



Lake St. Croix Total Maximum Daily Load

Total Phosphorus Analysis for the City of River Falls and UW-River Falls

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Description of the Lake St. Croix Total Maximum Daily Load (TMDL)

The St. Croix River and Lake St. Croix are highly valued resources that sustain diverse ecological species and provide exceptional opportunities for recreation. In fact, the river is one of just 32 rivers in the country that is designated as a National Park – The St. Croix National Scenic Riverway. The City of River Falls lies within the watershed of the St. Croix River and the Kinnickinnic River is a tributary to Lake St. Croix, a riverine impoundment in the lower 25 miles of the St. Croix River. See Figure 1.

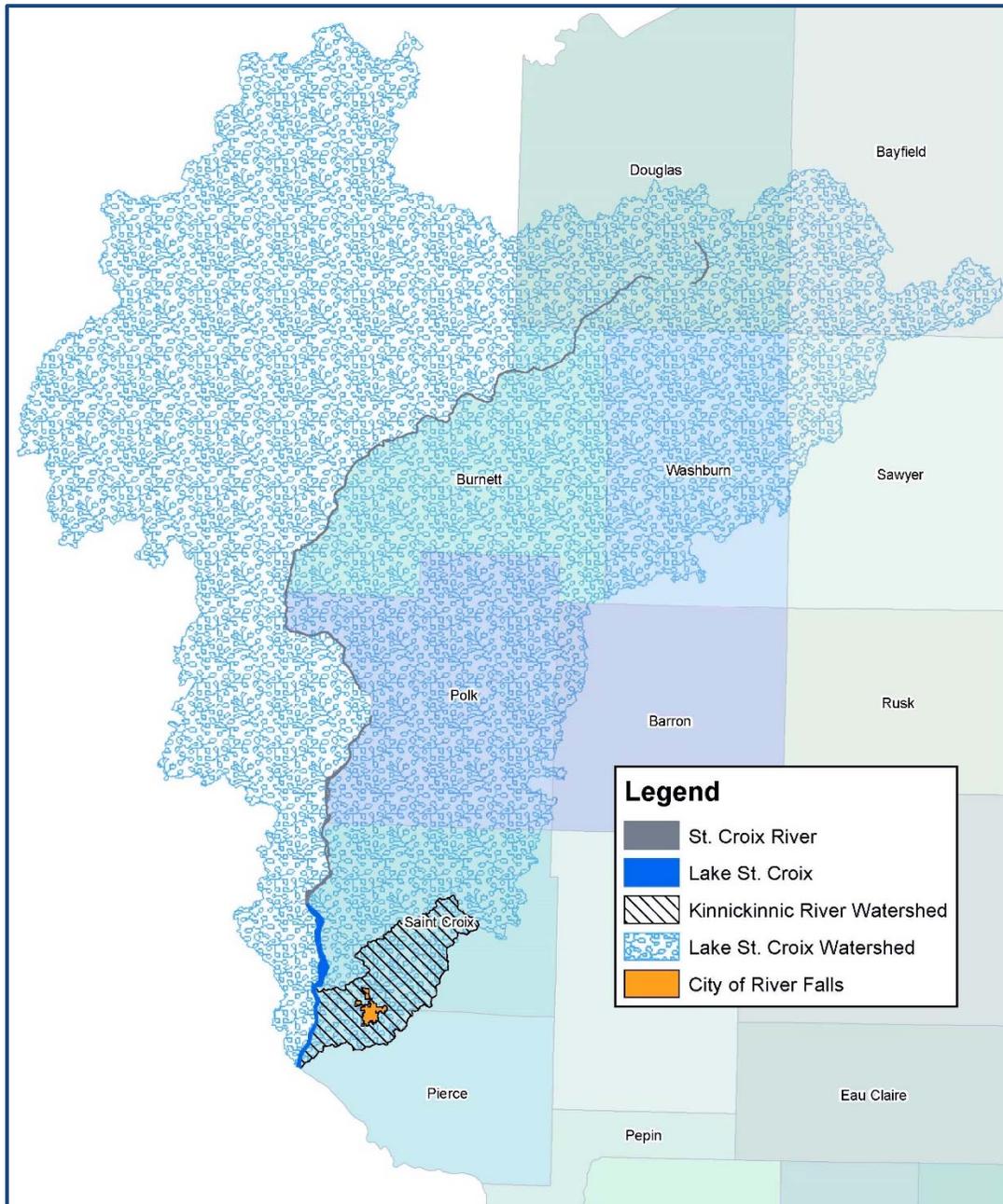


Figure 1 – Lake St. Croix Watershed

Recognizing that increased development and urbanization will have negative impacts to the waterway, various protections have been implemented over the last 5 decades, beginning with inclusion in the National Wild and Scenic Rivers Act of 1968. More recently, in May 2012, the Minnesota Pollution Control Agency and Wisconsin Department of Natural Resources published 'Lake St. Croix Nutrient Total Maximum Daily Load'. This important document set the stage for stakeholders in the watershed to implement strategies that will reduce the total phosphorus carried into the system. The document, along with its implementation plan, prescribes waste load allocations and total phosphorus reduction targets for regulated discharges within the watershed such as municipal storm water discharges and waste water treatment facilities.

Timeline

- **1968** – Upper St. Croix River (including the Namekagon River) is included in the National Wild and Scenic Rivers Act.
- **1972** – Lower St. Croix National Scenic Riverway added to the National Wild and Scenic Rivers Act.
- **1972-2000** – Clean Water Act and subsequent updates to it. One of the provisions of the Clean Water Act requires states to identify water bodies that do not meet state water quality standards and designated uses and place them on the US Environmental Protection Agency impaired waters list which is referred to as the 303(d) List.
- **2008** – Lake St. Croix is listed on the Minnesota and Wisconsin 303(d) Impaired Waters List due to eutrophication (excess phosphorus). Once listed, the states are required to quantify the amount of a specific pollutant that the water body can receive without violating water quality standards and apportion that load among the sources of the pollutant. This is referred to as the Total Maximum Daily Load or TMDL.
- **May 2012** – Lake St. Croix Nutrient Total Maximum Daily Load was published jointly by the Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources. (<http://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=73903197>)
- **August 2012** – EPA Approval letter of Lake St. Croix Nutrient Total Maximum Daily Load with decision document (<http://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=73903536>)
- **October 2012** (revised February 2013) – Implementation Plan for the Lake St. Croix Nutrient Total Maximum Daily Load (http://dnr.wi.gov/topic/nonpoint/documents/9kep/St_Croix_River_Basin-Plan.pdf)
- **May 2014** – Effective Date of Current Municipal Separate Storm Sewer System (MS4) Permit for the City of River Falls and UW-River Falls. This permit cycle requires reporting on TMDLs for MS4 permittees whose storm sewer system lies within a TMDL.
- **October 2014** – TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance by WDNR (<http://dnr.wi.gov/news/input/documents/guidance/ms4guidancefinal.pdf>)

- **February 2016** – TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance Addendum A (Percent Reduction) by WDNR (<http://dnr.wi.gov/news/input/documents/guidance/MS4PercentReductionGuidanceFinal.pdf>)
- **March 2018** – Wisconsin DNR requires that MS4s which fall under a TMDL that was approved prior to May 2014 provide a Tabular Summary and Written Report detailing the MS4's compliance with the TMDL Implementation Plan.

Requirements for City of River Falls & UW-River Falls

The City of River Falls is wholly contained within the Lake St. Croix TMDL Watershed. All areas within the municipal boundary drain to the Kinnickinnic River and eventually to Lake St. Croix. Additionally, the UW-River Falls campus is wholly contained within the City's municipal boundary. The City and University have entered into an intergovernmental agreement which calls for the City to provide storm water management and assistance with MS4 compliance in exchange for a storm water utility fee. The City and the University storm water BMPs have been combined to meet the TMDL requirements for the University, which are more stringent than those for the City.

The Lake St. Croix TMDL published in May 2012 establishes a "baseline" condition of Total Phosphorus (TP) export as that which was exported in the 1990s. The TMDL reports that the City of River Falls MS4 was releasing TP at a rate of 1429 lb/year for its baseline (1990s) condition. The TMDL sets a TP export goal for the City of 908 lb/year which is a reduction of 36%.

The TMDL reports that the University of River Falls MS4 was releasing TP at a rate of 142 lb/year for its baseline (1990s) condition. The TMDL sets a TP export goal for UW-RF of 90 lb/year which is a reduction of 37%.

In October 2014, the Wisconsin DNR released a modeling guidance document that addressed how to tie pollutant loading models to the city-wide total suspended solids (TSS) models for MS4 communities under a TMDL. This document clarified how to deal with the "baseline" condition being spread over the decade of the 1990s which has no significance in the city-wide TSS model. (The city-wide TSS model only shows TSS loading under no controls and under the controls that were present at the time the model was originally run, 2007.)

The modeling guidance document provides a formula to adapt the 1990s “baseline” condition to the “no controls” condition used in the city-wide TSS model back in 2007. This formula converts the TP removal percentages from baseline (1990s) to removal percentages from a “no controls” condition by increasing the TP percent removal required. The formula to use for the Lake St. Croix TMDL (since it was approved after Jan 1, 2012) is:

$$\text{TP \% Reduction (no controls)} = 15 + (0.85 * \% \text{ control from baseline in TMDL})$$

Applying this formula to the percentage reductions as reported in the TMDL, the City is subject to 45.6% reduction of TP from the no-controls condition and the UW is subject to 46.5% reduction from the no-controls condition. In following the intragovernmental agreement that is in place between the City and UW-River Falls, we will set the TP % reduction goal to **47%** from no-controls.

Once an adequate level of TMDL implementation has been achieved, ambient monitoring can be used to judge progress and monitoring will ultimately be needed to de-list impaired waters and show compliance with the TMDL.

Discussion of Modeling

The following approach was taken to develop the TP reduction model for the City of River Falls:

1. Pull data from 2007 City-wide TSS model. Verify land use categories and use GIS data to collect statistics from each land use.
2. Use the land use statistics to model the amount of TSS and TP generated by each land use in the City. Note that TSS data was collected only because it was readily available. The City of River Falls already meets TSS removal requirements of the MS4 permit. WinSLAMM version 10.2.1 was used for these calculations. This model is referred to as the ‘No-Controls’ scenario.
3. Identify storm water best management practices (BMPs) which provide removal of TP and delineate the watershed for each practice.
4. Calculate totals of each land use category within each BMP’s watershed.
5. Determine how each BMP functions. Use storm water reports, construction, and record drawings from development projects, field data, St. Croix County 2015 LiDAR contours, and other available resources.
6. Use WinSLAMM to determine the pounds of TSS and TP that are removed from the City by the BMPs on an average annual basis. The TMDL allocation goal is to remove 47% of the TP generated by the City annually. These models are referred to as ‘With-Controls’.

The City-wide model included 4,173 acres of various urban land uses as described in Table 1. In the ‘no-controls’ scenario, the TP yield from the City is 3,084 pounds annually. **In order to meet the TMDL, City BMPs must remove 1,449 pounds (47%) of TP on an annual basis.**

Table 1: City of River Falls Urban Land Use Classifications		
Land Use	Acreage	TP Generated Annually
Commercial Land Use ¹	187 Acres	198.1 Pounds
Highway Land Use ¹	160 Acres	117.5 Pounds
Industrial Land Use ¹	324 Acres	315.3 Pounds
Institutional Land Use ¹	473 Acres	499.0 Pounds
Other Urban Land Use ¹	1,351 Acres	514.2 Pounds
Residential Land Use ¹	1,677 Acres	1,440.1 Pounds
Totals	4,173 Acres	3,084 Pounds

¹WinSLAMM provides guidance on using the urban land use classifications in this document: <http://www.winslamm.com/docs/Standard%20Land%20Use%20and%20Parameter%20file%20descriptions%20final%20April%2018%202011.pdf>

Approximately 200 BMPs were modeled in 82 separate WinSLAMM models. Due to complexities associated with routing and sequence of BMPs, some of the WinSLAMM models contain only one BMP while other models encompass several subwatersheds and several BMPs. Modeling of BMPs continued until the City reached the goal of 47% TP reduction. **It’s important to note that there are several storm water BMPs in practice in the City that are not included in the modeling.**

Modeling Results

The results of the modeling show that City BMPs remove 1,462 pounds of TP annually. This surpasses the load allocation standards of the TMDL which require removal of 47% or 1,449 pounds of TP. **The existing storm water BMPs in practice in the City provide adequate TP reduction to meet the Lake St. Croix TMDL.**

The DNR requires that the modeling be reported in a tabular format. Appendix A contains the table of results from the WinSLAMM modeling. Appendix B contains mapping that shows modeling results from sub watersheds within the City.

Assumptions

The most recent annexation to the City of River Falls, Mann Valley, was not included in this model. There are several reasons for excluding this area from the model. First, the annexation area is primarily agriculture or undeveloped woodland. It is zoned as agriculture. The WinSLAMM model is designed for urban runoff and would likely not accurately represent TP in rural/agricultural runoff. Secondly, new development within this annexation area will be subject to the City's current storm water ordinance which calls for 85% TSS removal, among other storm water controls. Though not a direct correlation between TSS and TP, TP removal on new development far exceeds the 47% required by the TMDL. After complying with water quality and infiltration standards, most new development achieves nearly 100% TP removal. Thirdly, the runoff from this area is not directly connected to the MS4 boundary. Runoff discharges from this annexation and runs in a channel for more than 2 miles prior to draining back into the MS4 boundary, and an additional 800 feet into the Lower Kinnickinnic River, below Lake Louise.

Several areas that are modeled to receive treatment by BMPs are currently not within City limits. These areas are not included in the No-Controls model because the TP discharged from these areas is not generated by or within the City of River Falls MS4 area however that TP is removed by storm water BMPs that are maintained by the City of River Falls.

Conclusion

The Kinnickinnic River, through the heart of River Falls, is highly valued for its recreational uses and aesthetic beauty. The City of River Falls has been a leader in storm water management due its continual support of the many surface water protection measures that have been put in place throughout the years to protect this invaluable resource. **Because of those measures, the City's municipal separate storm sewer system meets the Lake St. Croix TMDL waste load allocations** without having to modify or construct additional storm water facilities.

The continual maintenance of existing BMPs is crucial to maintaining the health of the Kinnickinnic River and, in turn, Lake St. Croix. That maintenance will be accomplished by the owners of those BMPs, the Wisconsin DOT, UW-River Falls, and the City of River Falls through access easements, long-term maintenance agreements, and intergovernmental agreements. The City will also continue to enforce its storm water ordinances to new and re-development projects, ensuring continual improvement to phosphorus reduction efforts in Lake St. Croix.

Appendix A

Tabular Summary of Results



Lake St. Croix Total Maximum Daily Load
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January 23, 2018

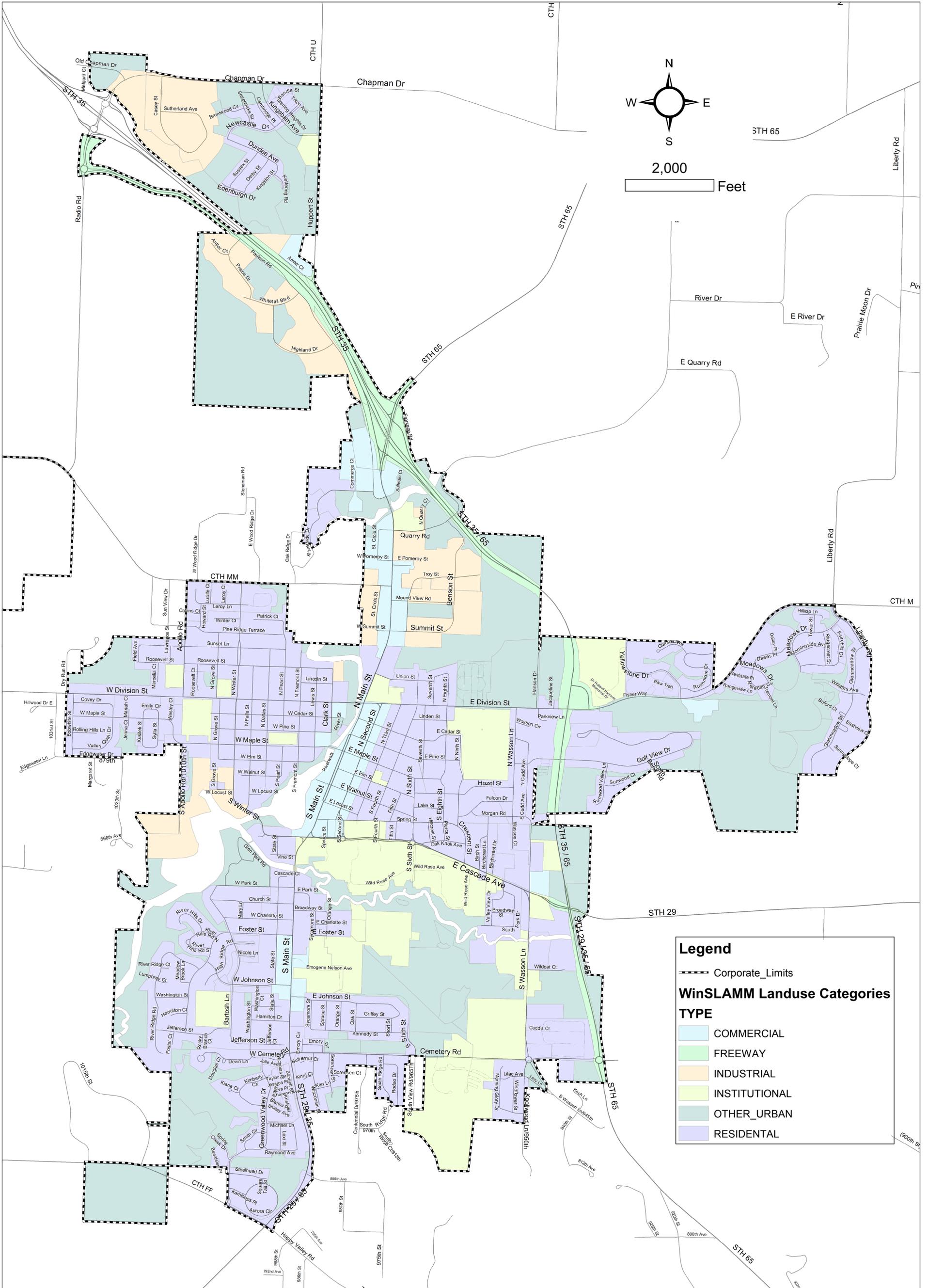
Drainage Area Name	Description of BMP(s)	City Outfall Number	Outfall Description	Pounds of TSS Removed Annually	Pounds of TP Removed Annually	BMP Ownership	Is there a Maintenance Agreement for the BMP
Ames	Grass Swales, Biofilters		Surface Discharge Near Outfall 036	6440.4	19.5	Private	Y
Ball Field	Biofilter	050	Surface Discharge to Greenwood Detention Basin	847.9	3.9	Private	Y
Best Maid N	Biofilter	044	Discharge to Benson St Storm Sewer	1462.1	2.7	Private	Y
Best Maid SE	Wet Pond, Biofilter	044	Discharge to Troy St Storm Sewer	1592.0	9.2	Private	Y
Best Maid W	Grass Swale	044	Discharge to Troy St Storm Sewer	1598.4	2.8	Private	Y
Boulder Ridge C,D,F	Wet Ponds	050	Discharge to Yellowstone Drive Storm Sewer	8904.0	22.9	Public	N/A
Campusview Central	Biofilter		Surface Discharge to South Fork near Outfall 034	259.0	0.9	Private	Y
Campusview East	Biofilter		Surface Discharge to South Fork near Outfall 034	272.3	0.9	Private	Y
Centennial Way	Biofilter	056	Surface Discharge to Sorenson Court Swale	522.7	2.0	Public	N/A
City Hall	Grass Swales, Biofilters	009	Discharge to City Hall Storm Sewer	498.3	1.1	Public	N/A
Collinswood PUD	Biofilters		Surface Discharge to Kinnickinnic near Outfall 042	2876.0	11.3	Private - Public	N-N/A
Collinswood Swale	Grass Swale	042	Grassed Swale over Rugo Property	14766.0	48.4	Private	Y
Desanctis	Grass Swale, Biofilter		Surface Discharge west of City near Dry Run Road	16427.0	78.0	Public	N/A
Downtown with Sweeping	Street Cleaning	023, 019, 020, 021, 011, 008, 007, 006, 004	Several Outfalls along Kinni and Lake George	8696.0	13.6	Public	N/A
Ecovillage	Biofilters	081	Discharge to Dry Detention then Outfall 081	507.6	1.7	Private	Y
Falcon Center	Wet Ponds, Grass Swales		Surface Discharge to South Fork near Outfall 078	15013.0	38.7	Private	Y
Falcon Center East Swale System	Grass Swale, Wet Pond		Surface Discharge to South Fork near Outfall 078	7308.8	19.9	Private	Y
Falcon Drive Swale	Grass Swale	050	Surface Discharge to Unnamed Tributary through City	1751.3	6.3	Private	Y
Foley United	Biofilter	052	Surface Discharge to Industrial Park pond	1345.2	2.3	Private	N
Foster Bartosh Swale	Grass Swale	040	Discharge to Storm Sewer to Kinnickinnic	4165.0	9.9	Public	N/A
Greenwood Infiltration	Biofilter	050	Surface Discharge to Unnamed Tributary through City	548.3	1.6	Private	Y
Greenwood Swale	Grass Swale	050	Surface Discharge to Unnamed Tributary through City	8769.0	26.9	Public	N/A
HighView A	Wet Pond, Biofilter	050	Surface Discharge to Unnamed Tributary through City	4935.0	17.1	Public	N/A
Highway Ditch 1	Grass Swale		Surface Discharge to Unnamed Tributary through Sterling Ponds	1896.8	10.0	DOT	N/A
Highway Ditch 2	Grass Swale		Surface Discharge to Interchange Ponds	1194.3	5.8	DOT	N/A
Highway Ditch 3	Grass Swale, Biofilter		Surface Discharge to Interchange Ponds	4942.0	17.3	DOT	N/A
Highway Ditch 4	Grass Swale		Surface Discharge to Interchange Ponds	1117.0	5.7	DOT	N/A
Highway Ditch 5	Grass Swale, Biofilter		Surface Discharge to Interchange Ponds	3247.0	11.6	DOT	N/A
Highway Ditch 6	Grass Swale, Biofilter		Surface Discharge to Interchange Ponds	571.5	2.8	DOT	N/A
Highway Ditch 7	Grass Swale, Biofilter		Surface Discharge to Interchange Ponds	518.1	2.2	DOT	N/A
Highway Ditch 8	Grass Swale		Surface Discharge to Interchange Ponds	265.4	1.4	DOT	N/A
Highway Ditch 9	Grass Swale		Surface Discharge to Kinnickinnic near Outfall 027	153.2	0.7	DOT	N/A
Highway Ditch 10	Grass Swale		Surface Discharge to Kinnickinnic near Outfall 028	356.7	1.8	DOT	N/A
Highway Ditch 11	Grass Swale	050	Surface Discharge to Unnamed Tributary through City	1156.4	4.8	DOT	N/A
Highway Ditch 12	Grass Swale		Surface Discharge to South Fork	2392.7	12.5	DOT	N/A
Highway Ditch 13	Grass Swale		Surface Discharge to South Fork	533.7	2.0	DOT	N/A
Highway Ditch 14	Grass Swale		Surface Discharge to South Fork	233.1	1.1	DOT	N/A
Highway Ditch 15	Grass Swale		Surface Discharge to South Fork near Outfall 076	1740.6	6.3	DOT	N/A
Hamilton Rocky Devin	Wet Ponds, Biofilter	064	Discharge to Rocky Run	12832.0	40.3	Public	N/A
High School & Hockey & Other	Wet Ponds, Grass Swales		Discharge to South Fork	43923.0	134.7	Private - Public	N-N/A
Hospital	Biofilter, Wet Pond, Grass Swale	050	Surface Discharge to Unnamed Tributary through City	8917.0	22.7	Private	Y
Industrial Park	Grass Swales, Biofilter	044	Discharge to Quarry Rd Storm Sewer	15199.0	44.9	Public	N/A
Knollwood	Wet Pond, Biofilter		Discharge to South Fork	6432.0	21.7	Public	N/A
Kwik Trip North	Biofilters, Wet Pond	044	Discharge to Quarry Rd Storm Sewer	3327.0	5.8	Private	Y
Kwik Trip South	Wet Pond	040	Discharge to North Main Street Storm Sewer	1061.8	2.0	Private	Y
Parkview Place	Biofilter	050	Discharge to Unnamed Tributary through City	814.9	3.0	Public	N/A
Paulson Road-McDonalds	Wet Pond	065	Discharge to Kinnickinnic	2458.0	4.8	Public	N/A
Public Works	Biofilter	052	Discharge to Benson St Storm Sewer	3463.0	6.2	Public	N/A
Quail Ridge South	Biofilter		Surface Discharge West of City	310.6	1.2	Public	N/A
Quail Ridge	Wet Pond, Grass Swale	063	Surface Discharge West of City	4138.0	12.0	Public	N/A
River Oaks	Wet Pond, Grass Swale	041	Surface Discharge to Kinni	11874.0	45.4	Public	N/A
Riverside Drive	Wet Pond	046	Surface Discharge to Kinni	2724.0	7.0	Public	N/A
Rolling Hills N.	Wet Pond	068	Discharge to West Side Storm Sewer	1413.0	3.8	Public	N/A
Rolling Hills S.	Biofilter		Surface Discharge West of City	1554.3	5.8	Public	N/A
Royal Oaks Overall	Wet Ponds, Biofilter		Surface Discharge East of City	21682.0	92.7	Public	N/A
Sawdust City	Grass Swale, Biofilter	075	Discharge to Cascade Avenue Storm Sewer	397.2	1.3	Private	Y
ShopKo	Biofilters		Discharge to Highway Ditch 3	7373.3	23.2	Private	N
Soccer Fields	Grass Swales, Biofilter	050	Discharge to Unnamed Tributary through City	23027.0	99.8	Public	N/A
South Ridge Ranch N	Wet Pond		Discharge to Cemetery Rd Storm Sewer	1692.9	4.8	Public	N/A
South Ridge Ranch S.	Wet Pond	056	Surface Discharge to Sorenson Court Swale	763.5	2.1	Public	N/A
Spring Creek 1-3-1	Wet Ponds, Biofilter	057	Surface Discharge to Rocky Run	8319.5	32.3	Public	N/A
Spring Creek C-C1	Biofilter, Wet Pond	056	Surface Discharge to Rocky Run	15280.0	52.5	Public	N/A
Spring Creek 4	Wet Pond	055	Surface Discharge to Rocky Run	3307.0	8.6	Public	N/A
Spring Creek 8	Wet Pond, Biofilter	060	Surface Discharge South of City	4946.1	18.2	Public	N/A
Spring Creek 9	Biofilter		Surface Discharge to Rocky Run	522.5	2.0	Public	N/A
Sterling Corp A	Wet Pond, Biofilter	073	Surface Discharge to Unnamed Tributary through Sterling Ponds	29895.5	54.9	Public	N/A
Sterling Corp B	Wet Pond, Biofilter	084	Surface Discharge to Unnamed Tributary through Sterling Ponds	5042.3	8.9	Public	N/A
Sterling Corp C-D	Wet Ponds, Biofilter	082	Surface Discharge to Unnamed Tributary through Sterling Ponds	7615.0	25.0	Public	N/A
Sterling Ponds A	Wet Pond, Biofilter	072	Surface Discharge to Unnamed Tributary through Sterling Ponds	7109.3	31.6	Public	N/A
Sterling Ponds F	Wet Pond, Biofilter	070	Surface Discharge to Unnamed Tributary through Sterling Ponds	2063.0	9.3	Public	N/A
Sterling Ponds G-G1	Wet Ponds, Biofilter	071	Surface Discharge to Unnamed Tributary through Sterling Ponds	5658.0	23.1	Public	N/A
Sterling Ponds H	Wet Pond, Biofilter	085	Surface Discharge to Unnamed Tributary through Sterling Ponds	2115.0	6.3	Public	N/A
Super 8-Westconsin	Biofilters	069	Surface Discharge to Kinnickinnic	4463.2	9.3	Private - Private	Y - N
Tremont	Wet Pond, Biofilters, Grass Swale	050	Discharge to Storm Sewer along Division and into Boulder Ridge	5583.6	20.4	Private	
University Center	Grass Swale, Wet Ponds		Surface Discharge to South Fork near Outfall 050	1637.3	4.1	Private	Y
University Falls	Biofilters, Pervious Pavement	013	Storm Sewer discharge to Lake George	366.0	1.4	Private	Y
Walgreens	Biofilter	052	Discharge to St. Croix Street storm sewer	878.9	1.8	Private	Y
Wasson Swale	Grass Swale	050	Surface Discharge to Unnamed Tributary through City	1563.4	4.9	Public	N/A
Wasson Trail	Grass Swale, Biofilter	075	Surface Discharge to South Fork	675.9	2.1	Public	N/A
W Division Swale	Grass Swale		Surface Discharge to CTH M ditch	1067.4	4.1	Public	N/A
Whitetail Ridge N.	Biofilter		Discharge to Highway Ditch 3	19643.0	47.5	Public	N/A
Whitetail Ridge S.	Biofilters		Discharge to Highway Ditch 3	29743.0	81.3	Public	N/A
Total Pounds Removed				462696.2	1462.4		
% of Total City Discharge				49.2%	47.4%		

Appendix B

Mapped Results



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Appendix B1
WinSLAMM Landuse Categories



