated to provide only the phosphorus load reduction results based on the selected summary statistic values.

The technical team has yet to review the approach and results. The technical team should be briefed on the proposed crediting approaches detailed in the calculator Tool. Updates to the calculator Tool can be made based on feedback from the technical team.

The University has committed to developing standard operating procedures (SOPs) for sample collection and processing, so municipalities have guidance on how to accurately develop the data needed to use the street sweeping credit calculator Tool. Additionally, MPCA should determine how frequently these data must be collected by permittees to allow for use in the model.

Following completion of the SOPs, Tetra Tech can create a crediting calculator Tool user guide to provide instructions to the municipalities in how to use the Tool, select the most appropriate crediting method, and collect the appropriate data in accordance with the SOPs. An outreach plan will also be developed for the street sweeping credit methodology to educate MS4 permittees on the availability of the new credit and how to use the calculator Tool.

Minimal Impact Design Standards (MIDS) is currently undergoing an update. Once complete, Tetra Tech will explore how the street sweeping calculator Tool can be incorporated into MIDS.