Watershed Analysis for Sugar Lake

Wright County, MN

September 2017

Prepared By

Wright SWCD

Executive Summary

The purpose of this watershed assessment is to identify the most effective locations for water quality improvement projects within the Sugar Lake watershed. The project area is based on the drainage area to Sugar Lake. It is located in northwest Wright County and encompasses portions of Clearwater, Silver Creek, and Corinna Townships (Figure 1). The goal of this assessment is to improve the quality of water entering Sugar Lake by reducing total suspended solids and total phosphorous through construction of best management practices (BMPs).

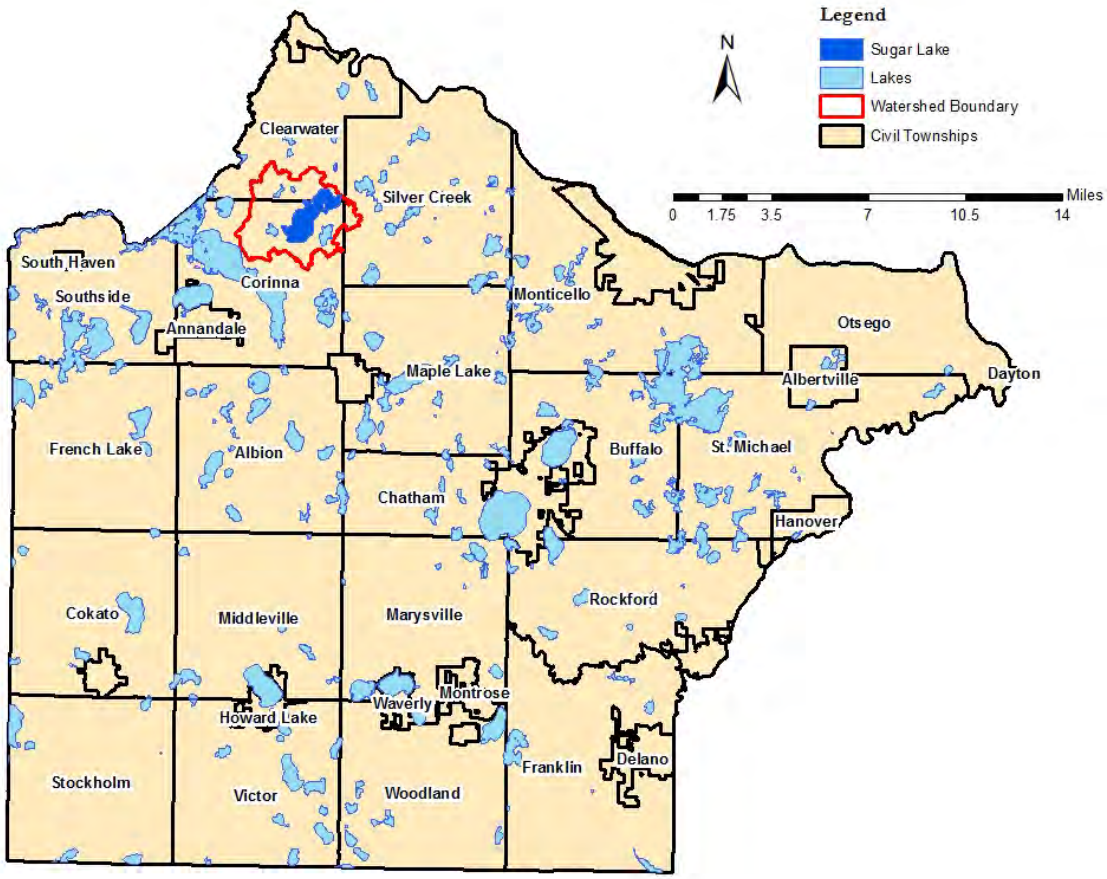

Figure 1. The project area is located in northern Wright County including Silver Creek, Corinna and Clearwater Townships

The assessment used a computer model, developed by Houston Engineering Inc., called Prioritize, Target and Map Application (PTMApp). It uses geospatial information to identify locations where BMPs will likely be most cost effective and provide efficient removal of contaminants. Field review of suggested locations by experienced staff is still required as the data the program uses to identify locations may have changed since collected and the value of on- site judgment is indispensable

The pollutant reduction estimates may be used to prioritize practices within the Sugar Lake Watershed and for grant applications but in no case should this data be used to represent actual pollutant removal until after installation is complete and site-specific monitoring data is available.

PTMApp identified 959 potential BMPs within the Sugar Lake Watershed. Each of these is broken up into one of six treatment groups. There were 74 filtration BMPs, 20 biofiltration BMPs, 12 infiltration BMPs, 283 protection BMPs, 304 source reduction BMPs and 266 storage BMPs. Based on PTMApp output data and field work by Wright Soil and Water Conservation District (SWCD) staff 16 practices were chosen to further investigate and prioritize for possible installation. Of these 16 practices 6 are filtration, 5 are storage and 5 are source reduction.

In general, we found some common patterns in how the computer generated BMPs would differ from a BMP assessment made by Wright SWCD staff. These differences are noteworthy inasmuch as it would change PTMApp outputs for loads and reductions. Filtration BMPs when reviewed on an aerial photo seemed to be more accurate in a location for grassed waterways as opposed to filter strip/buffer locations. Situations in which a filter strip/buffer would be most appropriate didn't match flow lines and tended to be square in design. Grassed waterway BMPs seemed to be designed smaller than they would actually be installed. Storage BMP sizes were overestimated and shapes seemed impractical for actual installation. Source reduction BMPs were close in some cases but PTMApp divides them up by catchment rather than field or parcel. In such cases the source reduction area may be either overestimated or underestimated. We did not assess such tendencies for infiltration, biofiltration or protection practices since we didn't select any for further analysis.

The selected BMPs were prioritized based on the total sediment and total phosphorus load from its field size catchment, the estimated reduction in total sediment and total phosphorus per year, the potential contaminant reduction to occur in a downstream lake and a slight preference of structural BMPs over management BMPs (Table 1

Table 1. Priority ranking system for select BMPs in the Sugar Lake Watershed

Rank	Feature ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)	Estimated Project Cost
1	S2	Control Basin	5.41	31.65	4.43	$69,575
2	S4	Control Basin	3.22	5.87	1.39	$13,591
3	S3	Control Basin	1.42	3.81	0.53	$10,126
4	F6	Grassed Waterway	0.60	5.34	N/a	$100.80 or $2,813.60
5	SR5	Management	40.18	17.46	2.60	$1,405.30-$2,812.60
6	SR4	Management	43.51	14.02	2.88	$1,522.82-$3,045.70
7	S1	Control Basin	0.51	2.72	0.51	$10,148
8	F4	Filter Strip	1.25	19.68	N/a	$210.00 or $1,263.75
9	S5	Control Basin	2.31	0.94	0.24	$17,435
10	SR1	Management	22.31	6.12	1.41	$781.90-$1,561.70
11	SR3	Management	8.58	4.47	0.41	$300.30-$600.60
12	SR2	Management	5.33	4.01	0.36	$186.55-$373.10
13	F5	Grassed Waterway	0.52	1.67	N/a	$87.36 or $1,495.61
14	F1	Filter Strip	0.48	1.79	N/a	$80.68 or $485.28
15	F3	Filter Strip	0.33	0.61	N/a	$55.44 or $333.63
16	F2	Grassed Waterway	0.47	0.68	N/a	$78.96 or $2,417.80

Table of Contents

Introduction

The watershed analysis of Sugar Lake was performed to identify suitable locations for best management practices (BMPs) that will most effectively remove contaminants and be the most cost effective. The analysis includes an estimation of the water quality benefits that could result from the potential projects. The analysis was completed using Prioritize, Target and Measure Application (PTMApp) Desktop.

PTMApp was chosen as the model for this analysis because it is designed for rural settings, innovative and preferred by the Board of Water and Soil Resources. The sources of sediment, nitrogen and phosphorus leaving the landscape are identified. Specific fields are targeted as potential locations for BMPs. Finally the benefits of implementing the BMPs are calculated as a reduction in the nutrient or sediment loading reaching the outlet of the watershed.

The BMPs that result from PTMApp are intended to help protect the water quality of Sugar Lake and provide measurable progress towards the Clearwater Total Maximum Daily Load efforts. The resulting targeted BMPs are appropriate for funding in accordance with the Minnesota Nonpoint Priority Funding Plan and statewide nutrient reduction strategies. The data and information from this report will be used by the Wright SWCD and local partners to implement accountable projects and practices that improve water quality within the Sugar Lake watershed.

Study Area

This watershed analysis was based on the land area that contributes water to Sugar Lake (Figure 2). The project area is located in northwest Wright County and encompasses portions of Clearwater, Silver Creek, and Corinna Townships (Figure 1). The Sugar Lake Watershed encompasses 6,540 acres, including Sugar Lake (991 acres), Indian Lake (140 acres), Sandy Lake (107 acres) and several small unnamed lakes. The Sugar Lake watershed is a headwater portion of the 12-digit Hydrologic Unit Code called Silver Creek (070102030603). The outlet to Sugar Lake is an unnamed stream that flows through several other lakes before it becomes Silver Creek, a tributary to the Mississippi River. Water enters Sugar Lake through surface runoff and/or groundwater.

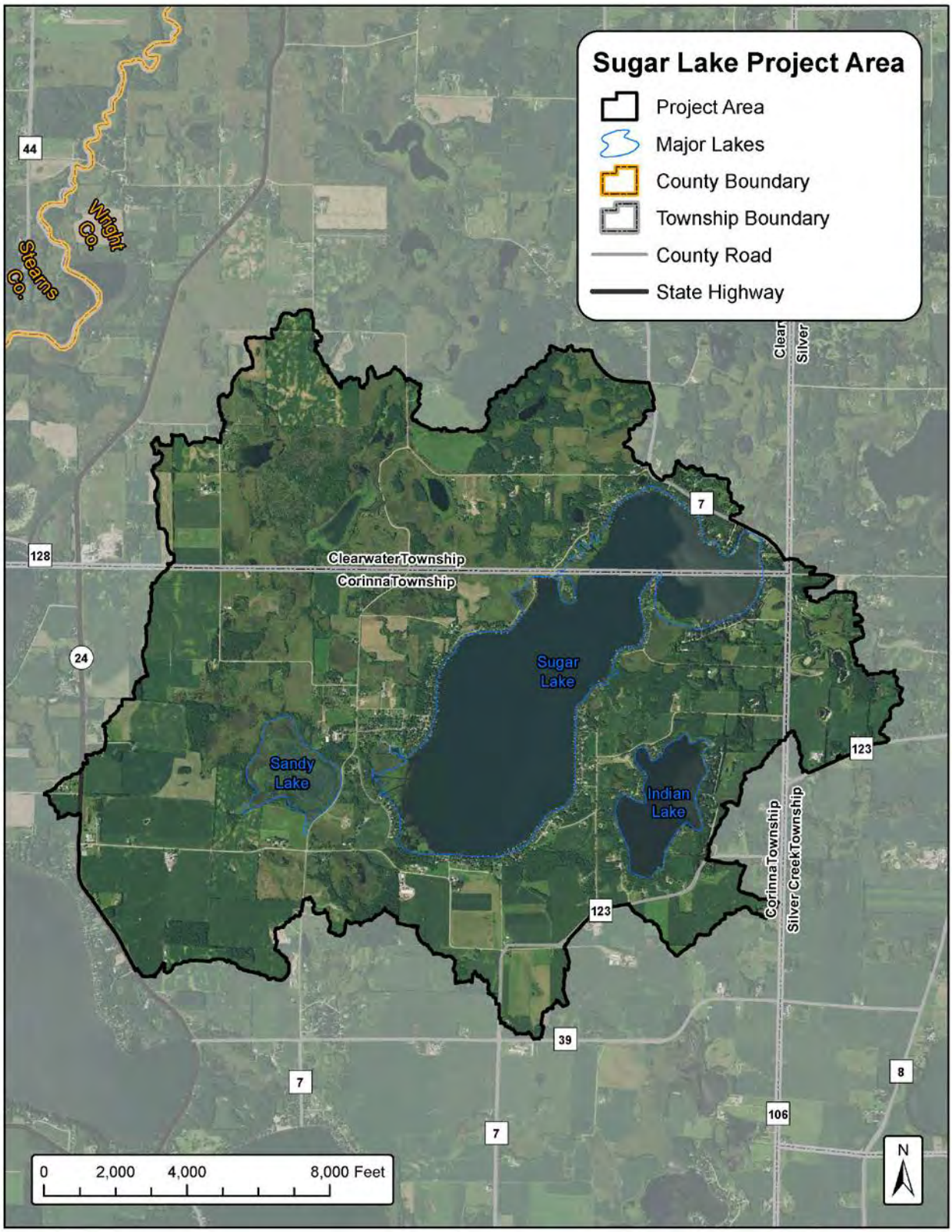

Figure 2. The area that drains to Sugar Lake (outlined in black) and the lakes within the watershed.

There are a variety of land uses in the Sugar Lake watershed (Table 1). Just over a fifth of the land area is covered by the lakes. According to the National Land Cover Database (Homer et al., 2011) approximately forty percent of the watershed area is either cultivated crops or hay/pasture. Other covers include forest (13.8%), scrubland (2.2%) and herbaceous cover (6.9%). Only about six percent of the land area is developed. According to the 2016 Wright County parcel data there are 1,016 parcels in the watershed and 307 lakeshore properties on Sugar Lake. Approximately one third of the homes on the lake are used year-round.

Table 2. Land cover within the Sugar Lake Watershed according to the 2011 National Land Cover Dataset

Land Cover	Area (acres)	Percent of Area
Open Water	1367	20.9%
Developed	385	5.9%
Forest	905	13.8%
Shrub	143	2.2%
Herbaceous	449	6.9%
Hay/Pasture	762	11.6%
Cultivated Crops	2068	31.6%
Wetlands	461	7.0%
Total	**6540**	**100%**

Sugar Lake has relatively good water quality and was called out as a protection lake in the Wright County Water Management Plan. This effort will target BMP's in an effort to ensure the water quality is maintained in this highly used and prized Wright County and regional resource. The Sugar Lake Association (SLA) has been monitoring the lake since 1980 and has been participating in RMB Labs Lake Monitoring Program since 2002. As part of RMB's monitoring program samples are taken five times a year between May and September. Sampling includes a water clarity reading with a secchi disc (mean 10.5 ft), weather conditions, total phosphorous (mean 18.3 µg/L) and chlorophyll-a (mean 6.8 µg/L) (Figure 3). Based on this data the tropic state index on Sugar Lake is 45.6, categorizing it as mesotrophic. Sugar Lake has two public boat accesses. One launch on the southern end of the lake and the other on the north end of the lake. There are two invasive species known to be present in Sugar Lake, Eurasian watermilfoil (*Myriophyllum spicatum)* and curly-leaf pondweed (*Potamogeton crispus*) (MNDNR, 2016).

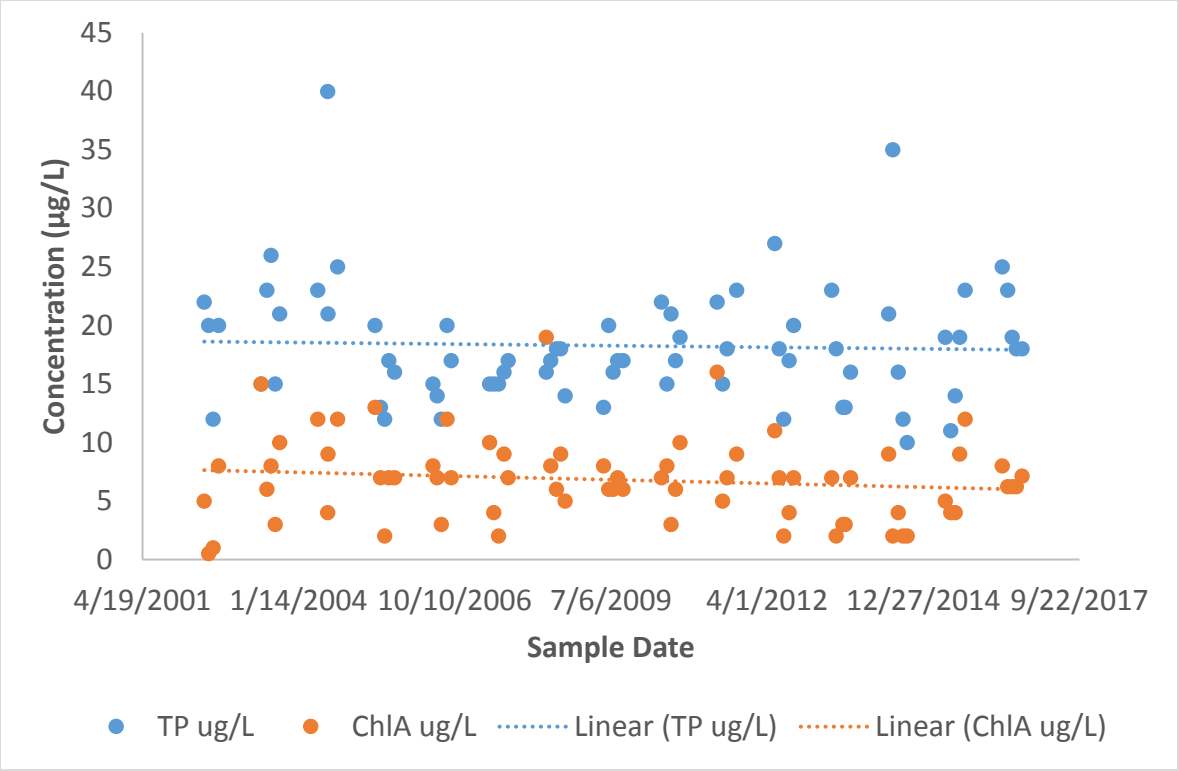

Figure 3. Total Phosphorous (blue) and chlorophyll-a (orange) concentrations in Sugar Lake since 2002 from the RMB Lake monitoring database. Neither parameter shows a significant trend.

Data Sources

Several data sources are required to prepare and run PTMApp Desktop. These data sources are either the direct inputs for PTMApp or allow for the creation of the required inputs. A full list of the required inputs are available in the PTMApp Desktop User Guide (HEI, 2016). Descriptions and summaries of primary data sources and their origins and content follows.

Elevation

The elevation data used for this project is Light Detection and Ranging (LiDAR) developed in 2008. The data was collected in 2012 for the Minnesota Department of Natural Resources. The vertical accuracy is about 2 in root mean squared error. The horizontal accuracy is +/-3.8 ft at 95% confidence. The data was interpolated into a digital elevation model (DEM) at one meter by one meter resolution (MNDNR, 2014).

Rainfall/Runoff

Meterological data affects how much soil may be removed from the landscape. Rainfall data used were from the National Oceanic and Atmospheric Administration (NOAA). The total rainfall depths used represented a 2-year, 24-hour event and a 10-year 24-hour event from the NOAA Atlas 14 (NOAA, 2013). As a portion of the revised universal soil loss equation (RUSLE) the r-factor accounts for meteorological impact on erosion rates. The r-factor data layer was generated from the National Resource Conservation Service (NRCS) Minnesota Field Guide.

Land use/Land Cover

Land cover affects infiltration of water and erosion of soils. Land cover data used were from the National Land Cover Dataset (NLCD) of 2011 (Homer et al., 2015). The data was used to generate runoff Curve Numbers and to estimate the total nitrogen and total phosphorus loading. Cover management values for various land cover types were used from the National Agricultural Statistics Service 2014 Cropland Data Layer (USDA, 2014) for RUSLE.

Soils

Some soil types are more susceptible to erosion. Soil data was used from the NRCS SSURGO database (NRCS, 2016). Attributes from the soil dataset were used in developing the Curve Numbers and the soil erodibility factor (K_w). Other soil attributes considered in the PTMApp Model and potential BMP locations were hydric rating, crop productivity index, and minimum depth to groundwater.

Study Boundary and Priority Resource Points

The study area boundary and priority resources point data layers were developed by Wright SWCD. The preliminary study area boundary was determined using the D8 method (Tribe, 1992). The final study area boundary was a result of the hydrologic conditioning using protocol from Houston Engineering Inc (HEI, 2017). Priority resource points were developed during a site visit between Wright SWCD and SLA. Culverts were automatically considered to be priority resource points. Additional priority resource points were added during the hydrologic conditioning process to represent overland flow to the lake. All of the priority resource points entering Sugar Lake are shown in Figure 4. The priority resource point representing the exit from Indian Lake is the only groundwater resource point used in this assessment.

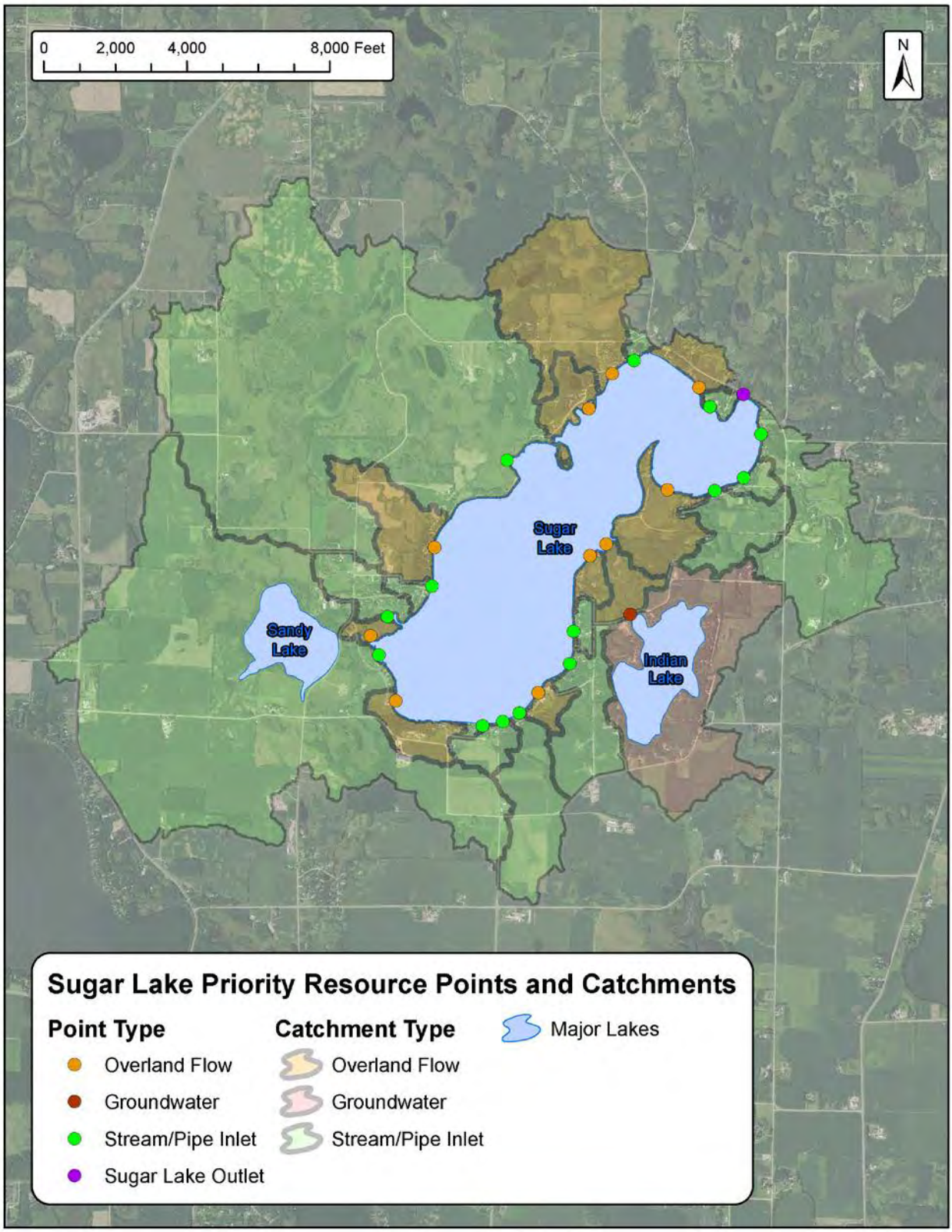

Figure 4. Priority resources points and their drainage areas by type of flow to the lake.

Methods

Hydrologic Conditioning

Creation of an elevation model is based on surficial features. However, subsurface features such as culverts are not captured. In the resulting elevation model a road acts as a barrier preventing the passage of water. Hydrologic conditioning “burns” a hole in the road to allow water to flow (Figure 5). Several data sources were used to determine where subsurface features are present, including: aerial imagery, the original elevation model, transportation features and structure inventories.

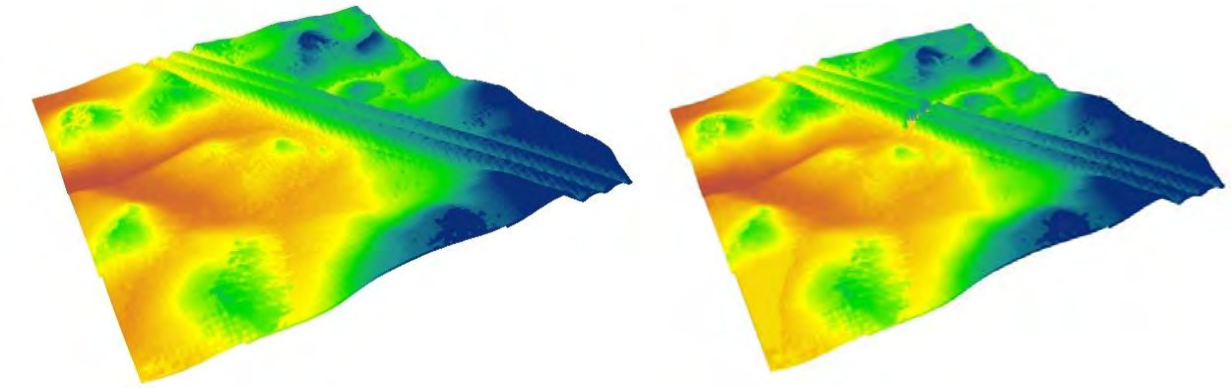

Figure 5. Image on the left shows how a road can act as a barrier since subsurface structures are not captured in a normal elevation model. The image on the right shows the "burn" or correction made to allow water to flow through a culvert. Image credit: Houston Engineering Inc.

The elevation data for the Sugar Lake watershed was hydrologically conditioned by Wright SWCD to account for subsurface features (e.g. culverts). The hydrologic conditioning process attempted to capture as many subsurface features as possible.

An effort was made through hydrologic conditioning to capture all of the drainage to the lake. This involved building an imaginary “wall” around the lake so water will drain to priority resource points. This model ensures that the entire load of phosphorous, nitrogen and sediment is represented at the priority resource points. Additional priority resource points were created as necessary to represent areas that are primarily overland flow.

A non-contributing drainage area analysis was completed. This analysis determined the areas where water is unlikely to continue downstream during a 10-year, 24-hour rainfall event. Field inspections were completed in areas where the drainage direction was unclear.

The preliminary hydrologically conditioned elevation model was subject to a quality assurance/quality control process by Houston Engineering Inc. All the other data layers were dependent on the hydrologic conditioning. Some of the data was simply dependent on the boundary of the watershed which changed slightly with the hydrologic conditioning process. Other layers utilized elevation, water flow direction and/or water accumulation as part of their creation.

Time of Travel

The quantity of sediment and nutrients delivered to Sugar Lake is dependent on the time it takes runoff to reach the receiving water. A raster dataset was created to simulate water travel time throughout the watershed. An ArcGIS script made available to Wright SWCD from HEI used land cover, flow direction, flow accumulation, slope from the hydrologically conditioned elevation model to compute hydrologic velocities between each cell. The velocities were converted to time based on the length between cells as the water moves downstream.

Processing Data in PTMApp Desktop

The vast amount of processing that takes place in PTMApp is too extensive to fully relay in this report. The Red River Basin Decision Information Network houses the documentation of the science and theory used to process data in PTMApp. Several Technical Memoranda are available on their webpage, they describe the specific processing used to generate the output products for PTMApp (HEI, 2016a).

As a brief overview, PTMApp estimates the annual loads of total phosphorous, total nitrogen and sediment received at the outlet of the watershed. The loads are routed through the watershed based on an upstream to downstream analysis of water pathways. A sediment delivery ratio and first order decay equations (TP, TN) are used to account for changes in load throughout the watershed. The placement of BMPs are based on NRCS design standards and are sorted by treatment group (biofiltration, filtration, infiltration, protection, source reduction, and storage). The placement of the BMPs is then combined with the initial loads calculated to estimate efficiency and load reductions (HEI, 2016b).

Targeted Implementation Scenarios

The original output of PTMApp produced 959 practices, obviously not all of these practices can be implemented. Wright SWCD chose to narrow down the practices by cost effectiveness for sediment and phosphorous reduction. The cost of BMPs was based on averages from the Minnesota Environmental Quality Incentives Programs payment schedules. Initially the top 30 most cost effective practices were selected. First practices were selected by the cost effectiveness. Practices that would cost less than $1000 per ton of sediment and less than $1000 per pound of phosphorous were selected. Then of the remaining practices the 30 practices that PTMApp predicted would remove the most sediment and phosphorous per acre per year. However, these turned out to be all source reduction practices such as cover crops and improved rotation. Wright SWCD does not discount the value of such BMPs but we understand these practices require a change in the type of farming in many instances or in the crops grown and we realize these are difficult long term changes where structural practices can be integrated into the existing crop rotations and have less disruption to the overall farm management. Therefore the same selection process was used again except it was restricted to structural practices. Thirty-six structural practices have a cost effectiveness less than $1000 per unit contaminant, Wright SWCD decided to keep all 36 rather than only the top 30. In addition the top 30 source reduction practices were kept for the next stage of selection.

Field Reconnaissance Procedures

After using the PTMApp results to determine the top 66 practices Wright SWCD staff used their professional judgement to determine if the practices were practical. First staff spoke with local partners at the Sugar Lake Association to gain their opinion if some practices were more likely to be built or which would do the most good. Three Wright SWCD staff conducted field checks of the 66 practices. Observations included validating a good location and noting reasons why certain locations are not optimal. Some reasons noted included that fields appeared to no longer be in production or a structural practice would not fit due to a building or a lawn. In addition, staff offered alternative practices especially in fields that PTMApp identified as source reduction. After the field check 6 filtration practices and 5 source reduction fields were selected, 5 storage practices were created as a result of field checks (Figure 6).

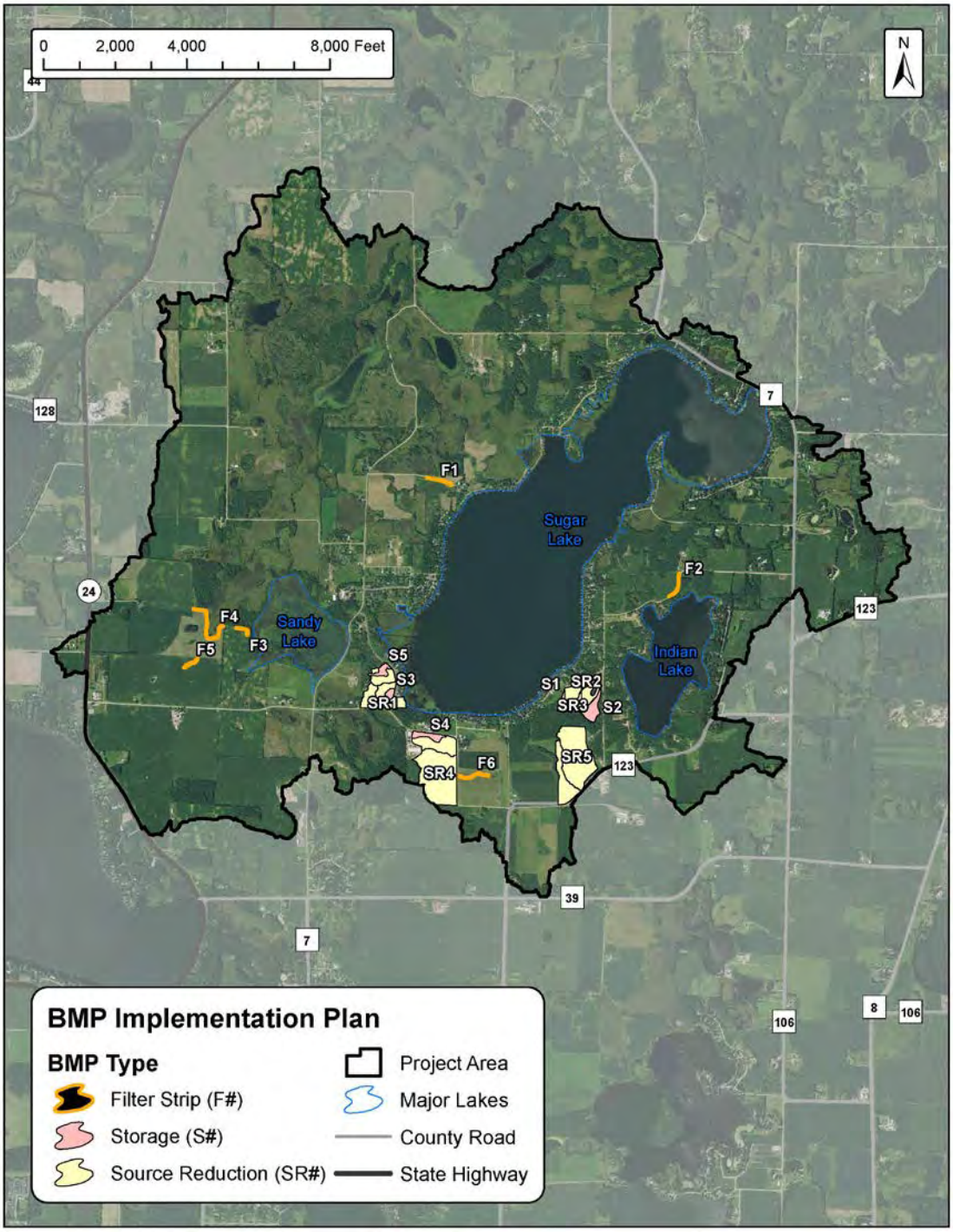

Figure 6. BMPs selected by Wright SWCD staff, including post field work modifications

Post Field Work Modifications

After the field check the selected practices were redrawn by Wright SWCD staff (Figure 7). This was necessary because of the restrictions and inherent error of PTMApp. Filtration practices were often expanded and drawn to better follow flow lines and contours. Source reduction practices were drawn to follow both parcel and field lines, this may have restricted or expanded

the size of the practices. Storage practices added by Wright SWCD staff were also created by PTMApp but did not meet the original requirement of less than $1000 per unit contaminant. These were redrawn to better follow contours. HEI repopulated the data outputs of PTMApp for the new drawings of the BMPs selected.

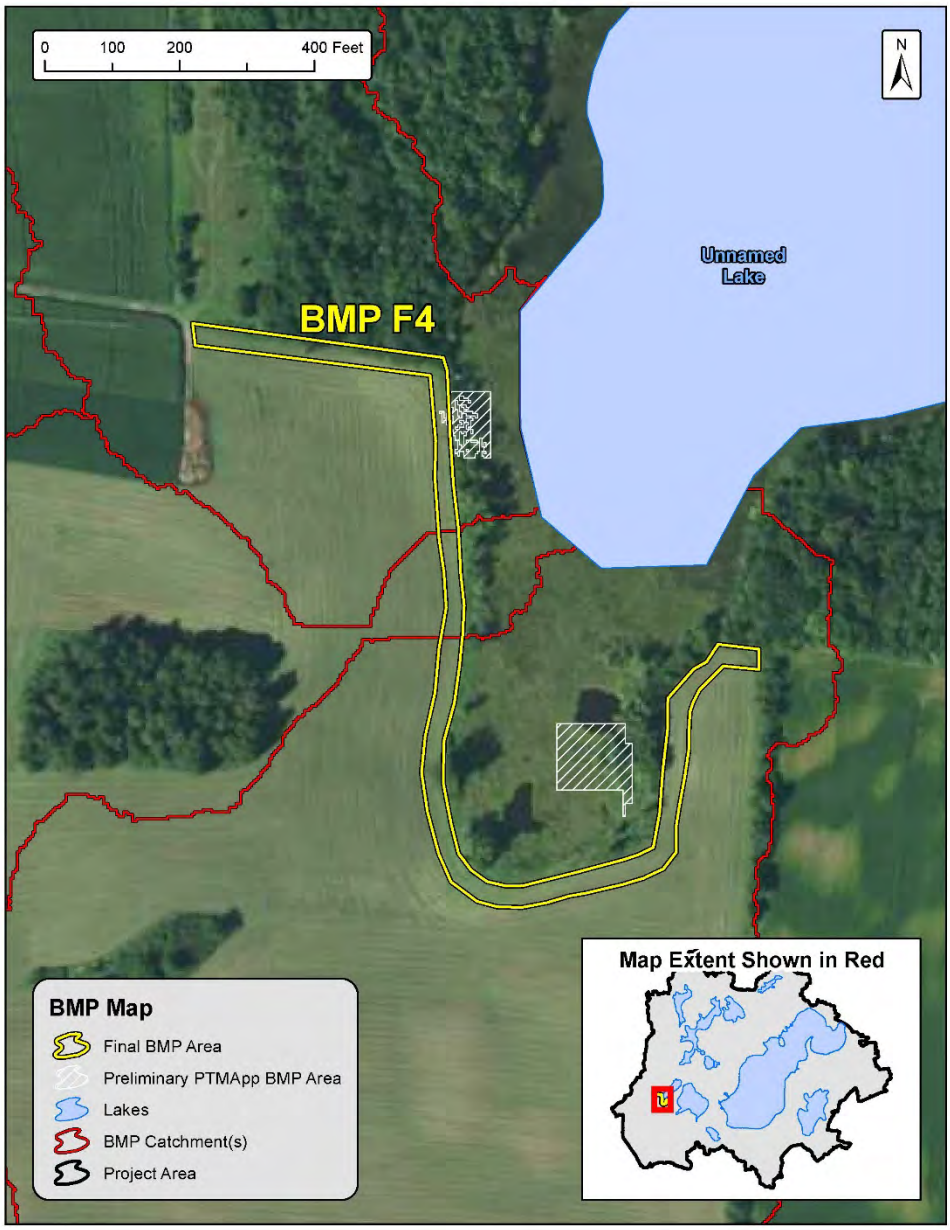

Figure 7. Two practices created by PTMApp (white) were redrawn by WSWCD staff to buffer the wetland.

Ranking

BMPs were ranked by SWCD staff using outputs from PTMApp. The ranking was based on four parameters load of sediment and phosphorus leaving the catchment (lbs/year/acre), load reduction of sediment and phosphorus to Sugar Lake from the BMP (lbs/year), and whether the practice was structural or management based (a structural practice was given a higher rank).

Catchment load, BMP load reduction, and the BMP type were given equal weight in the ranking process. The following is a simplified equation used to determine ranking. For a detailed equation see Appendix A.

$$(Catchment\ Rank * 33\%) + (BMP\ Reduction\ Rank * 33\%) + (BMP\ Value * 33\%) = BMP\ Rank$$

Note that some practices span two or more catchments. In these cases only the catchment with the highest load was used in the equation, the load reduction from the entire BMP was used.

Lake Routing

Given that this watershed is based on the outlet to a lake and there are several other lakes within the watershed we wanted to include the lake routing tool in this assessment. Lake routing was accounts for settling of sediment and treatment of phosphorus that may occur in the waterbodies within the watershed. However, the lake routing button of the PTMApp toolbar was still in progress during the creation of this report. Site selection was based on data that did not include lake routing, ranking and all final data in tables of this report take lake routing into account.

Table 3. Priority ranking system for select BMPs in the Sugar Lake Watershed

Rank	Feature ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)	Estimated Project Cost
1	S2	Control Basin	5.41	31.65	4.43	$69,575
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Watershed Profile

PTMApp creates field scale catchments that average approximately 40 acres in size. The Sugar Lake Watershed was divided into 180 catchments. Once the catchments are created PTMApp determines the contaminant load delivered to the outlet of the catchment itself and the outlet of the watershed (Table 4). At the time of this report PTMApp was unable to calculate the reduction occurring within Sugar Lake, therefore we assume that the delivery to the outlet of the watershed is the same as the delivery to Sugar Lake.

Table 4. Contaminant delivery from each field scale catchment to the catchment outlet and to the outlet of Sugar Lake Watershed. An entry of N/A indicates the value is less than 0.01.

ID	Size (acres)	Sediment to Catchment Outlet (tons)	TP to Catchment Outlet (lbs)	Sediment to Sugar Lake (tons)	Sediment to Sugar Lake (tons/acre)	TP to Sugar Lake (lbs)	TP to Sugar Lake (lbs/acre)
72	23.20	1.47	2.52	0.44	0.02	1.26	0.05
102	15.77	0.93	3.23	0.07	0.00	0.56	0.02
110	29.53	0.59	2.61	0.04	0.00	0.45	0.01
116	17.66	0.53	3.92	0.11	0.01	1.61	0.07
125	21.18	0.42	0.87	0.05	0.00	0.23	0.01
144	13.84	0.08	0.61	0.01	0.00	0.16	0.01
149	18.34	0.01	0.12	0.00	0.00	0.06	0.00
163	63.92	13.62	7.82	1.61	0.02	2.05	0.02
170	14.24	0.60	1.72	0.07	0.00	0.45	0.02
177	16.29	0.19	0.55	0.05	0.00	0.27	0.01
184	45.39	0.00	0.25	0.00	0.00	0.12	0.00
203	51.03	17.60	3.83	5.05	0.09	1.91	0.03
211	10.01	0.00	0.03	0.00	0.00	0.02	0.00

ID	Size (acres)	Sediment to Catchment Outlet (tons)	TP to Catchment Outlet (lbs)	Sediment to Sugar Lake (tons)	Sediment to Sugar Lake (tons/acre)	TP to Sugar Lake (lbs)	TP to Sugar Lake (lbs/acre)
235	37.45	27.82	8.17	7.47	0.20	4.08	0.11
254	33.98	0.11	0.58	0.03	0.00	0.29	0.01
301	65.80	0.00	0.00	0.00	0.00	0.00	0.00
304	49.94	<Null>	0.00	<Null>	<Null>	0.00	0.00
305	15.25	0.00	0.02	0.00	0.00	0.01	0.00
329	23.85	28.59	3.05	7.71	0.31	1.52	0.06
359	10.03	1.51	1.33	0.33	0.03	0.66	0.06
373	14.67	0.00	0.04	0.00	0.00	0.02	0.00
397	26.31	0.53	1.05	0.07	0.00	0.27	0.01
423	42.37	1.05	2.67	0.17	0.00	0.85	0.02
446	48.61	0.21	0.51	0.04	0.00	0.16	0.00
460	12.86	1.49	2.43	0.08	0.01	0.35	0.02
469	30.53	91.39	10.15	12.34	0.36	2.61	0.07
473	21.89	0.86	2.08	0.05	0.00	0.30	0.01
495	20.71	0.00	0.00	0.00	0.00	0.00	0.00
502	13.27	0.00	0.00	0.00	0.00	0.00	0.00
515	6.60	0.00	0.05	0.00	0.00	0.03	0.00
518	18.54	0.75	0.93	0.05	0.00	0.13	0.01
521	20.31	2.59	1.07	0.54	0.03	0.34	0.02
525	16.04	0.39	4.84	0.09	0.01	2.42	0.14
536	22.07	17.24	5.70	3.88	0.17	2.85	0.12
543	44.00	9.22	2.97	0.46	0.01	0.42	0.01
551	61.63	180.13	20.84	34.85	0.53	6.64	0.10
601	11.47	8.31	4.27	1.70	0.14	1.75	0.14
9901	0.34	0.00	0.04	0.00	0.00	0.04	0.11
9902	22.78	1.61	7.58	0.40	0.02	3.78	0.16
9903	24.51	17.63	7.27	3.72	0.15	3.63	0.15
9904	106.72	179.94	28.78	40.04	0.37	14.33	0.13
9905	6.47	0.39	1.25	0.11	0.02	0.63	0.09
9906	19.01	12.88	8.28	2.48	0.13	4.13	0.21
9907	17.43	2.16	1.56	0.53	0.03	0.78	0.04
9908	43.77	46.82	8.45	9.37	0.21	4.22	0.09
9909	3.78	0.21	0.93	0.04	0.01	0.47	0.12
9910	10.32	0.28	2.64	0.07	0.01	1.32	0.12
9911	72.24	14.57	20.85	3.08	0.04	10.37	0.14
9912	17.37	5.92	6.42	1.34	0.08	3.20	0.18
9913	11.19	0.08	0.37	0.02	0.00	0.18	0.02

ID	Size (acres)	Sediment to Catchment Outlet (tons)	TP to Catchment Outlet (lbs)	Sediment to Sugar Lake (tons)	Sediment to Sugar Lake (tons/acre)	TP to Sugar Lake (lbs)	TP to Sugar Lake (lbs/acre)
9914	12.97	6.98	4.39	1.34	0.10	2.19	0.17
9915	14.74	1.24	2.75	0.28	0.02	1.37	0.09
9916	43.95	9.32	16.38	2.30	0.05	8.18	0.18
9917	39.23	3.56	12.41	0.74	0.02	6.19	0.16
9918	33.51	97.19	8.45	30.15	0.89	4.22	0.12
9919	26.45	34.22	6.57	6.73	0.25	3.28	0.12
9920	2.28	0.26	1.44	0.07	0.03	0.71	0.28
9921	26.92	29.54	8.12	5.70	0.21	4.05	0.15
9922	61.15	83.28	19.54	16.84	0.27	9.74	0.15
9923	112.86	14.35	18.61	3.17	0.03	9.27	0.08
9924	19.39	0.16	3.82	0.03	0.00	1.91	0.09
9925	0.00	0.00	0.00	0.00	0.00	0.00	0.03
9926	58.11	4.33	10.49	1.04	0.02	5.22	0.09
9927	26.11	1.11	1.14	0.18	0.01	0.37	0.01
9928	13.63	0.17	0.96	0.02	0.00	0.25	0.01
9929	9.22	0.08	0.73	0.01	0.00	0.30	0.03
9930	35.17	0.01	0.28	0.00	0.00	0.14	0.00
9931	23.13	1.00	2.18	0.08	0.00	0.38	0.01
9932	39.60	18.99	10.66	0.47	0.01	0.91	0.02
9933	22.98	13.59	6.06	0.14	0.00	0.26	0.01
9934	9.35	0.21	1.54	0.03	0.00	0.40	0.04
9935	6.94	0.36	1.22	0.02	0.00	0.17	0.02
9936	7.23	0.00	0.12	0.00	0.00	0.04	0.00
9937	68.63	31.21	10.88	6.11	0.08	4.47	0.06
9938	16.02	1.45	5.23	0.30	0.02	2.61	0.16
500007	31.54	1.96	3.20	0.28	0.01	1.05	0.03
500017	93.23	35.79	12.43	4.45	0.04	4.07	0.04
500041	29.11	1.27	1.78	0.18	0.01	0.58	0.02
500043	113.51	410.59	38.11	28.67	0.20	6.53	0.04
500047	11.00	24.96	3.66	1.70	0.12	0.63	0.04
500050	17.97	0.75	1.01	0.10	0.01	0.33	0.02
500054	46.04	38.66	12.17	2.44	0.04	2.09	0.03
500061	16.86	1.07	1.61	0.06	0.00	0.28	0.01
500078	16.17	2.58	4.94	0.62	0.04	2.47	0.15
500079	38.75	25.04	7.31	1.56	0.03	1.26	0.02
500090	121.69	31.80	22.68	3.18	0.02	5.91	0.04
500103	18.47	20.84	7.92	4.31	0.23	3.95	0.21

ID	Size (acres)	Sediment to Catchment Outlet (tons)	TP to Catchment Outlet (lbs)	Sediment to Sugar Lake (tons)	Sediment to Sugar Lake (tons/acre)	TP to Sugar Lake (lbs)	TP to Sugar Lake (lbs/acre)
500104	24.76	4.96	4.88	1.24	0.05	2.43	0.10
500106	99.29	220.40	32.77	14.66	0.11	5.63	0.04
500112	6.91	0.00	0.04	0.00	0.00	0.02	0.00
500117	54.72	93.95	21.02	6.26	0.09	3.61	0.04
500119	15.94	1.82	5.94	0.12	0.01	1.02	0.04
500128	18.99	0.01	0.27	0.00	0.00	0.13	0.01
500143	70.57	28.58	16.29	4.92	0.06	6.65	0.08
500145	32.91	3.14	5.96	0.30	0.01	1.56	0.04
500148	78.20	24.31	14.73	4.76	0.05	6.02	0.06
500152	41.28	1.65	3.41	0.17	0.00	0.89	0.02
500157	12.15	0.01	0.02	0.00	0.00	0.01	0.00
500159	13.06	0.91	2.55	0.16	0.01	1.04	0.06
500166	58.51	0.00	0.43	0.00	0.00	0.21	0.00
500167	15.51	<Null>	0.00	<Null>	<Null>	0.00	0.00
500168	11.00	0.79	1.56	0.05	0.00	0.27	0.02
500186	21.87	0.02	0.08	0.00	0.00	0.04	0.00
500207	45.81	6.50	10.10	0.70	0.01	2.65	0.04
500213	31.71	0.75	2.57	0.17	0.01	1.28	0.04
500218	12.24	1.37	4.27	0.33	0.03	2.13	0.17
500219	86.18	12.64	9.66	2.86	0.03	4.80	0.05
500222	24.18	0.01	0.00	0.00	0.00	0.00	0.00
500228	120.36	42.66	23.05	9.64	0.07	11.45	0.08
500232	12.84	0.57	3.26	0.13	0.01	1.62	0.12
500250	8.71	0.00	0.00	0.00	0.00	0.00	0.00
500252	17.26	0.00	0.01	0.00	0.00	0.00	0.00
500255	32.95	0.00	0.00	0.00	0.00	0.00	0.00
500256	46.66	36.83	7.99	8.87	0.19	3.97	0.08
500258	15.74	0.11	1.61	0.03	0.00	0.80	0.05
500270	74.78	0.01	1.07	0.00	0.00	0.53	0.01
500272	10.61	0.00	0.01	0.00	0.00	0.01	0.00
500274	26.93	27.81	5.52	3.04	0.09	1.45	0.04
500290	34.93	54.12	6.18	12.83	0.36	3.07	0.08
500297	3.19	<Null>	0.00	<Null>	<Null>	0.00	0.00
500306	46.96	0.00	0.02	0.00	0.00	0.01	0.00
500307	92.00	52.92	22.55	5.14	0.04	5.89	0.05
500308	35.34	1.57	7.22	0.16	0.00	1.89	0.04
500330	50.12	53.61	15.50	12.53	0.24	7.71	0.15

ID	Size (acres)	Sediment to Catchment Outlet (tons)	TP to Catchment Outlet (lbs)	Sediment to Sugar Lake (tons)	Sediment to Sugar Lake (tons/acre)	TP to Sugar Lake (lbs)	TP to Sugar Lake (lbs/acre)
500347	13.49	0.01	0.18	0.00	0.00	0.09	0.01
500356	10.86	6.39	3.43	1.32	0.12	1.71	0.15
500359	120.30	321.91	31.33	85.81	0.68	15.58	0.12
500366	108.62	199.36	32.33	19.57	0.16	8.27	0.06
500369	102.34	108.83	28.43	27.47	0.26	14.16	0.13
500386	38.09	75.23	9.83	7.42	0.17	2.52	0.06
500389	12.42	0.69	1.71	0.09	0.01	0.54	0.04
500390	12.32	3.11	3.48	0.65	0.05	1.74	0.13
500395	17.39	1.76	2.53	0.21	0.01	0.81	0.04
500406	19.30	29.88	3.28	7.16	0.35	1.63	0.08
500416	7.67	0.01	0.06	0.00	0.00	0.03	0.00
500424	13.96	3.04	2.29	0.36	0.02	0.73	0.05
500441	20.97	0.29	0.71	0.03	0.00	0.18	0.01
500450	73.99	149.92	23.62	16.72	0.19	6.06	0.06
500454	18.83	24.34	4.51	2.61	0.12	1.16	0.05
500460	123.37	222.26	31.49	11.23	0.08	4.49	0.03
500462	17.33	1.72	3.31	0.08	0.00	0.47	0.02
500465	16.79	0.61	2.13	0.08	0.00	0.68	0.04
500470	51.73	0.02	0.33	0.01	0.00	0.16	0.00
500474	31.05	34.64	6.47	1.59	0.05	0.92	0.03
500481	26.62	60.03	9.09	6.16	0.19	2.33	0.07
500484	19.35	0.00	0.00	0.00	0.00	0.00	0.00
500486	61.22	0.00	0.03	0.00	0.00	0.02	0.00
500493	51.49	0.00	0.12	0.00	0.00	0.06	0.00
500496	13.48	<Null>	0.03	<Null>	<Null>	0.02	0.00
500499	50.01	0.00	0.00	0.00	0.00	0.00	0.00
500500	34.28	0.01	0.13	0.00	0.00	0.07	0.00
500503	13.65	0.00	0.00	0.00	0.00	0.00	0.00
500504	57.57	128.67	18.89	13.50	0.21	4.84	0.07
500506	23.31	<Null>	0.00	<Null>	<Null>	0.00	0.00
500511	25.77	19.60	4.74	2.26	0.08	1.51	0.05
500516	10.65	<Null>	0.00	<Null>	<Null>	0.00	0.00
500519	19.97	33.04	5.27	3.72	0.18	1.68	0.08
500523	63.88	160.88	19.25	18.27	0.24	4.93	0.06
500524	99.03	165.71	41.50	20.86	0.18	10.62	0.08
500531	29.32	32.94	4.96	4.03	0.13	1.58	0.05
500534	11.17	10.92	2.67	2.33	0.20	1.33	0.11

ID	Size (acres)	Sediment to Catchment Outlet (tons)	TP to Catchment Outlet (lbs)	Sediment to Sugar Lake (tons)	Sediment to Sugar Lake (tons/acre)	TP to Sugar Lake (lbs)	TP to Sugar Lake (lbs/acre)
500541	10.25	0.59	3.93	0.15	0.01	1.96	0.18
500542	34.13	2.41	2.21	0.11	0.00	0.32	0.01
500544	122.28	221.47	35.46	49.06	0.39	17.67	0.14
500548	16.63	52.52	5.43	7.32	0.41	1.73	0.09
500553	46.13	60.92	15.27	3.04	0.06	2.18	0.04
500563	22.47	0.61	7.15	0.15	0.01	3.56	0.15
500575	118.15	235.87	33.24	12.09	0.09	4.73	0.03
500588	12.28	25.39	4.87	3.59	0.26	1.55	0.11
500589	41.49	122.89	14.85	22.85	0.50	6.08	0.13
500602	98.53	233.76	29.49	46.52	0.43	12.05	0.11
500611	18.43	42.65	6.25	6.77	0.32	1.99	0.09
500613	21.78	2.93	4.17	0.48	0.02	1.71	0.07
500621	22.39	13.35	3.48	2.17	0.09	1.42	0.06
500631	29.09	85.11	7.89	20.98	0.70	3.94	0.13
500632	15.34	33.98	5.05	5.23	0.29	1.61	0.08
500647	112.16	230.13	25.22	60.49	0.52	12.54	0.11
500648	123.97	225.53	42.06	48.77	0.37	17.16	0.12
500662	51.02	106.23	19.61	17.24	0.28	6.21	0.09
500663	98.26	213.88	26.34	32.36	0.27	8.33	0.06

The primary sources of total sediment appear to be the catchments furthest from Sugar Lake (Figure 8). For the most part the catchments delivering the most sediment to Sugar Lake correspond to heaviest agricultural activities (primarily on the south side of the lake). The areas with low sediment delivery are primarily covered in wetland, a MNDNR protection area and residential. One area that will overestimate the total sediment delivered to Sugar Lake is the area draining through Indian Lake. Since the connection between Indian Lake and Sugar Lake is via groundwater very little sediment from this area would be contributed to Sugar Lake.

The primary sources of total phosphorus align closely to the total sediment sources (Figure 9). There are some additional source areas of total phosphorus that occur in some of the near shore and residential areas. Total phosphorus contributions from the Indian Lake area will be overestimated. However, there may still be some phosphorus contributions from the dissolved load that could travel through the groundwater.

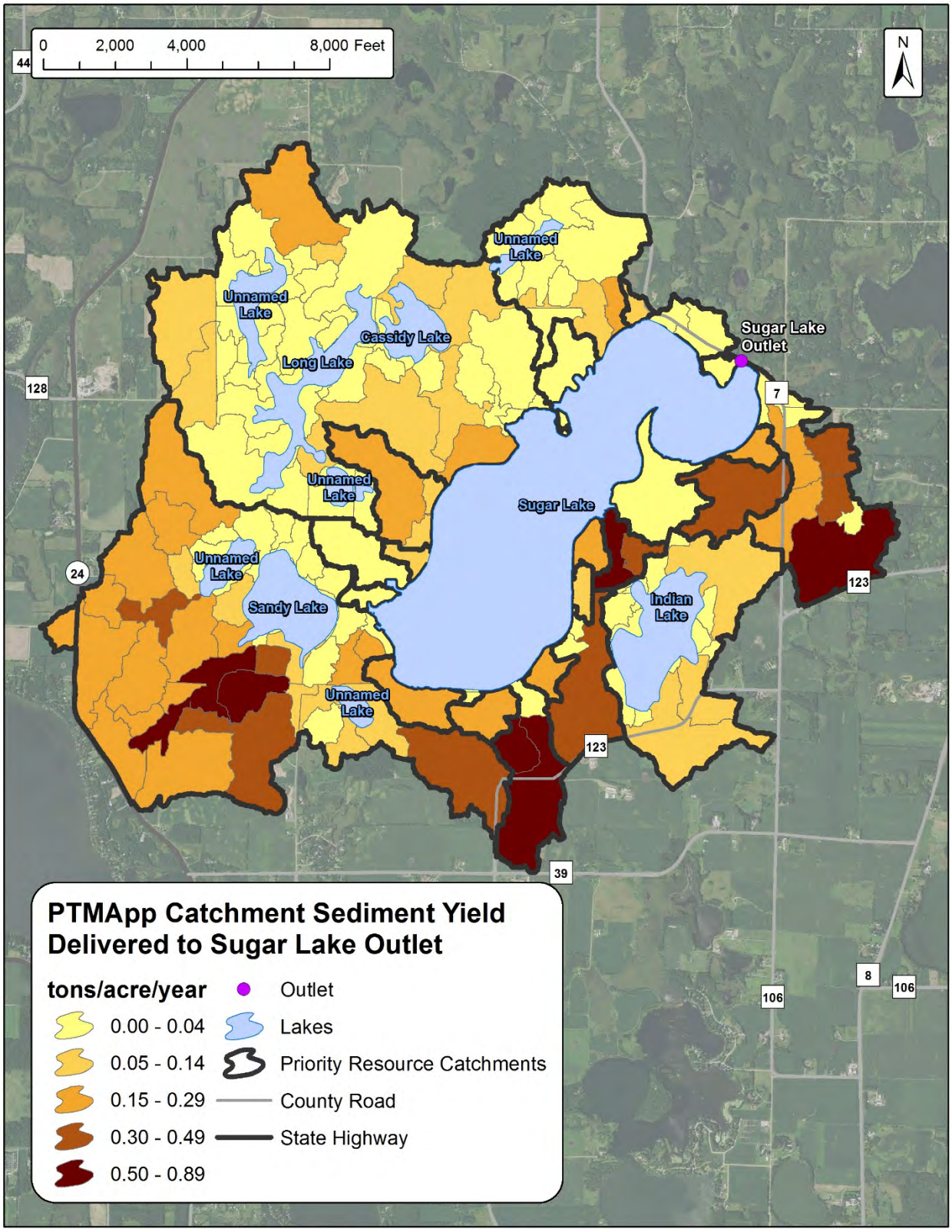

Figure 8. Sources of sediment to Sugar Lake. A darker color indicates a higher sediment delivery.

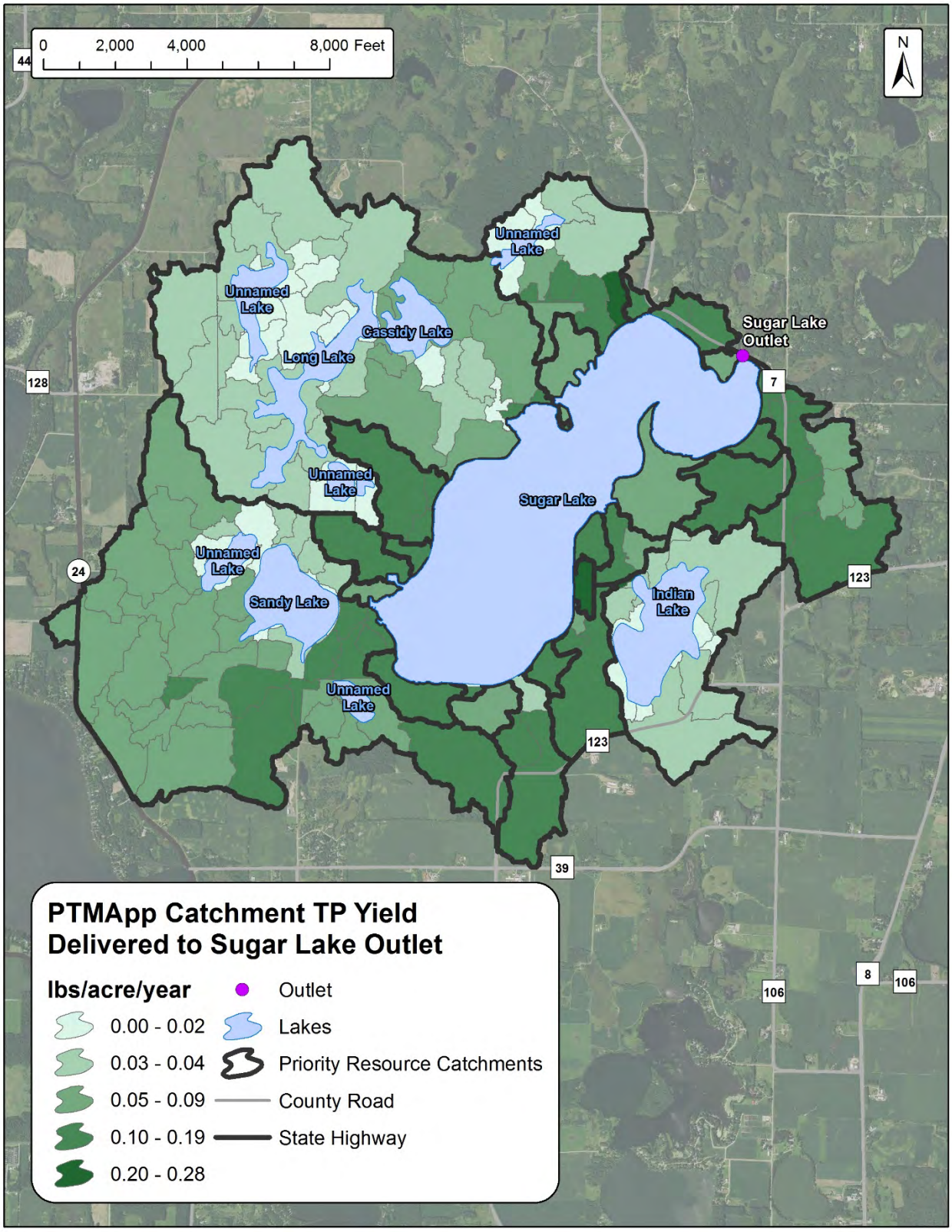

Figure 9. Total phosphorus delivery to Sugar Lake. A darker shade indicates higher delivery.

BMP Profiles

Filtration

There are two types of filtration BMPs considered as options when PTMApp identifies a filtration practice. The first is a filtration strip, it is meant to capture overland flow before it reaches a nearby resource of concern such as a wetland. The second practice is a grassed waterway, this practice is meant to take on a portion of concentrated flow and treat the water as it moves through the filter.

Cost estimates for filtration strips are based on Natural Resources Conservation Service (NRCS) program payments. Conservation Reserve Program (CRP) pays up to $84.00/acre which includes site preparation, 1-3 species seed mix, planting and weed control. This is assumed to be half the cost of construction so we assume a total cost of $168.00/acre. The producer will be provided a rental agreement lasting 10-15 years and receive annual payments to offset the loss of income due to taking the land out of production. Environmental Quality Incentives Program (EQIP) program pays a flat rate of $509.33/acre (native grass) or $501.95 (introduced grass), again this is assumed to be 50% of the total cost. Thus for this project we assume total cost of $1,011/acre. EQIP does not offer compensation for taking the land out of production but there is a lost production cost to the landowner.

Grassed waterways are eligible for CRP at the same rate, but EQIP payments are different. EQIP for grassed waterways are based on the size of area draining to the grassed filter and paid based on the length of filter. The majority of the drainage areas in this study will be less than 100 acres which would receive $1.57 per linear foot also assumed to be 50% of the total cost. The grassed waterways in this project are assumed to cost $3.14/linear ft. Since EQIP does not provide compensation for land removed from production there would be an additional cost to the farmer.

F1

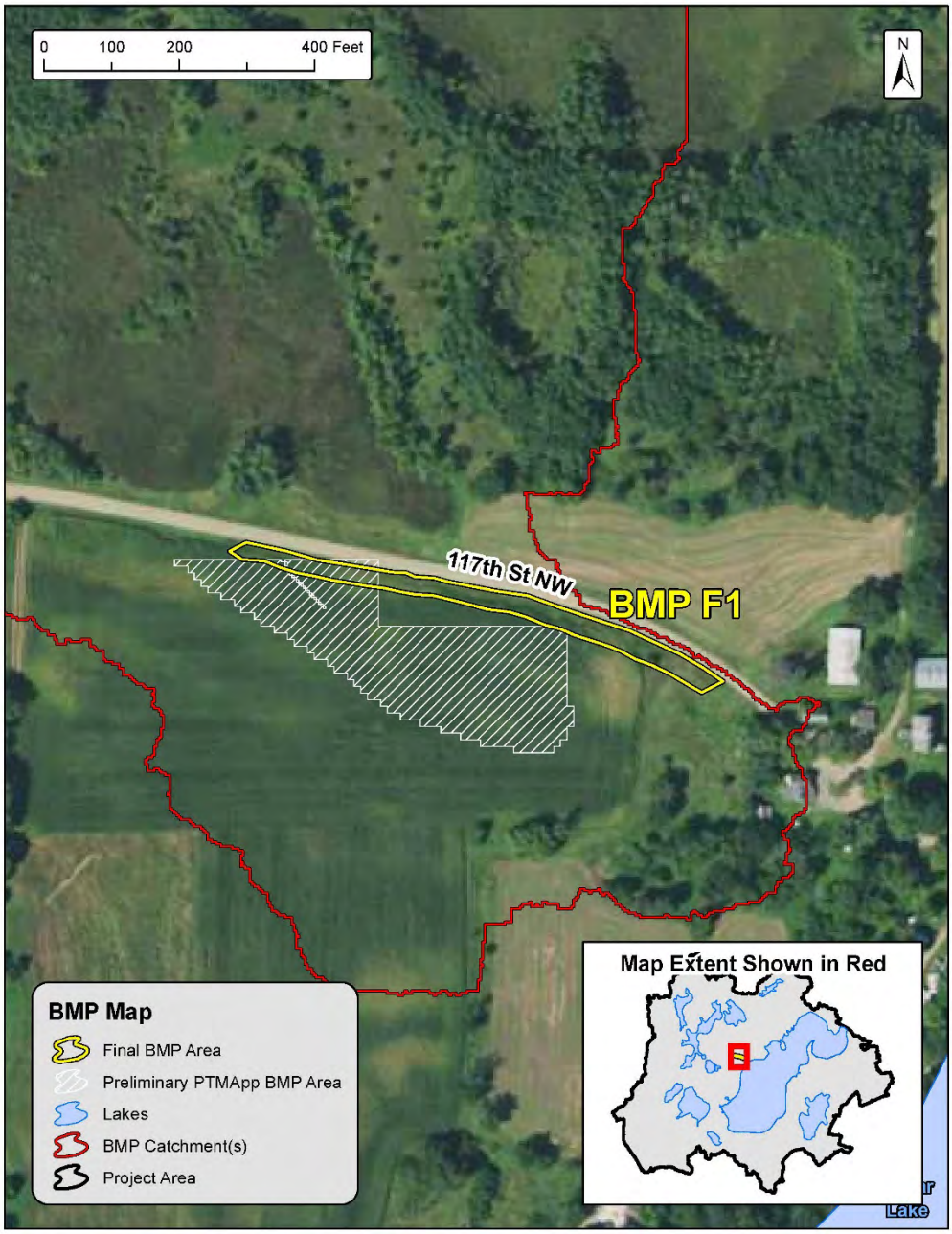

Figure 10. Field scale map of BMP F1, a filter strip. The white shaded area is what PTMApp orginially dilineated and the yellow outline is Wright SWCD staff estimate

BMP Description: Filtration BMP located on the northwest side of Sugar Lake. In 2011, the area was in farmland but recently the property was sold for development. Staff suggest that a filter strip would be useful along the road to treat stormwater runoff from potential impervious surfaces. The surface soil texture at the site is primarily sandy loam.

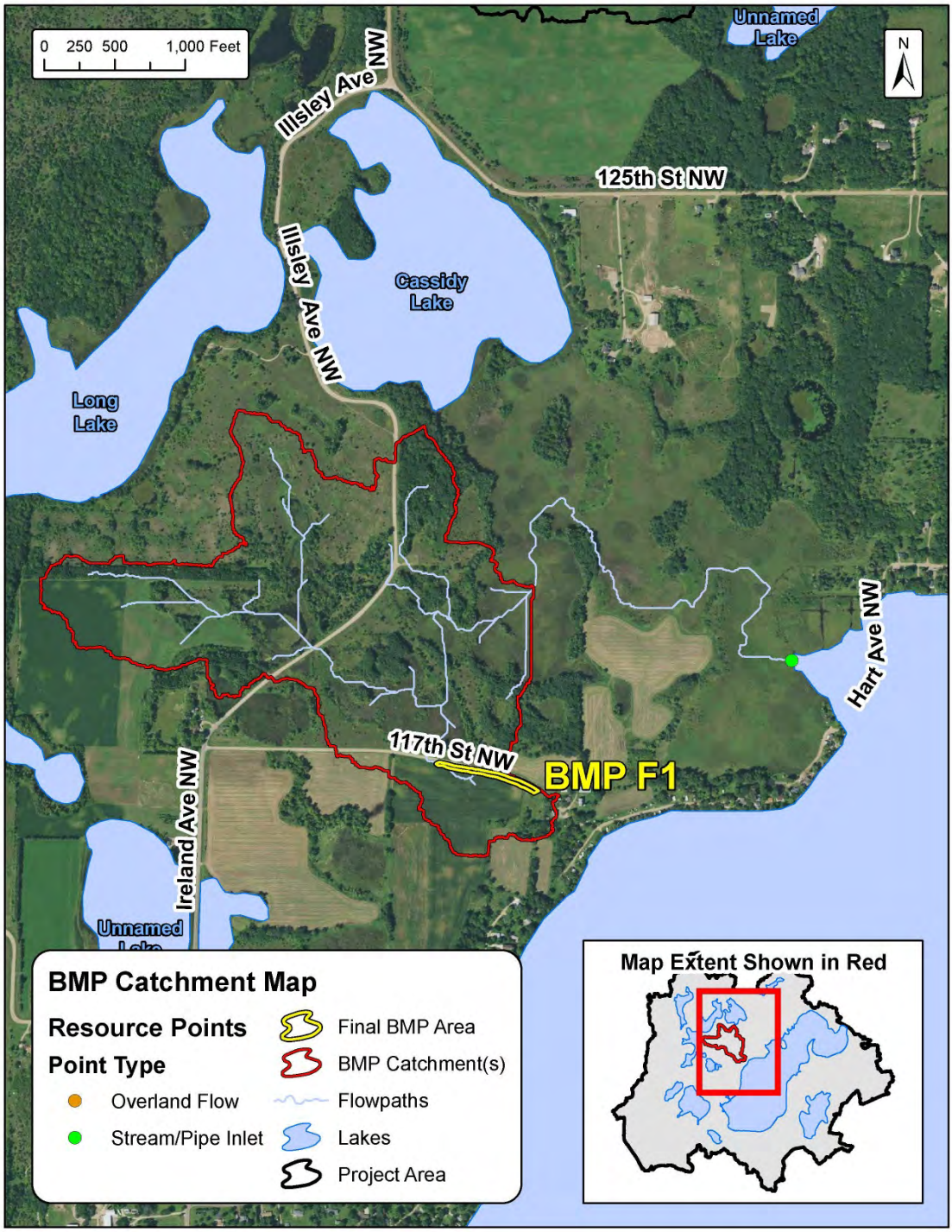

Figure 11. Catchment and flowpath for BMP F1

Catchment Description: F1 is contained in one catchment and is located at the top of the catchment. Water flows north after F1 through a DNR protected area before turning east and flowing into Sugar Lake via a culvert. The primary landuse in 2011 was herbaceous cover (25.94%), cultivated crops was 19.44% and developed space was 6.47%. Due to the change of property owners we expect that the landcover will change dramatically in this area.

Table 5. Ranking parameters for BMP F1

BMP Name	F1
Rank	14
Project Type	Filtration, Filter Strip
Project Size (acres)	0.48
Cost Estimate	$80.68 (CRP), $ 485.28 (EQIP)
BMP TSS Load Reduction (tons/year)	1.79
BMP TP Load Reduction (lbs/year)	N/A
Catchment Number(s)	500228
Catchment Size (acres)	120.36
Catchment TSS Load (tons/year/acre)	0.01
Catchment TP Load (lbs/year/acre)	0.12

This BMP was placed relatively well by PTMApp, it included a flowline and was near the edge of a field. However, our staff would adjust the placement to hug the roadway providing the most practicality. Additionally, our staff would thin out the practice reducing the size. The load reductions appear to be comparable although in the staff design TSS reductions are slightly higher and TP reductions are slightly lower than the PTMApp design. Staff were also able to take into account a property sale that took place since the 2011 landuse data was created.

Table 6. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP F1

	PTMApp Design	Staff Design
Size	1.77	0.48
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	3.43	1.79
TSS-Q3 (tons/year)	4.39	2.58
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.43	0.28
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	3.65	1.89
TSS-Q3 (tons/year)	5.26	2.72
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.48	0.30

F2

Figure 12. Field scale map of BMP F2,, a filter strip. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: A filtration BMP located on the southeast side of Sugar Lake and north on Indian Lake. A filter would reduce the load of nutrients prior to entering Indian Lake. It is worth noting that the connection from Indian Lake to Sugar Lake is primarily groundwater fed. Thusly, the sediment load reduction from this BMP would only affect Indian Lake. The land is on a single parcel that is privately owned. The onsite surface soil texture ranges from fine sandy loam to loam. The rank of this BMP was lowered to 16 because there is a known groundwater connection between the BMP and Sugar Lake.

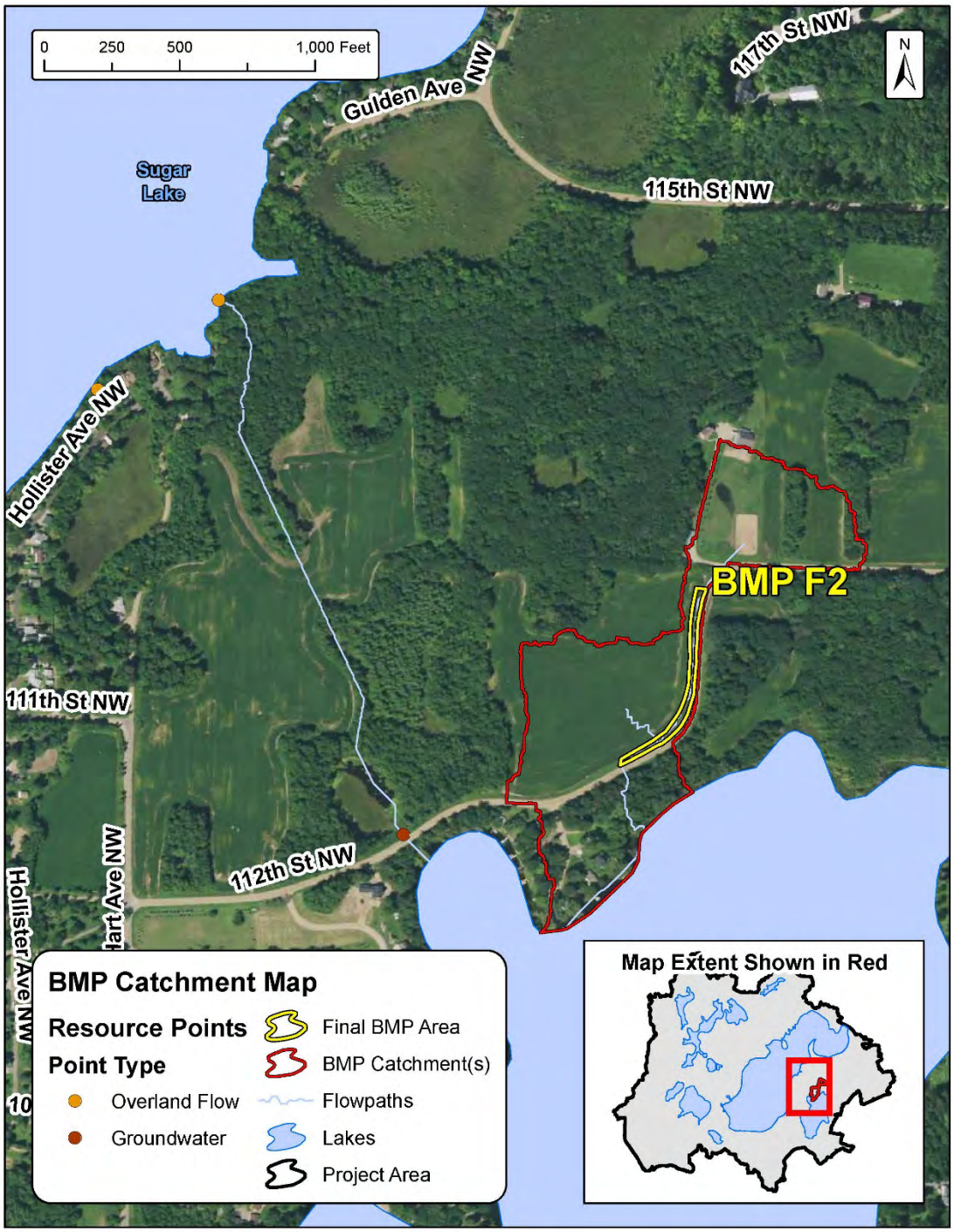

Figure 13. Catchment and flowpath for F2

Catchment Description: F2 is contained in one catchment. It is located in the middle of the catchment. This would likely be a 770 ft long grassed waterway to treat water in the roadway ditch. Water flows south through the proposed BMP and into Indian Lake. Water leaves Indian Lake via a groundwater connection and enters Sugar Lake via groundwater flow. The catchment is approximately 50% cultivated cropland with some forest (10.67%) and shrub land (11.5%).

Table 7. Ranking parameters for BMP F2.

BMP Name	F2
Rank	16
Project Type	Filtration, filter strip
Project Size (acres)	0.47
Cost Estimate	$78.96 (CRP), $2,417.80 (EQIP)
BMP TSS Load Reduction (tons/year)	0.69
BMP TP Load Reduction (lbs/year)	N/A
Catchment Number(s)	500474
Catchment Size (acres)	17.37
Catchment TSS Load (tons/year/acre)	0.05
Catchment TP Load (lbs/year/acre)	0.03

The computer placement of this BMP was close but the shape was dramatically different than staff design. The placement of the computer drawn BMP would have accepted all of the flow from the northern portion of the catchment. Staff considered the overland flow from the farm field in the southern catchment and modified the design to treat water as it flows through the road ditch. There is a significant increase in potential treatment by the staff design as shown by load reduction comparisons, this is likely due to the increase in size and area that will contribute water to the BMP.

Table 8.. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP F2

	PTMApp Design	Staff Design
Project Size (acres)	0.20	0.47
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	3.23	0.69
TSS-Q3 (tons/year)	4.65	0.99
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.30	0.12
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	3.23	0.74
TSS-Q3 (tons/year)	4.65	1.06
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.30	0.14

F3

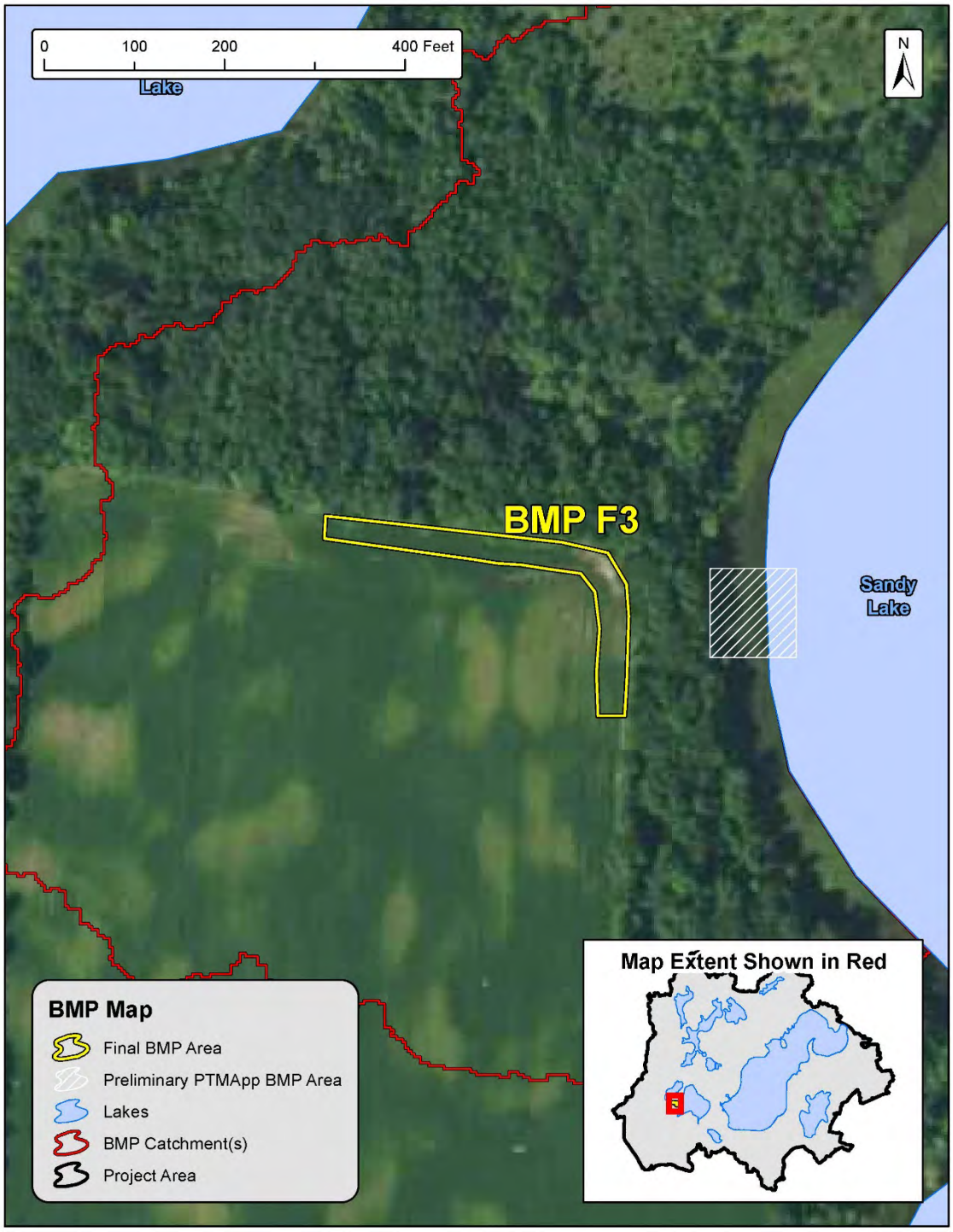

Figure 14. Field scale map of BMP F3, a filter strip. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: F3 is a filtration BMP located west of Sandy and Sugar lakes. A filter will reduce the nutrient load from farmland further to the west. The land is on a single parcel that is privately owned. On site surface soil texture is sandy loam.

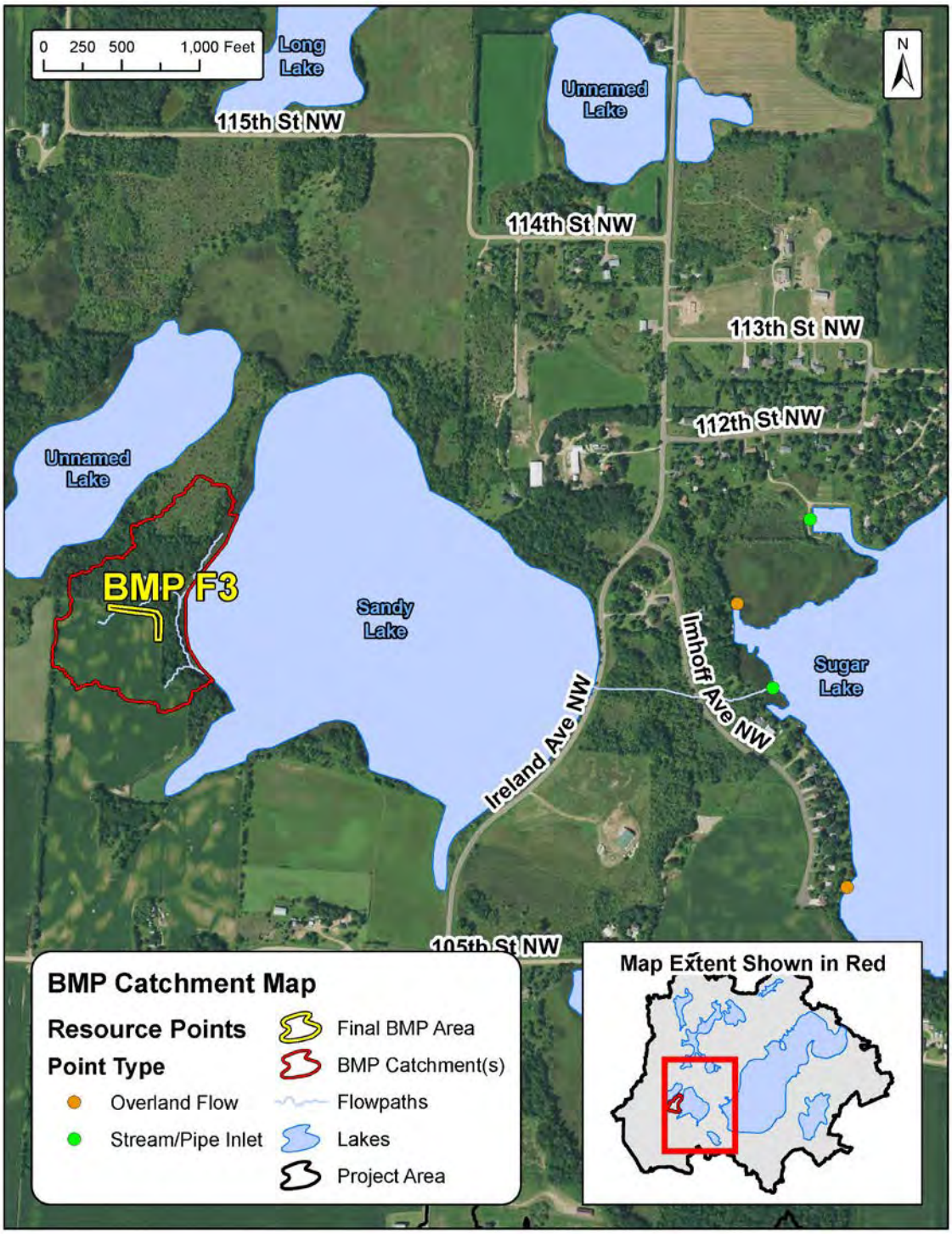

Figure 15. Catchment and flowpath for BMP F3

Catchment Description: F3 is contained in one catchment and is located near the bottom of the catchment. Water in the catchment flows northeast through the proposed BMP and into Sandy Lake then into Sugar Lake via a surface water connection. The primary landuse in the catchment is cultivated crops (42.37%) the remainder is forest (25.67%) and herbaceous (31.91%).

Table 9.. Ranking parameters for BMP F3

BMP Name	F3
Rank	15
Project Type	Filtration, filter strip
Size (acres)	0.33
Cost Estimate	$55.44 (CRP), $333.63 (EQIP)
BMP TSS Load Reduction (tons/year)	0.61
BMP TP Load Reduction (lbs/year)	N/A
Catchment Number(s)	500511
Catchment Size (acres)	22.15
Catchment TSS Load (tons/year/acre)	0.08
Catchment TP Load (lbs/year/acre)	0.05

The placement of this BMP was close but shape of the computer generated design is significantly different than the staff design. The placement of the BMP appears to be off slightly due to the coarseness of the land use layer used, but similar issues are to be expected with any computer model. The computer put the location in a crop area according to the landuse model but aerial imagery reveals it is actually a wetland. The shape of the PTMApp design is square but our staff would wrap the filter strip around the corner of the cultivated crop field. BMP load reductions appear to be lower in a 10 year storm, but higher in a 2 year storm. This is potentially due to the fact that the staff design is further upstream of the water flow path.

Table 10.. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP F3

	PTMApp Design	Staff Design
Size	0.21	0.33
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	2.96	0.61
TSS-Q3 (tons/year)	4.26	0.88
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.65	0.13
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	2.96	0.61
TSS-Q3 (tons/year)	4.26	0.88
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.65	0.13

F4

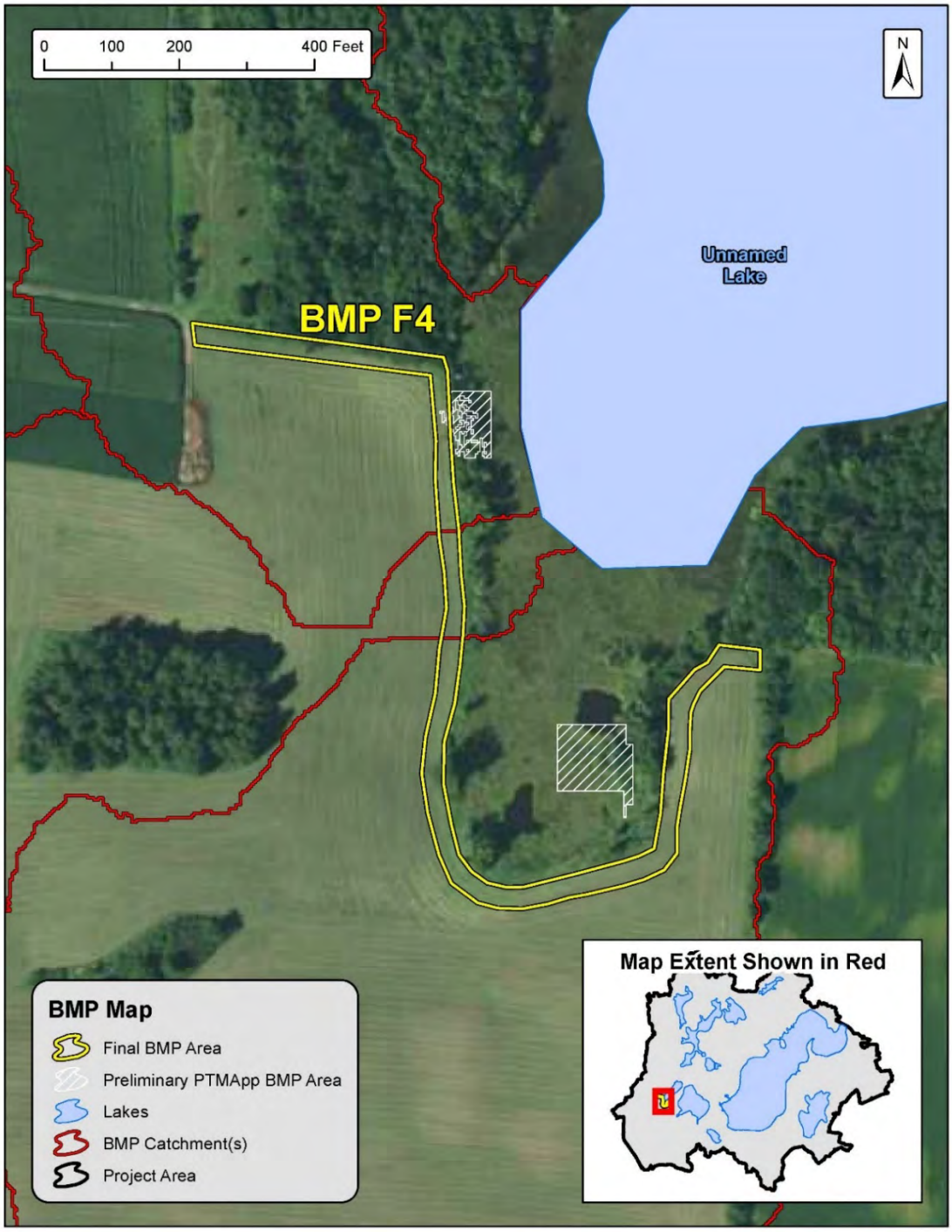

Figure 16. Field scale map of BMP F4, a filter strip. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: F4 is a filtration BMP located west of Sugar and Sandy Lakes. A filter strip would reduce the nutrient load from the farmland from the west and southwest to the wetland it borders. The BMP is located on a single parcel that is privately owned. The onsite surface soil texture is sandy loam with muck border.

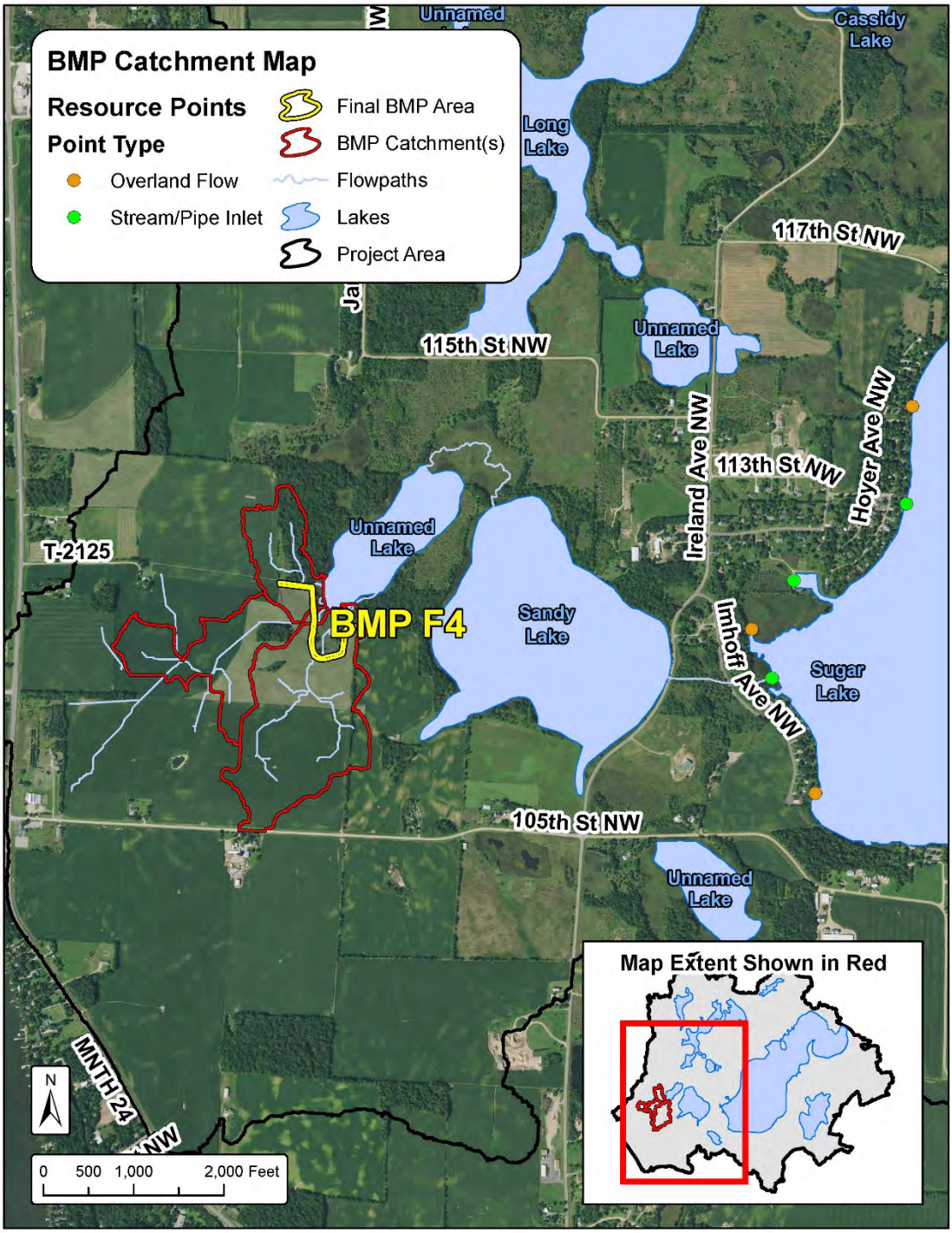

Figure 17. Catchment and flowpath for BMP F4

Catchment Description: F4 crosses through 3 field scale catchments. Flow out of the BMP area converges in the wetland the BMP borders. Runoff comes from the west flows through the BMP, into a wetland, an unnamed lake to Lake Sandy and finally into Sugar Lake through a surface water connection. The landuse of the combined catchments is mostly cultivated crops (88.73%).

Table 12. Ranking parameters for BMP F4

BMP Name	F4
Rank	4
Project Type	Filtration, filter strip
Project Size (acres)	1.25
Cost Estimate	$210.00 (CRP), $1,263.75 (EQIP)
BMP TSS Load Reduction (tons/year)	19.70
BMP TP Load Reduction (lbs/year)	N/A
Catchment Number(s)	500504, 500454, 469
Catchment Size (acres)	106.01
Catchment TSS Load (tons/year/acre)	0.69
Catchment TP Load (lbs/year/acre)	0.19

Shape and placement comparison of F4 has very similar issues as those mentioned above for F3. The computer placement was in a wetland but that is likely due to the coarseness of the landuse layer used as an input. Also the shape would be a more continuous buffer around the entire edge of the cropland to capture as much overland flow as possible. The differences in load reductions can likely be attributed to size. However, SWCD staff note the load reduction in the 2 year storm is almost 10 times the reduction in a 10 year for the staff design. While we recognize it is possible a smaller storm could result in more efficient removal such an extreme difference is unlikely.

Table 13. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP F4

	PTMApp Design	Staff Design
Size (acres)	0.36	1.25
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	1.64	19.70
TSS-Q3 (tons/year)	3.81	28.36
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.15	1.89
$Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	1.91	29.23
TSS-Q3 (tons/year)	4.21	42.09
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.18	3.49

F5

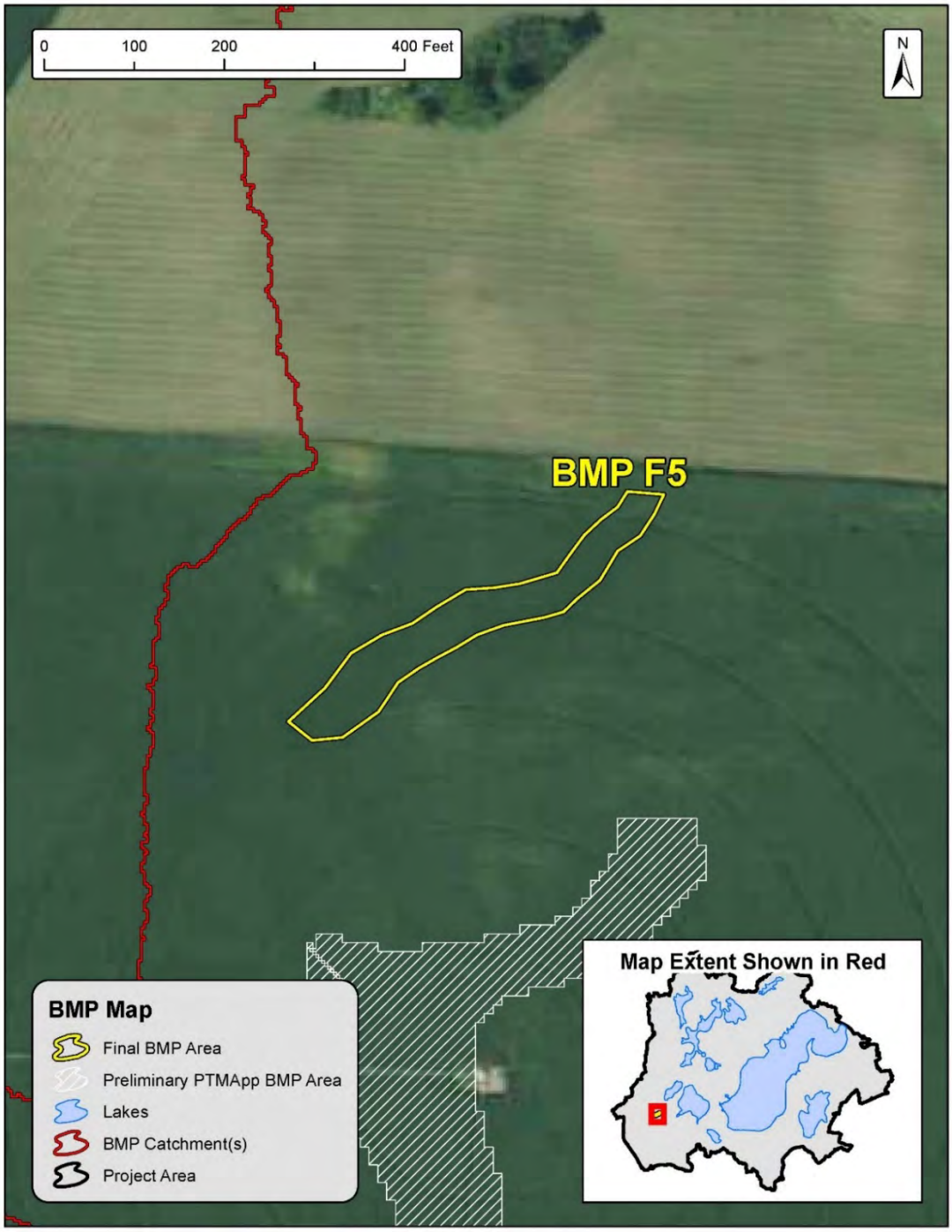

Figure 18. Field scale map of BMP F5, a grassed waterway. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: F5 is a filtration BMP west of Sugar and Sandy Lakes. Wright SWCD would suggest a 476ft grass waterway in this location. It is surrounded by cultivated crop, although it is placed so that it terminates at the edge of a parcel. It is completely contained within one parcel that is privately owned. The onsite surface soil texture is sandy loam.

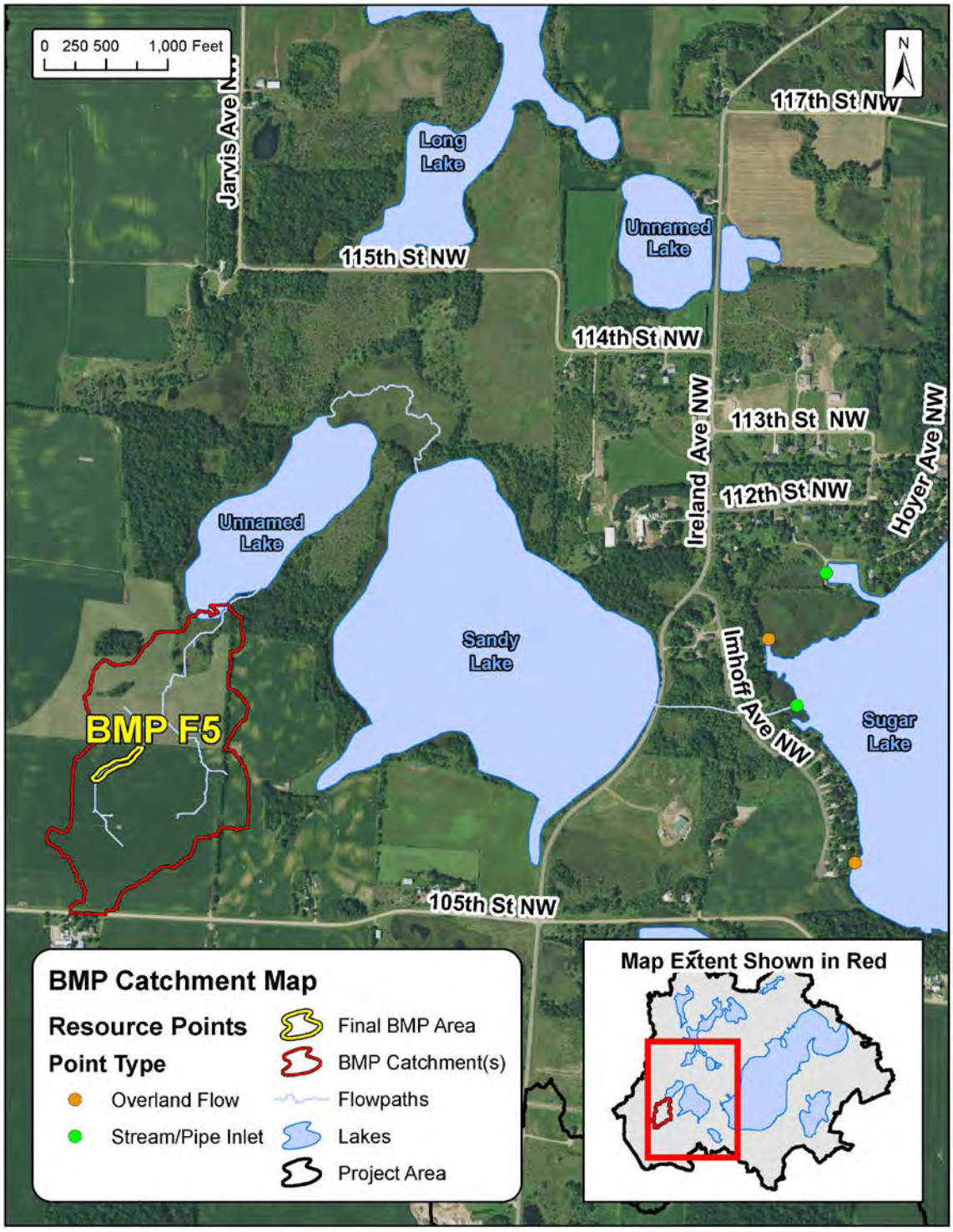

Figure 19. Catchment and flowpath for BMP F5

Catchment Description: F5 is contained in one catchment and is located in the middle. Flow comes from the south through the BMP and eventually into a wetland, an unnamed lake to Lake Sandy and finally into Sugar Lake through a surface water connection. The catchment is overwhelmingly cultivated cropland (92.8%).

Table 14. Ranking parameters for BMP F5

BMP Name	F5
Rank	10
Project Type	Filtration
Project Size (acres)	0.52
Cost Estimate	$ 87.36 (CRP), $1,495.61 (EQIP)
BMP TSS Load Reduction (tons/year)	1.67
BMP TP Load Reduction (lbs/year)	N/A
Catchment Number(s)	500504
Catchment Size (acres)	57.57
Catchment TSS Load (tons/year/acre)	0.21
Catchment TP Load (lbs/year/acre)	0.07

Table 15. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP F5

	PTMApp Design	Staff Design
Project Size (acres)	2.23	0.52
10 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	3.57	1.67
TSS-Q3 (tons/year)	5.14	2.41
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.51	0.25
2 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	3.57	1.91
TSS-Q3 (tons/year)	5.14	2.75
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.51	0.31

F6

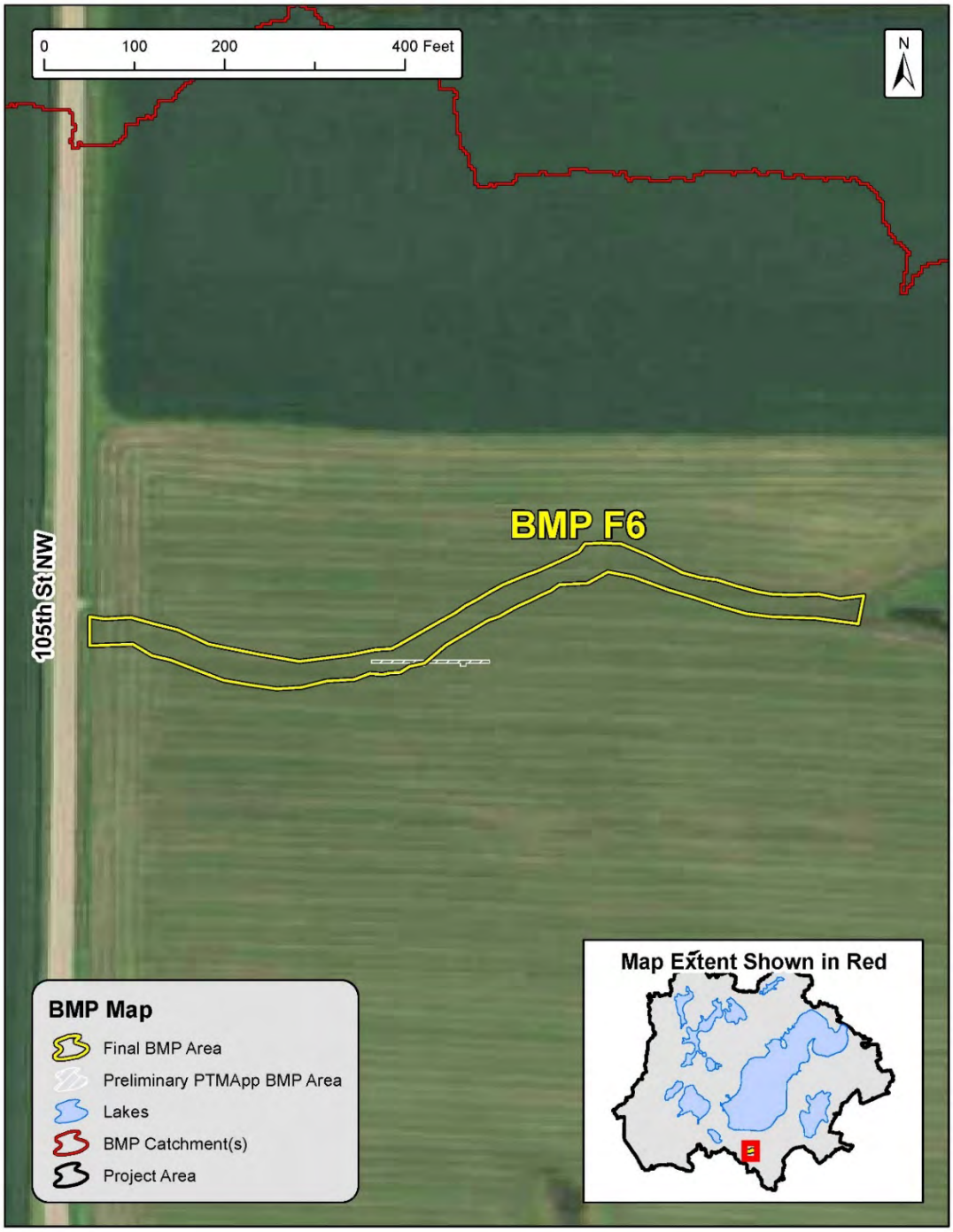

Figure 20. Field scale map of BMP F6, a grassed waterway. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: F6 is a filtration BMP located south of Sugar Lake. This practice is surrounded by cultivated cropland. There is an obvious wet spot at the top of the BMP, it follows flow across a farm field and terminates at the parcel edge. It is contained in a single parcel that is privately owned. The onsite surface soil texture is loam.

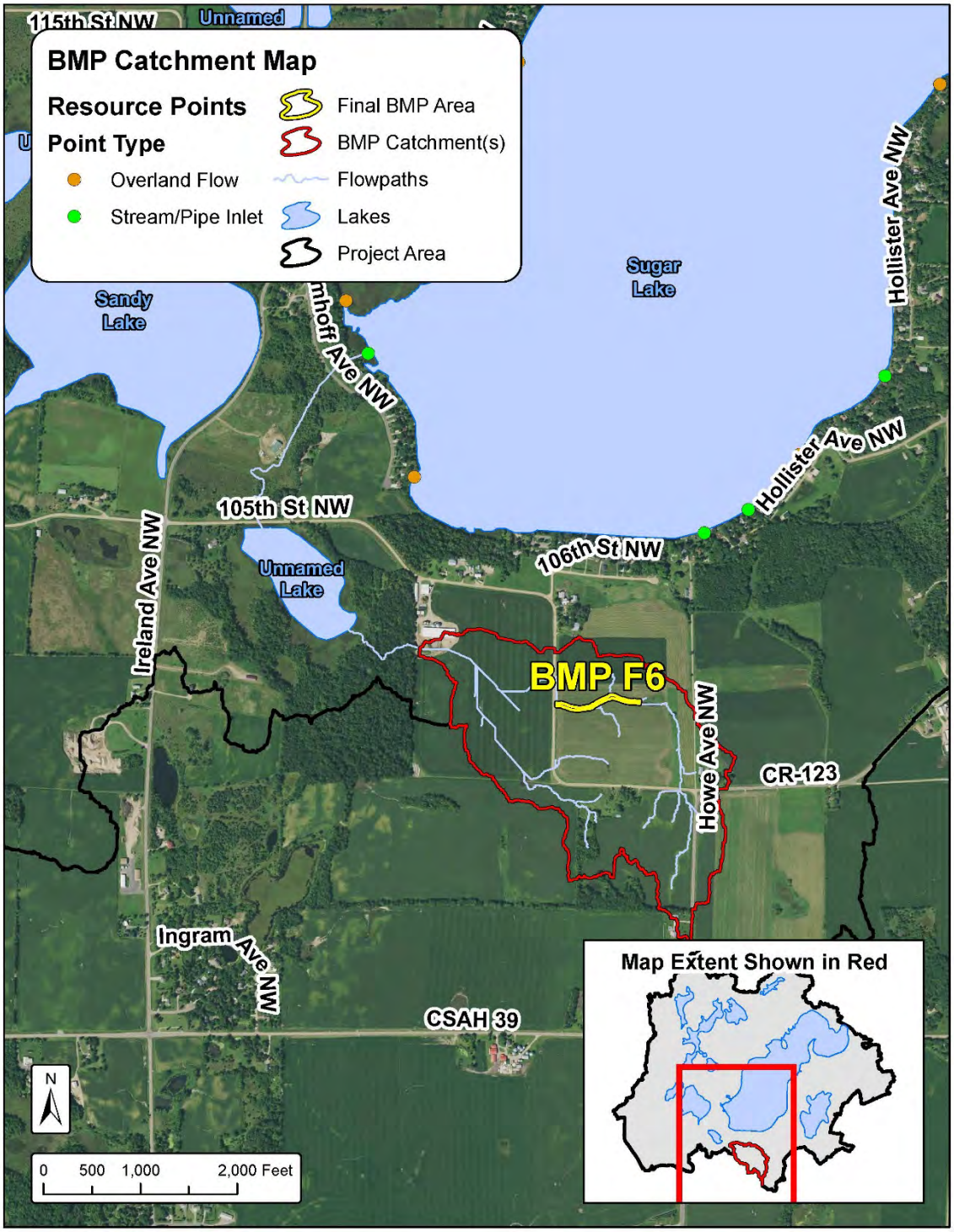

Figure 21. Catchment and flowpath for BMP F6

Catchment Description: F6 is contained in a single catchment. It is located near the top of the catchment. Water flows north through the proposed BMP, over more farmland, through an unnamed lake to Sugar Lake via a surface water connection. The landuse in the catchment is primarily farmland with cultivated crops at 68.46% and hay/pasture at 19.33%.

Table 16. Ranking parameters for BMP F6

BMP Name	F6
Rank	8
Project Type	Filtration
Project Size (acres)	0.60
Cost Estimate	$100.80 (CRP), $2,813.60 (EQIP)
BMP TSS Load Reduction (tons/year)	5.34
BMP TP Load Reduction (lbs/year)	N/A
Catchment Number(s)	500648
Catchment Size (acres)	124
Catchment TSS Load (tons/year/acre)	0.37
Catchment TP Load (lbs/year/acre)	0.12

Table 17. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP F6

	PTMApp Design	Staff Design
Project Size (acres)	0.28	0.60
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	N/A	N/A
TSS-Q2 (tons/year)	1.53	5.34
TSS-Q3 (tons/year)	2.20	7.69
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.06	0.25
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)		N/A
TSS-Q2 (tons/year)	1.53	8.22
TSS-Q3 (tons/year)	2.20	11.83
TP-Q1 (lbs /year)	N/A	N/A
TP-Q2 (lbs /year)	N/A	N/A
TP-Q3 (lbs /year)	0.06	1.44

Storage

Storage BMPs are intended to slow water travel, this can have several effects. First, slowing the water down reduces the erosion potential preventing sediment from being pick up in the first place. Second, the reduction in velocity and power allows some sediment already in suspension to fall out of suspension.

Cost estimations for the selected storage BMPs were created by Wright SWCD staff. Standard local pricing was used for materials and the basin construction was based on a per linear foot pricing. The pricing for the storage BMPs is likely the most accurate since the greatest number of factors were able to be taken into account.

S1

Figure 22. Field scale map of BMP S1, a storage basin.. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: S1 is a storage BMP on the south side of Sugar Lake. The BMP is located just over 500ft from the lakeshore. This BMP has cultivated crop upstream and downstream is nearshore cabin and house development. Onsite surface soil texture is loam.

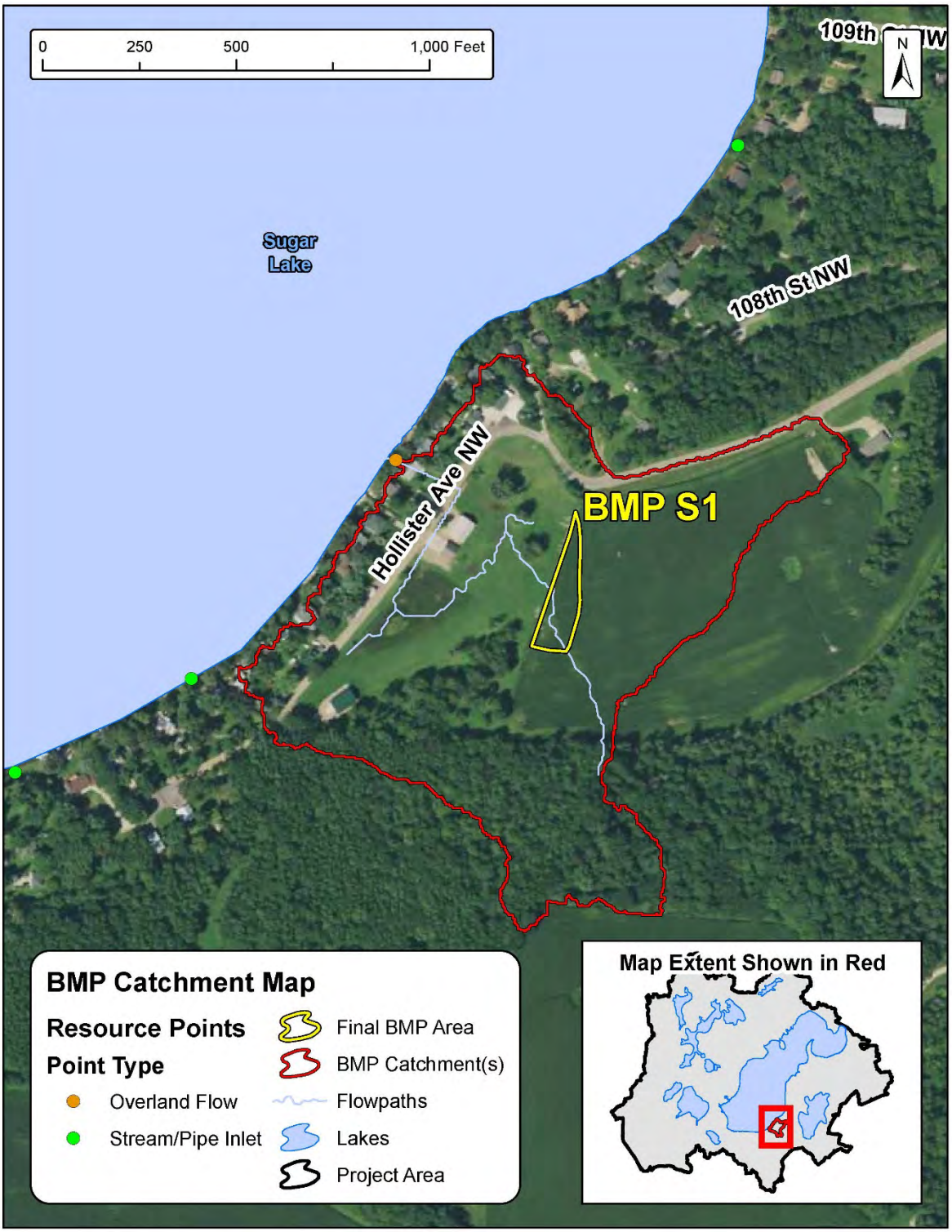

Figure 23. Catchment and flowpath for BMP S1

Catchment Description: S1 is contained in one catchment and is located near the top of the catchment. Flow comes from the east and south through the BMP and continues overland to Sugar Lake. The landuse in the catchment is varied hay/pasture (34.48%), cultivated crops (14.25%), forest (26.27%) and developed (15.6%).

Table 18. Ranking parameters for BMP S1

BMP Name	S1
Rank	12
Project Type	Storage
Project Size (acres)	0.51
Cost Estimate	$10,148
BMP TSS Load Reduction (tons/year)	2.72
BMP TP Load Reduction (lbs/year)	0.17
Catchment Number(s)	9919
Catchment Size (acres)	24.17
Catchment TSS Load (tons/year/acre)	0.25
Catchment TP Load (lbs/year/acre)	0.12

Table 19. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP S1

	PTMApp Design	Staff Design
Size (acres)	13.62	0.51
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	3.76	0.95
TSS-Q2 (tons/year)	10.83	2.72
TSS-Q3 (tons/year)	13.66	3.43
TP-Q1 (lbs /year)	0.06	N/A
TP-Q2 (lbs /year)	2.48	0.17
TP-Q3 (lbs /year)	4.39	0.30
Load reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	3.76	1.22
TSS-Q2 (tons/year)	10.83	3.51
TSS-Q3 (tons/year)	13.66	4.43
TP-Q1 (lbs /year)	0.06	0.01
TP-Q2 (lbs /year)	2.47	0.28
TP-Q3 (lbs /year)	4.39	0.49

S2

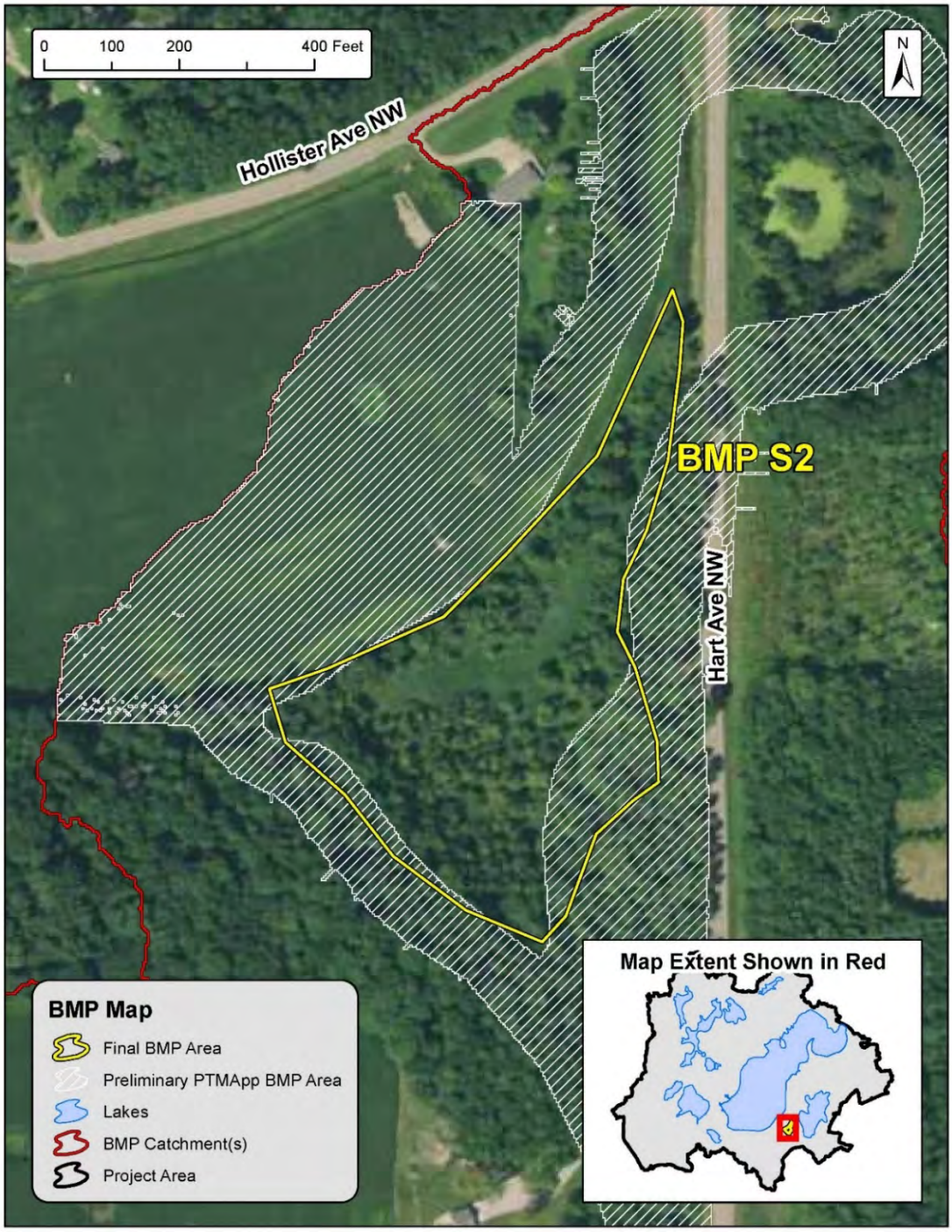

Figure 24. Field scale map of BMP S2, a storage basin.. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: S2 is a storage BMP on the south side of Sugar Lake. The proposed location is just over 1,000ft from Sugar Lake. This practice would reduce flows to near shore property owners. S2 crosses into 3 parcels that are each privately owned, but members of one family. The primary onsite surface soil texture is muck.

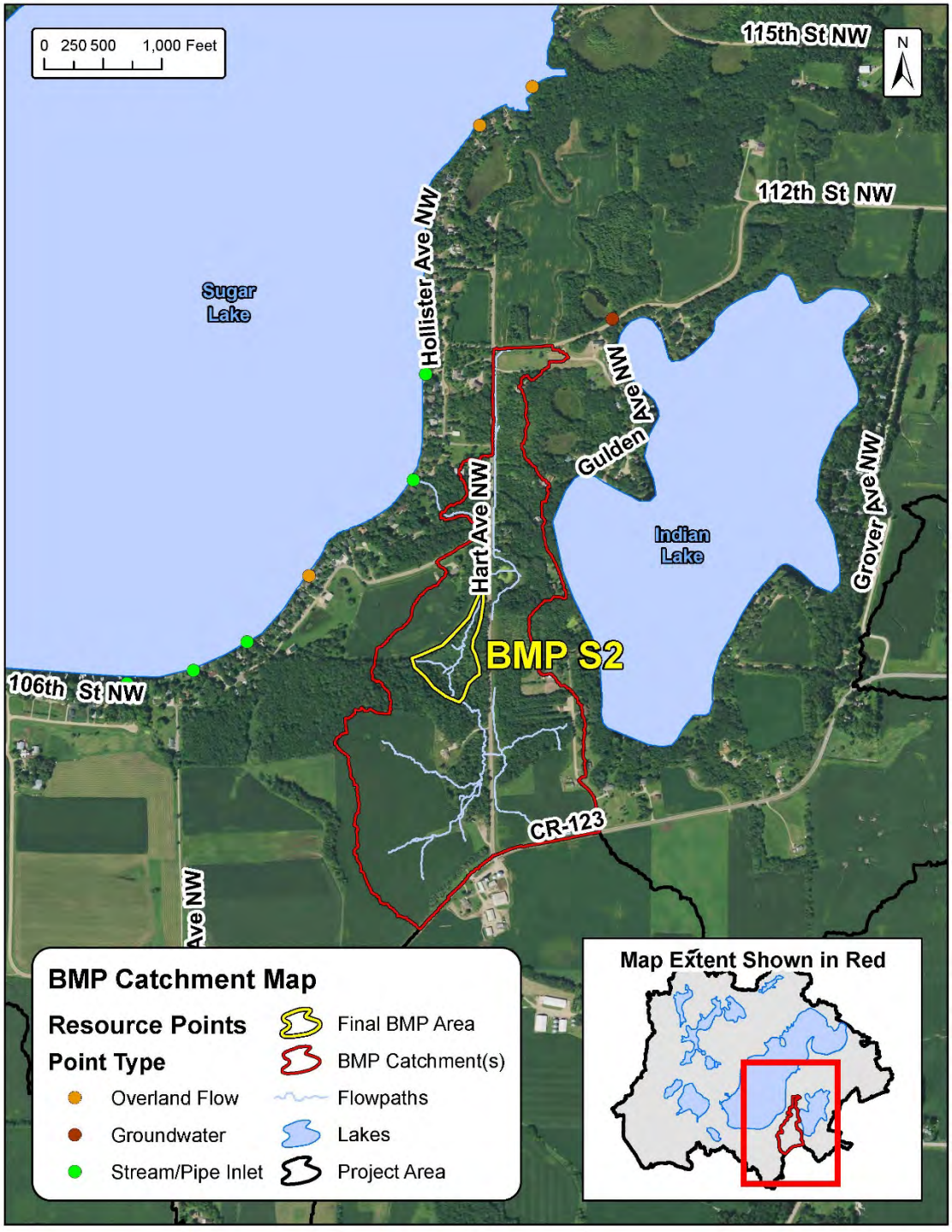

Figure 25. Catchment and flowpath for BMP S2

Catchment Description: S2 is contained in one catchment. It is located near the bottom of the catchment. Flow comes from the south through the proposed BMP and travels to Sugar Lake through a culvert. Landuse in the catch is primarily farmland (31.52% cultivated crops and 11.13% hay/pasture). There is also some forest (26.97%) and development near the lakeshore (19.94%).

Table 20. Ranking parameters for BMP S2

BMP Name	S2
Rank	1
Project Type	Storage
Project Size (acres)	5.41
Cost Estimate	$69,575
BMP TSS Load Reduction (tons/year)	31.65
BMP TP Load Reduction (lbs/year)	4.43
Catchment Number(s)	500544
Catchment Size (acres)	122.31
Catchment TSS Load (tons/year/acre)	0.39
Catchment TP Load (lbs/year/acre)	0.14

Table 21. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP S2

	PTMApp Design	Staff Design
Project Size (acres)	18.77	5.41
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	27.24	11.01
TSS-Q2 (tons/year)	78.31	31.65
TSS-Q3 (tons/year)	98.74	39.91
TP-Q1 (lbs /year)	0.33	0.11
TP-Q2 (lbs /year)	13.03	4.43
TP-Q3 (lbs /year)	23.06	7.84
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	27.24	11.01
TSS-Q2 (tons/year)	78.31	31.65
TSS-Q3 (tons/year)	98.74	39.91
TP-Q1 (lbs /year)	0.33	0.11
TP-Q2 (lbs /year)	13.03	4.43
TP-Q3 (lbs /year)	23.06	7.84

S3

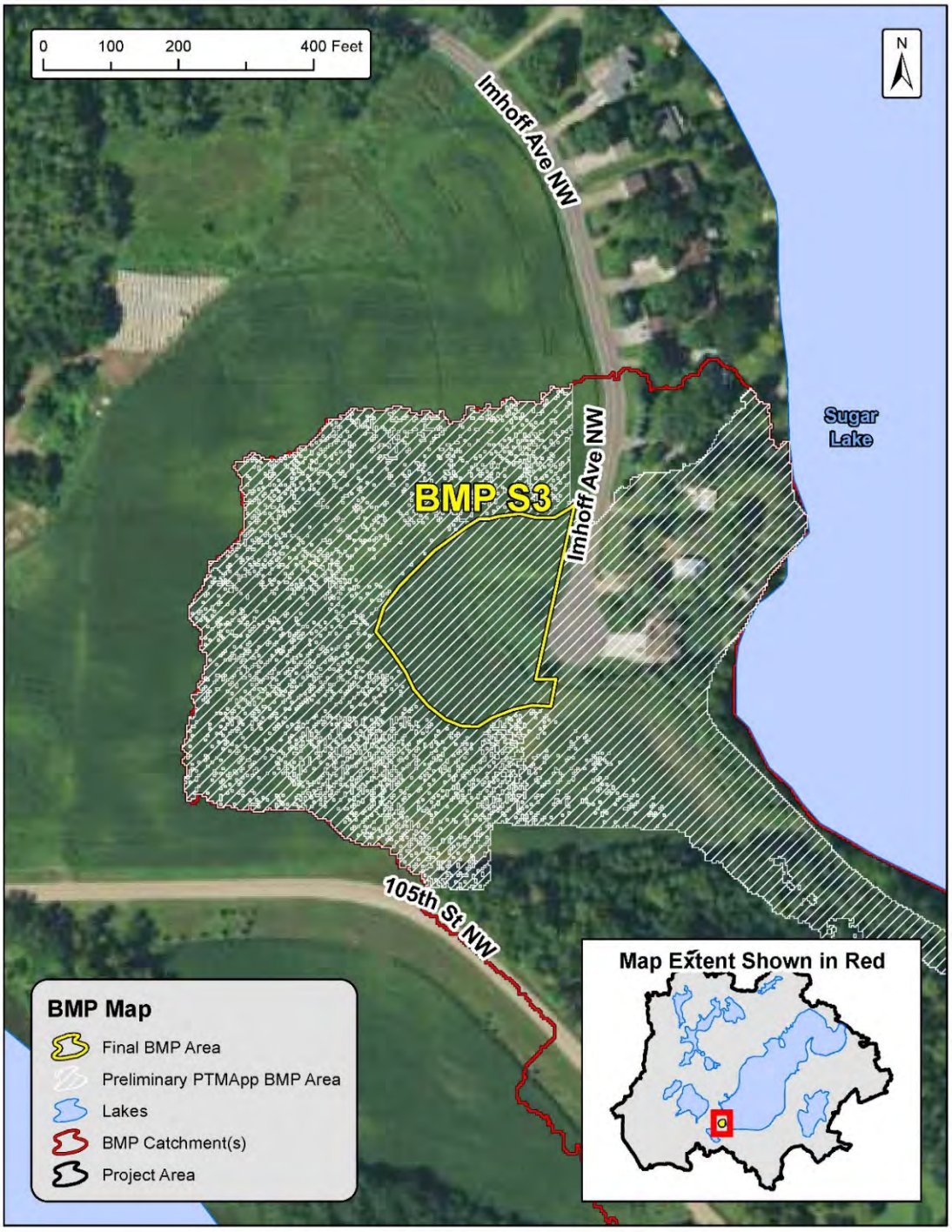

Figure 26. Field scale map of BMP S3, a storage basin. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: S3 is a storage BMP located on the west side of Sugar Lake. It is located within 350ft of Sugar Lake. The proposed location of S3 is on an obvious wet spot in a farmer's field. There is only one private landowner for this parcel. Primary onsite surface soil texture is loamy sand.

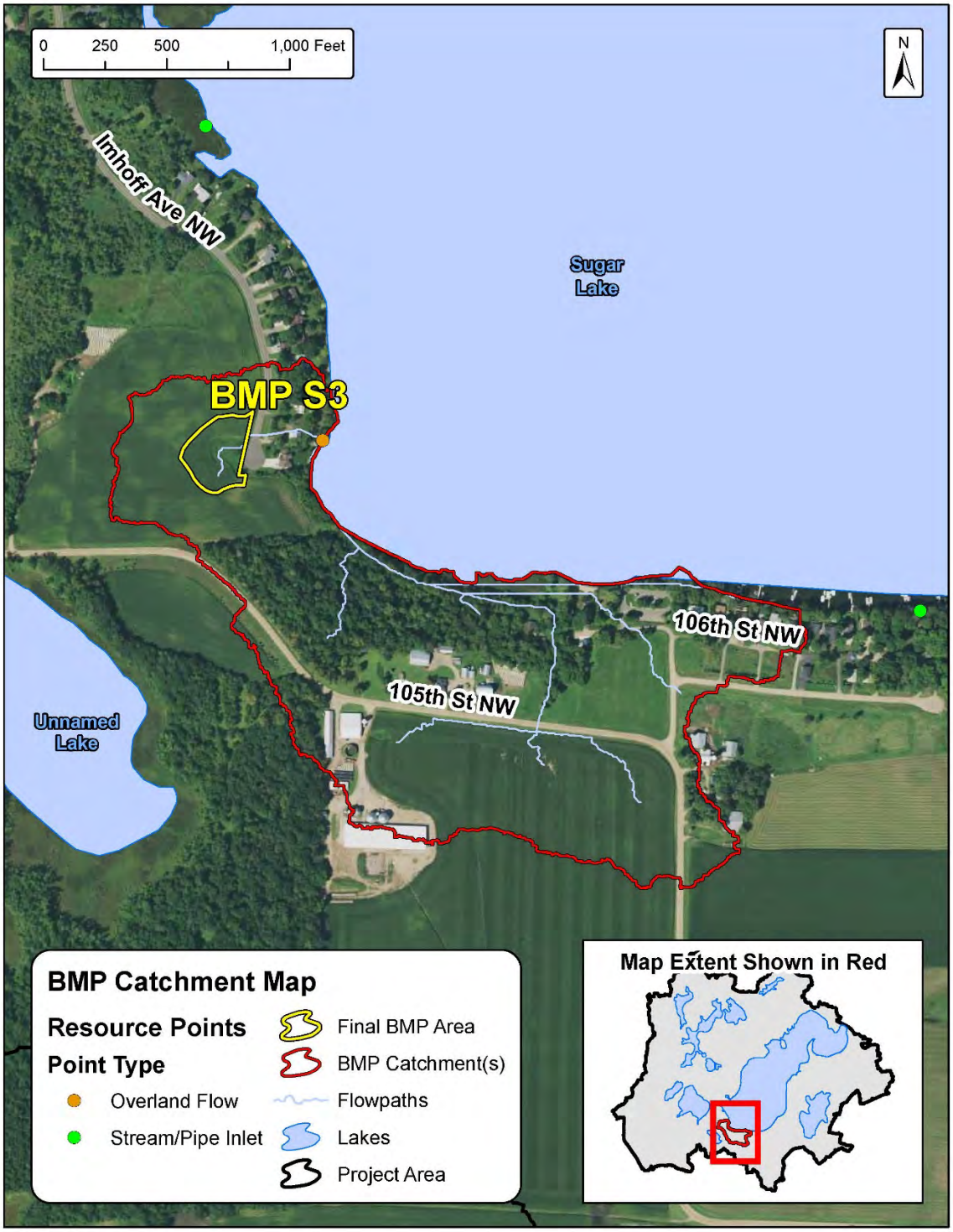

Figure 27. Catchment and flowpath for BMP S3

Catchment Description: S3 is contained in a single catchment. It is located near the top of the catchment. S3 receives water from the west, water will then flow overland to Sugar Lake. Landuse in the catchment is primarily farmland (39.5% cultivated cropland, 10.06% hay/pasture). There is also some forest (26.94%) and development (16.98%) near the lakeshore.

Table 22. Ranking parameters for BMP S3

BMP Name	S3
Rank	7
Project Type	Storage
Project Size (acres)	1.42
Cost Estimate	$10,126
BMP TSS Load Reduction (tons/year)	3.81
BMP TP Load Reduction (lbs/year)	0.54
Catchment Number(s)	9922
Catchment Size (acres)	61.15
Catchment TSS Load (tons/year/acre)	0.27
Catchment TP Load (lbs/year/acre)	0.15

Table 23. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for3 BMP S3

	PTMApp Design	Staff Design
Project Size (acres)	0.28	1.42
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	9.40	1.33
TSS-Q2 (tons/year)	27.01	3.81
TSS-Q3 (tons/year)	34.06	4.81
TP-Q1 (lbs /year)	0.19	0.01
TP-Q2 (lbs /year)	7.32	0.54
TP-Q3 (lbs /year)	12.96	0.95
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	9.40	1.33
TSS-Q2 (tons/year)	27.01	3.81
TSS-Q3 (tons/year)	34.06	4.81
TP-Q1 (lbs /year)	0.19	0.01
TP-Q2 (lbs /year)	7.32	0.54
TP-Q3 (lbs /year)	12.96	0.95

S4

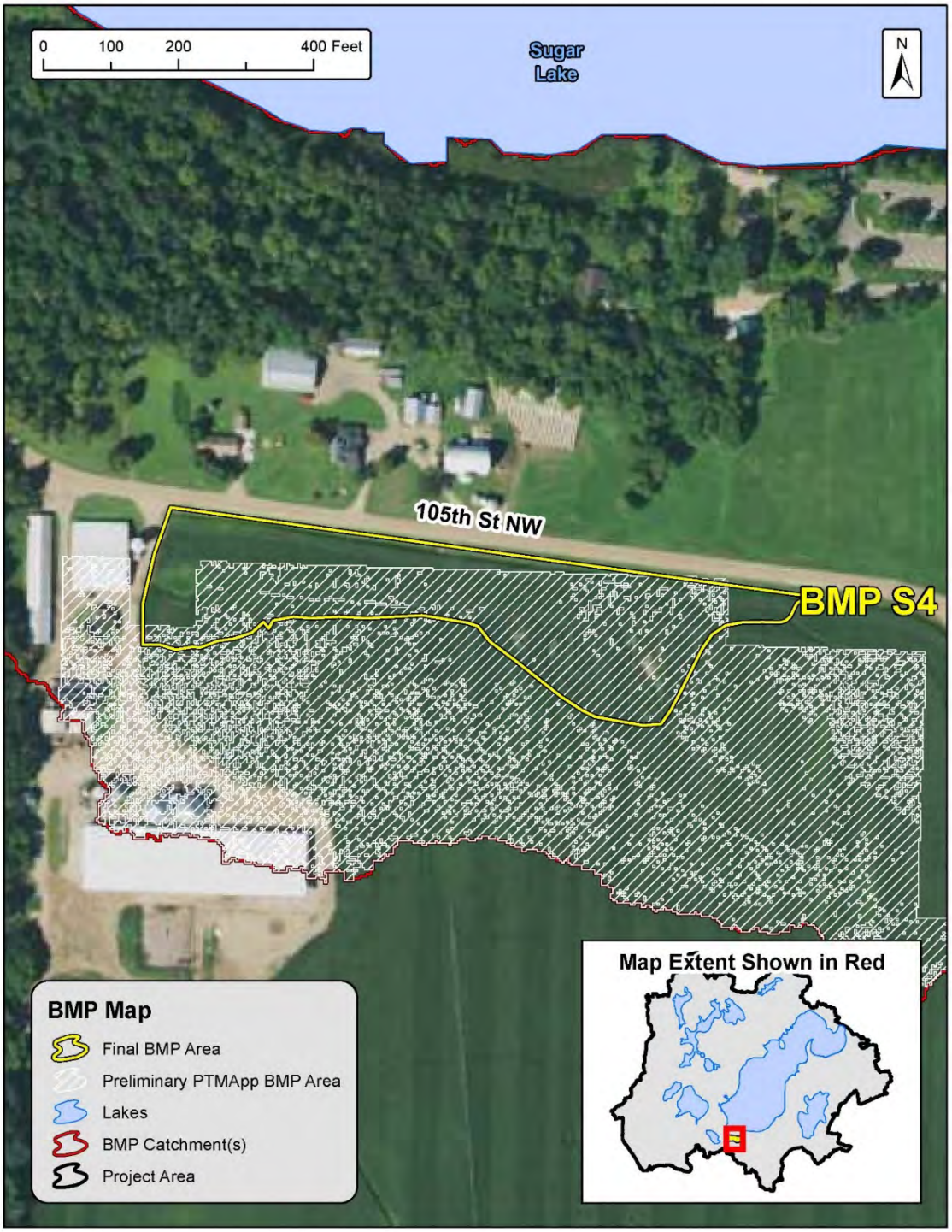

Figure 28. Field scale map of BMP S4, storage basin. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: S4 is a storage BMP on the south side of Sugar Lake. It is located within 700ft of the lakeshore. It would cross two parcels that are owned by the same private landowner. Primary onsite surface soil texture is Loam.

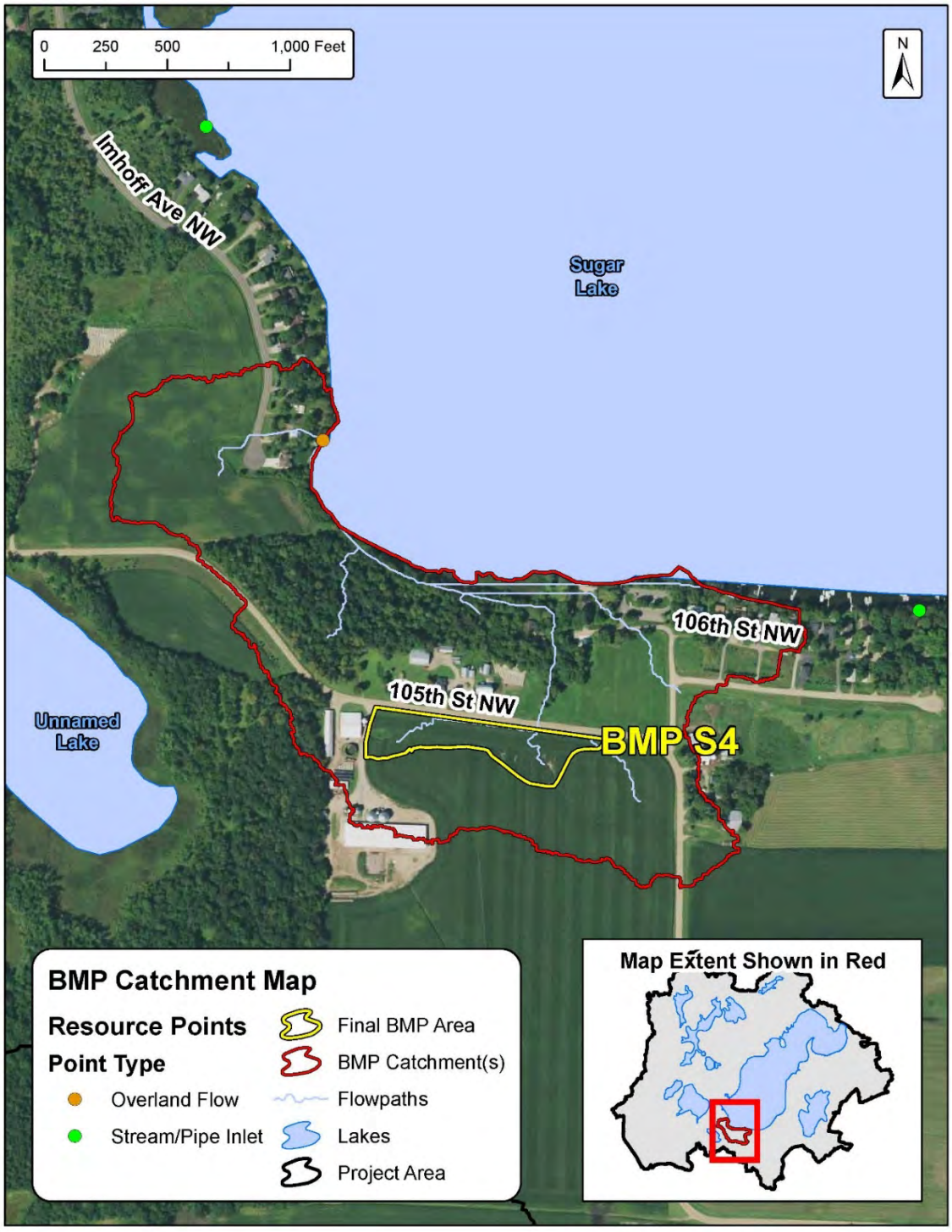

Figure 29. Catchment and flowpath for BMP S4

Catchment Description: S4 is contained in a single catchment. It is located near the top of the catchment. S4 receives water from the south, water will then flow overland to Sugar Lake. Landuse in the catchment is primarily farmland (39.5% cultivated cropland, 10.06% hay/pasture). There is also some forest (26.94%) and development (16.98%) near the lakeshore.

Table 24. Ranking parameters for BMP S4

BMP Name	S4
Rank	5
Project Type	Storage
Project Size (acres)	3.22
Cost Estimate	$13,591
BMP TSS Load Reduction (tons/year)	5.87
BMP TP Load Reduction (lbs/year)	1.39
Catchment Number(s)	9922
Catchment Size (acres)	61.15
Catchment TSS Load (tons/year/acre)	0.27
Catchment TP Load (lbs/year/acre)	0.15

Table 25. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP S4

	PTMApp Design	Staff Design
Project Size (acres)	11.01	3.22
10 year 24 hour storm event		
TSS-Q1(tons/year)	2.31	2.04
TSS-Q2 (tons/year)	6.67	5.87
TSS-Q3 (tons/year)	8.40	7.40
TP-Q1 (lbs /year)	0.02	0.04
TP-Q2 (lbs /year)	0.86	1.39
TP-Q3 (lbs /year)	1.52	2.45
2 year 24 hour storm event		
TSS-Q1(tons/year)	2.46	2.04
TSS-Q2 (tons/year)	7.08	5.87
TSS-Q3 (tons/year)	8.93	7.40
TP-Q1 (lbs /year)	0.02	0.04
TP-Q2 (lbs /year)	0.96	1.39
TP-Q3 (lbs /year)	1.70	2.45

S5

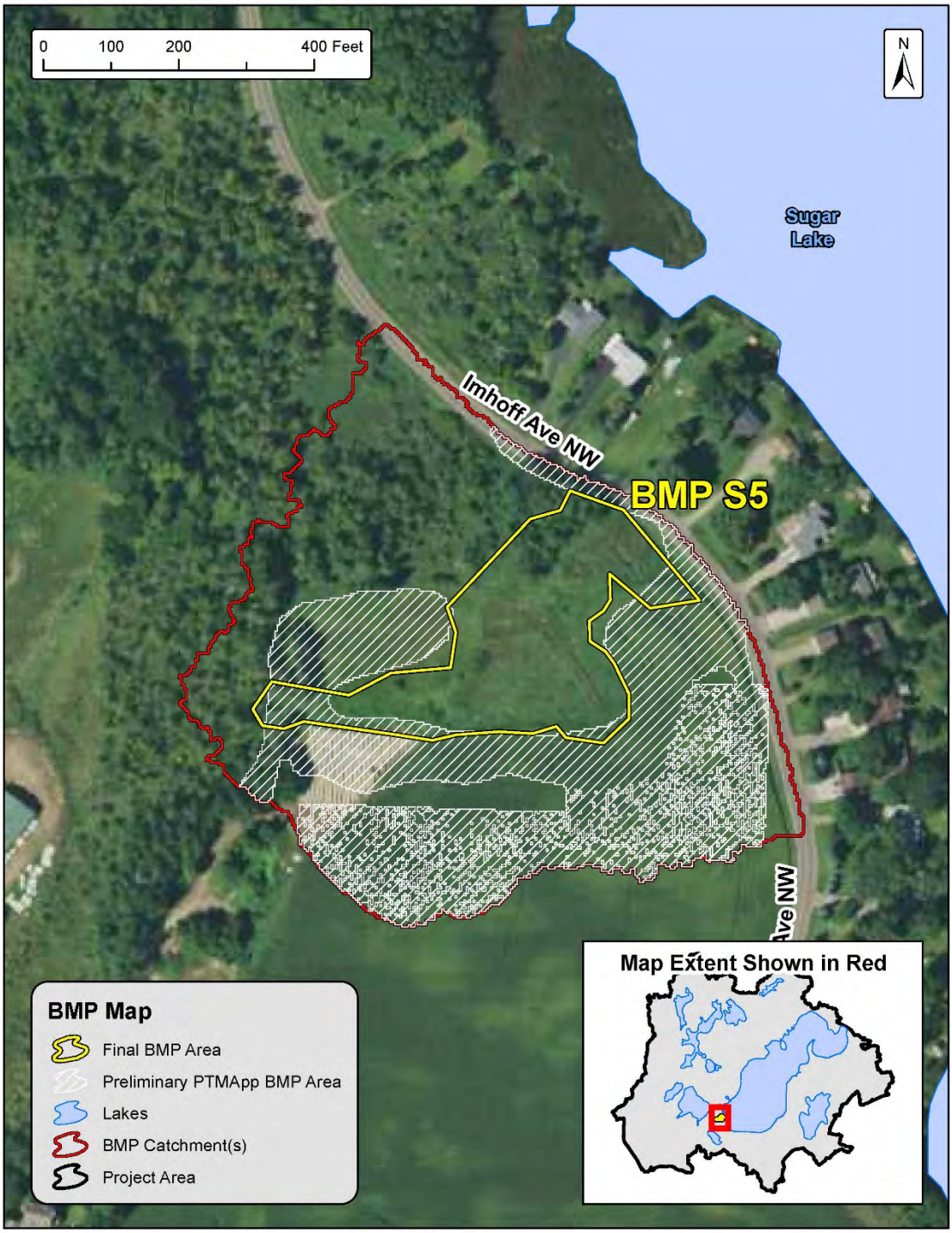

Figure 30. Field scale map of BMP S5, storage basin. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: S5 is a storage BMP that is located on the southwest corner of Sugar Lake. It is located within 350ft of the lakeshore. It is contained within a single parcel that is privately owned. Primary onsite surface soil textures are muck and sandy loam.

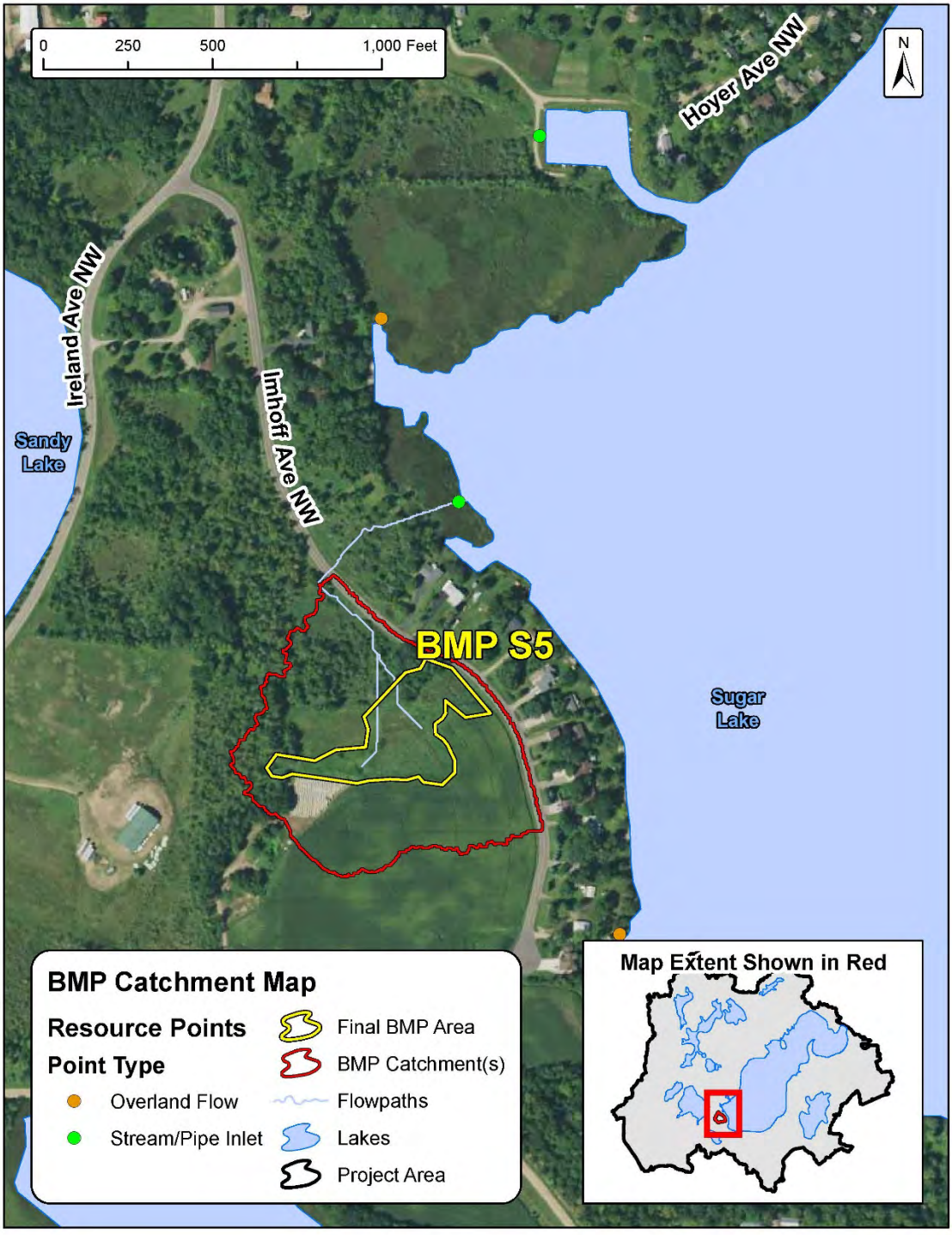

Figure 31. Catchment and flowpath for BMP S5

Catchment Description: S5 is located within a single catchment. It is near the top of the catchment. Water flows from the south through the BMP, enters ditch and flows into Sugar Lake via a culvert. Landuse in the catchment is primarily cultivated cropland (57.90%), there is also some forest (23.73%) and wetland (15.52%).

Table 26. Ranking parameters for BMP S5

BMP Name	S5
Rank	14
Project Type	Storage
Project Size (acres)	2.31
Cost Estimate	$17,435
BMP TSS Load Reduction (tons/year)	0.94
BMP TP Load Reduction (lbs/year)	0.25
Catchment Number(s)	500534
Catchment Size (acres)	11.17
Catchment TSS Load (tons/year/acre)	0.20
Catchment TP Load (lbs/year/acre)	0.11

Table 27. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP S5

	PTMApp Design	Staff Design
Project Size (acres)	0.60	2.31
Loading in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	0.41	0.33
TSS-Q2 (tons/year)	1.20	0.94
TSS-Q3 (tons/year)	1.51	1.19
TP-Q1 (lbs /year)	N/A	0.01
TP-Q2 (lbs /year)	0.16	0.25
TP-Q3 (lbs /year)	0.29	0.44
Loading in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	0.41	0.33
TSS-Q2 (tons/year)	1.20	0.94
TSS-Q3 (tons/year)	1.51	1.19
TP-Q1 (lbs /year)	N/A	0.01
TP-Q2 (lbs /year)	0.16	0.25
TP-Q3 (lbs /year)	0.29	0.44

Source Reduction

Source reduction practices are intended to reduce the amount of contaminants coming off of the field therefore reducing pollution at is place of origin. These are generally management practices on farmland such as introducing a new crop rotation, adding a cover crop, using conservation tillage or improving nutrient management strategies.

Cost of implementing a source reduction practice is highly variable depending on the project choice. For example taking a field out of production and into CRP would result in a loss of income from crop production but may net a profit based on federal compensation and current crop prices. A change in rotation may also yield an income loss because certain crops are less profitable. Cover crops require an additional planting but can have a profit if the land is rented for pasture. Equipment changes due to any of these programs is also an indirect cost to the producer. Conservation tillage is a great example of this, less tillage saves a producer money but if he needs to buy a new piece of EQIPment to do it his savings will be offset for several years.

In an effort to standardize the costs for this project we use cover crop as our standard practice. This is in part because we assume that cover crops will have one of the highest direct costs per acre. EQIPment changes are not included in this assumption. Wright SWCD is currently working on a new cost-share program to fund cover crop plantings (especially inter-seeding). NRCS also funds cover crops through EQIP. Both the Wright SWCD program and EQIP use a flat rate price of $35-$70/acre depending on seed mixes, this is assumed to cover seed and installation cost.

SR1

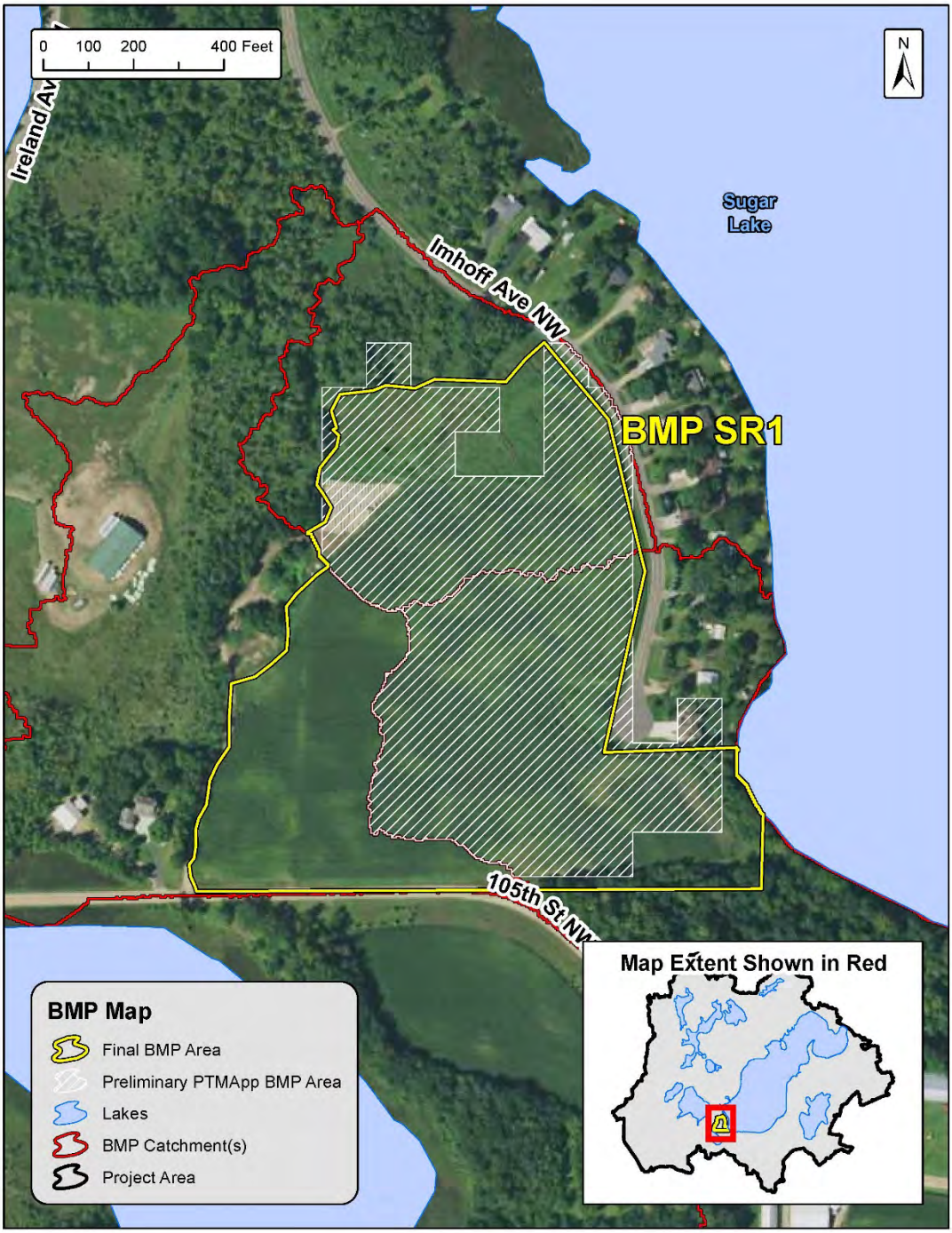

Figure 32. Field scale map of BMP SR1, a management BMP. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: SR1 is a source reduction BMP located on the southwest corner of Sugar Lake. The majority of the field is adjacent to a road and near shore property, a small portion of the field is very near the lakeshore with only a small vegetated buffer protecting the lake. Surface soil texture is primarily sandy loam with some loamy sand and muck.

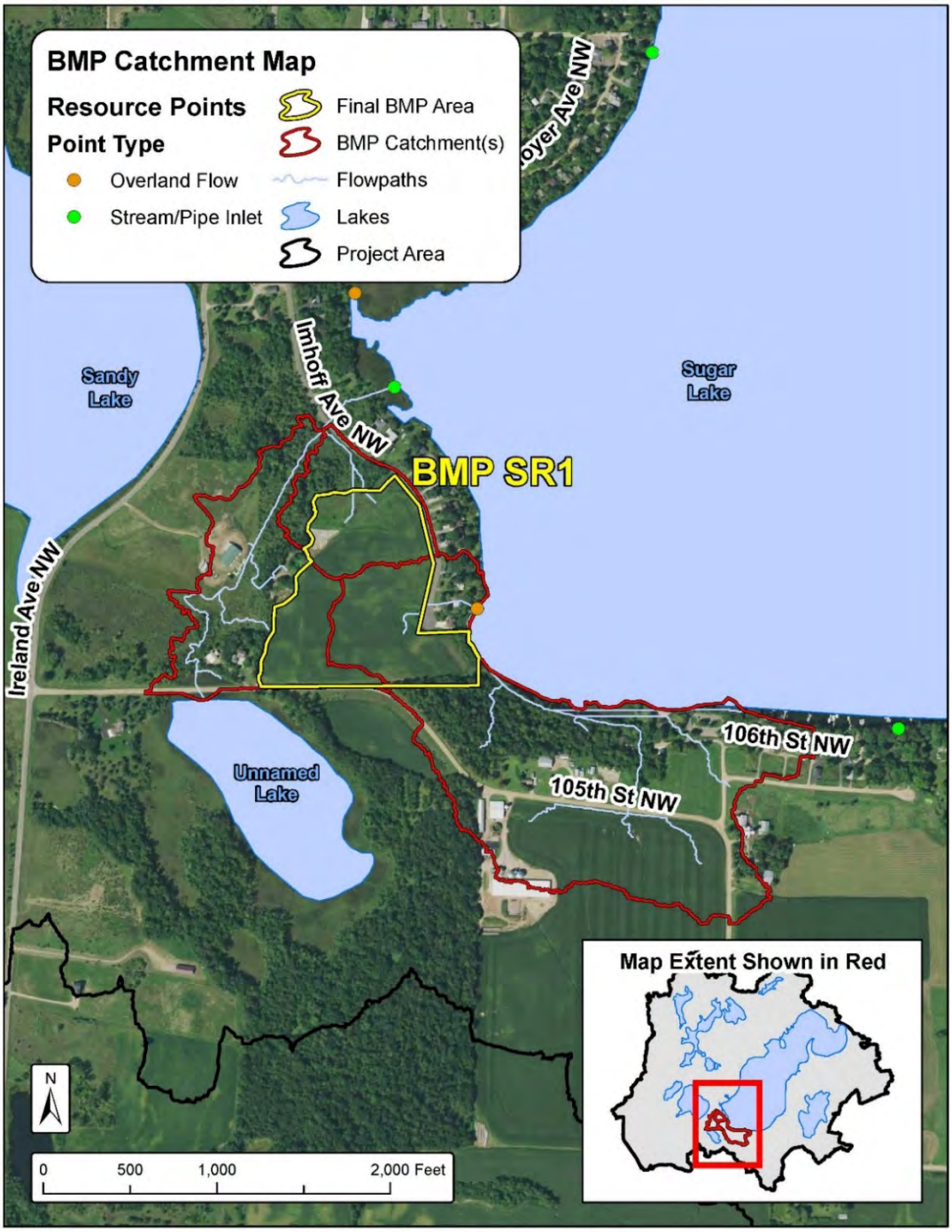

Figure 33. Catchments and flowpaths for BMP SR1

Catchment Description: SR1 is divided by three different catchments. Water in the northern catchment flows northwest to a ditch into Sugar Lake via a culvert. Water from the southwestern catchment flow west into the same ditch culvert system to flow to Sugar Lake. Water from the southeastern catchment flow east overland directly to Sugar Lake. The catchments are dominated by cultivated crops (41.89%). There is also near shore development (13.59%) and forest (28.13%).

Table 28. Ranking parameters for BMPs SR1

BMP Name	SR1
Rank	6
Project Type	Source Reduction
Project Size (acres)	22.31
Cost Estimate	$781.90-$1561.70
BMP TSS Load Reduction (tons/year)	6.14
BMP TP Load Reduction (lbs/year)	1.42
Catchment Number(s)	500534, 9922, 536
Catchment Size (acres)	94.39
Catchment TSS Load (tons/year/acre)	0.59
Catchment TP Load (lbs/year/acre)	0.31

Table 29. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP SR1

	PTMApp Design	Staff Design
Project Size (acres)	15.44	22.31
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	2.57	1.53
TSS-Q2 (tons/year)	10.31	6.14
TSS-Q3 (tons/year)	13.87	8.26
TP-Q1 (lbs /year)	0.05	0.03
TP-Q2 (lbs /year)	2.43	1.42
TP-Q3 (lbs /year)	2.57	1.69
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	2.57	1.53
TSS-Q2 (tons/year)	10.31	6.14
TSS-Q3 (tons/year)	13.87	8.26
TP-Q1 (lbs /year)	0.05	0.03
TP-Q2 (lbs /year)	2.43	1.42
TP-Q3 (lbs /year)	2.57	1.69

SR2

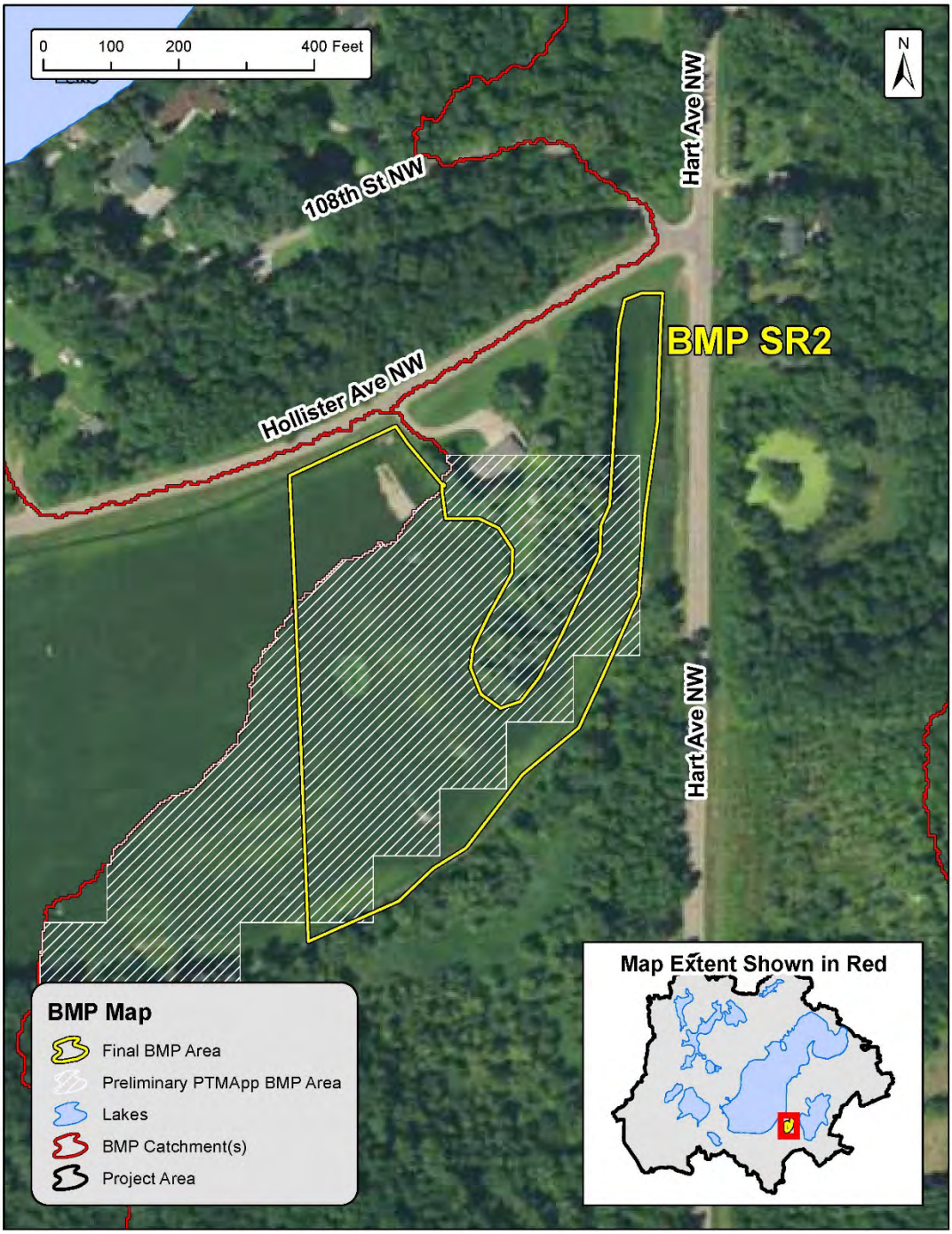

Figure 34. Field scale map of BMP SR2, a management BMP. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: SR2 is a source reduction BMP near the southeastern corner of Sugar Lake. This practice is within 1000ft of the lakeshore. Primary onsite soil textures are fine sandy loam and loam. This BMP occurs on one parcel but SR3 is in the adjacent parcel which are owned by members of the same family.

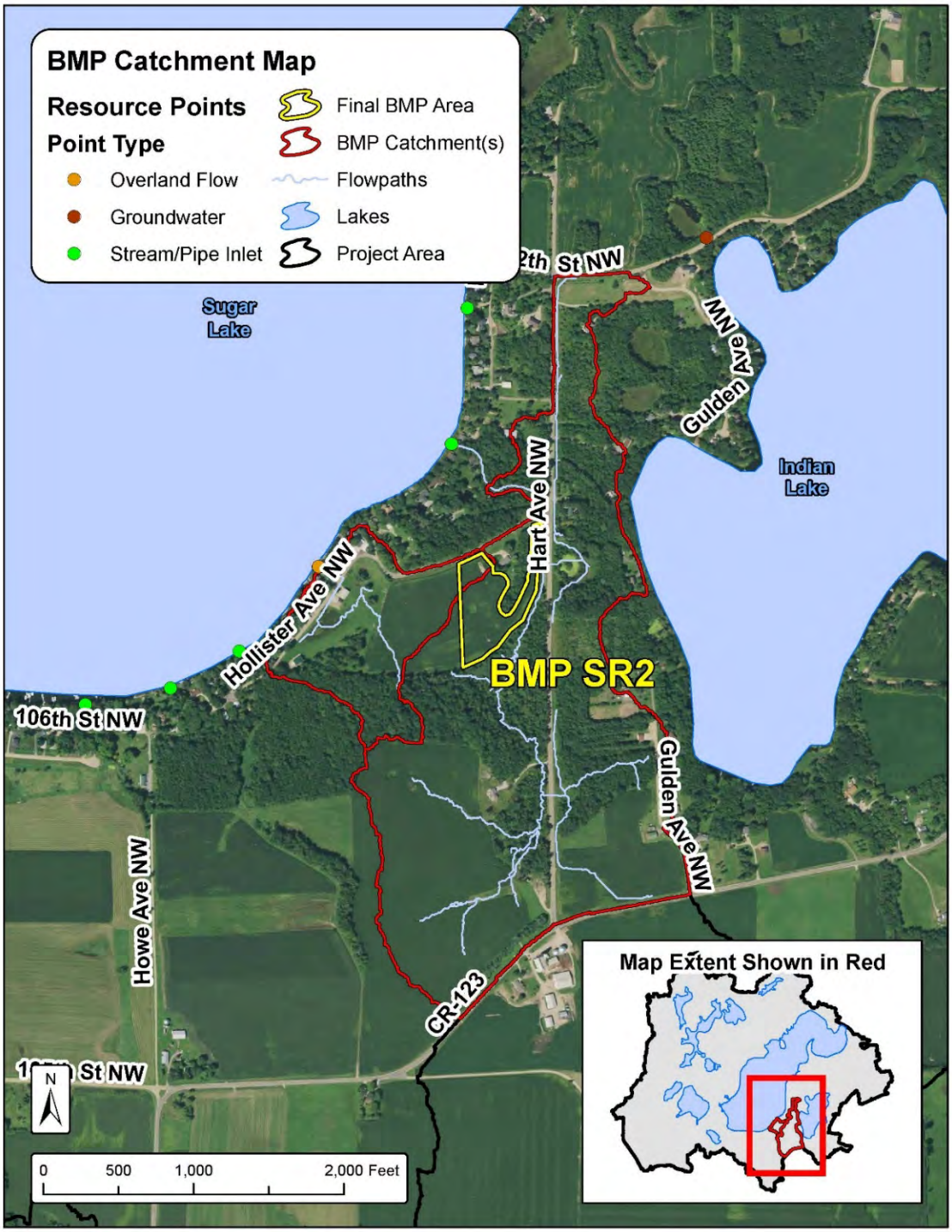

Figure 35. Catchments and flowpaths for BMP SR2

Catchment Description: SR2 occurs in two different catchments. The southern portion of the BMP flows east then north and enters Sugar Lake through a culvert. The north portion of the field flows west to Sugar Lake via overland flow. The majority of the landuse in the catchments is dedicated to farming (28.67% cultivated crops and 14.98% hay/pasture). Forest cover 26.85% of the catchments and 15.04% is developed.

Table 30. Ranking parameters for BMP SR2

BMP Name	SR2
Rank	11
Project Type	Source Reduction
Project Size (acres)	5.33
Cost Estimate	$186.55-$373.10
BMP TSS Load Reduction (tons/year)	4.01
BMP TP Load Reduction (lbs/year)	0.36
Catchment Number(s)	500544, 9919
Catchment Size (acres)	146.48
Catchment TSS Load (tons/year/acre)	0.64
Catchment TP Load (lbs/year/acre)	0.26

Table 31. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP SR2

	PTMApp Design	Staff Design
Project Size (acres)	7.35	5.33
10 year 24 hour storm event		
TSS-Q1(tons/year)	3.47	1.00
TSS-Q2 (tons/year)	13.89	4.01
TSS-Q3 (tons/year)	18.69	5.40
TP-Q1 (lbs /year)	0.02	0.01
TP-Q2 (lbs /year)	0.97	0.36
TP-Q3 (lbs /year)	1.16	0.43
2 year 24 hour storm event		
TSS-Q1(tons/year)	3.47	1.00
TSS-Q2 (tons/year)	13.89	4.01
TSS-Q3 (tons/year)	18.69	5.40
TP-Q1 (lbs /year)	0.02	0.01
TP-Q2 (lbs /year)	0.97	0.36
TP-Q3 (lbs /year)	1.16	0.43

SR3

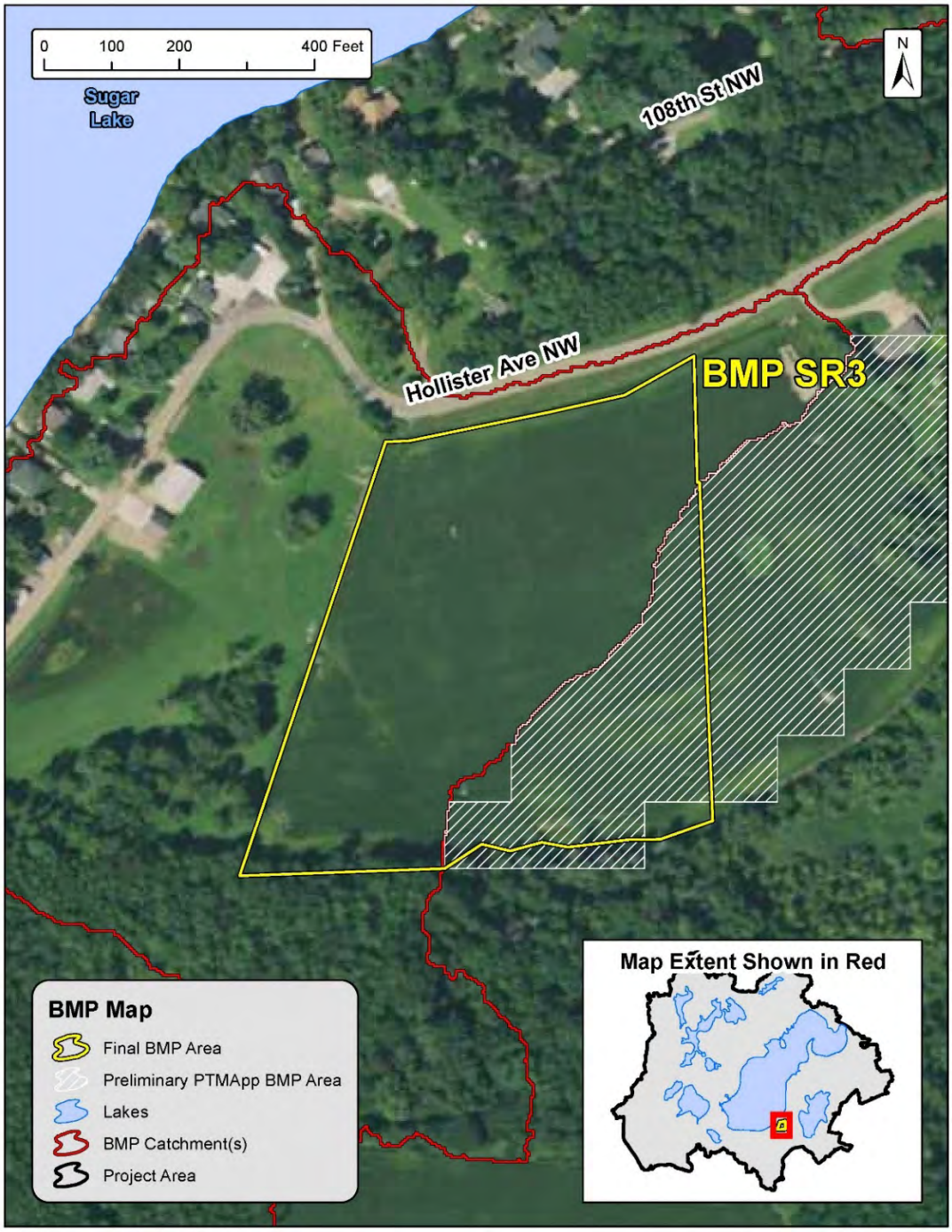

Figure 36. Field scale map of BMP SR3, a management BMP. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: SR3 is a source reduction BMP near the southeastern corner of Sugar Lake. This practice is within 1000ft of the lakeshore. Primary onsite soil textures are fine sandy loam and loam. This BMP occurs on one parcel but SR2 is in the adjacent parcel which are owned by members of the same family.

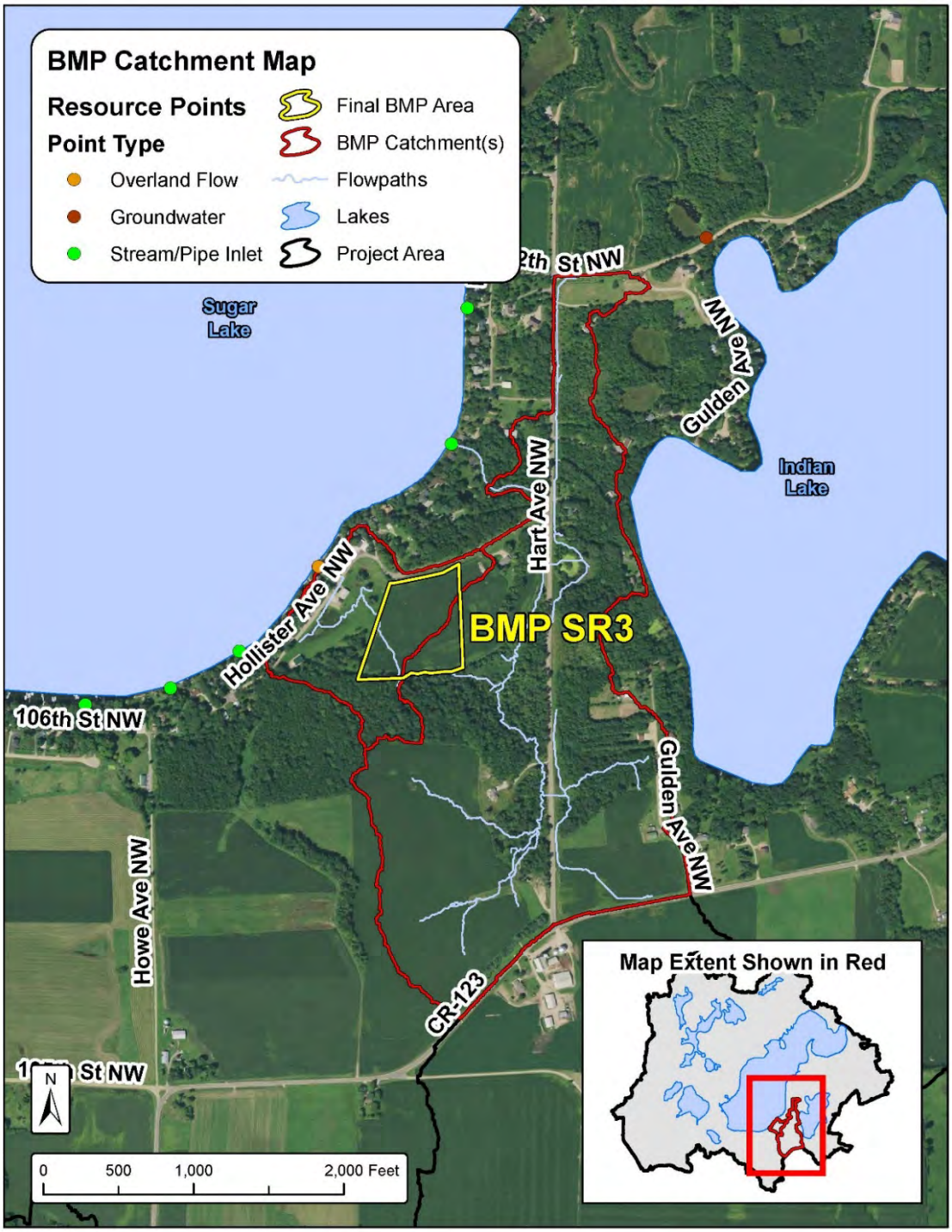

Figure 37. Catchments and flowpaths of SR3

Catchment Description: SR3 occurs in two different catchments. The southern portion of the BMP flows east then north and enters Sugar Lake through a culvert. The north portion of the field flows west to Sugar Lake via overland flow. The majority of the landuse in the catchments is dedicated to farming (28.67% cultivated crops and 14.98% hay/pasture). Forest cover 26.85% of the catchments and 15.04% is developed.

Table 32. Ranking parameters for BMP SR3

BMP Name	SR3
Rank	9
Project Type	Source Reduction
Project Size (acres)	8.58
Cost Estimate	$300.30- $600.60
BMP TSS Load Reduction (tons/year)	4.48
BMP TP Load Reduction (lbs/year)	0.42
Catchment Number(s)	500544, 9919
Catchment Size (acres)	146.47
Catchment TSS Load (tons/year/acre)	0.64
Catchment TP Load (lbs/year/acre)	0.26

Table 33. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP SR3

	PTMApp Design	Staff Design
Size (acres)	7.35	8.58
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	0.73	1.12
TSS-Q2 (tons/year)	2.94	4.48
TSS-Q3 (tons/year)	3.96	6.02
TP-Q1 (lbs /year)	0.01	0.01
TP-Q2 (lbs /year)	0.44	0.42
TP-Q3 (lbs /year)	0.53	0.51
Load Reduction in a 2 year 24 hour storm event		
TSS-Q1(tons/year)	0.73	1.12
TSS-Q2 (tons/year)	2.94	4.48
TSS-Q3 (tons/year)	3.96	6.02
TP-Q1 (lbs /year)	0.01	0.01
TP-Q2 (lbs /year)	0.44	0.42
TP-Q3 (lbs /year)	0.53	0.51

SR4

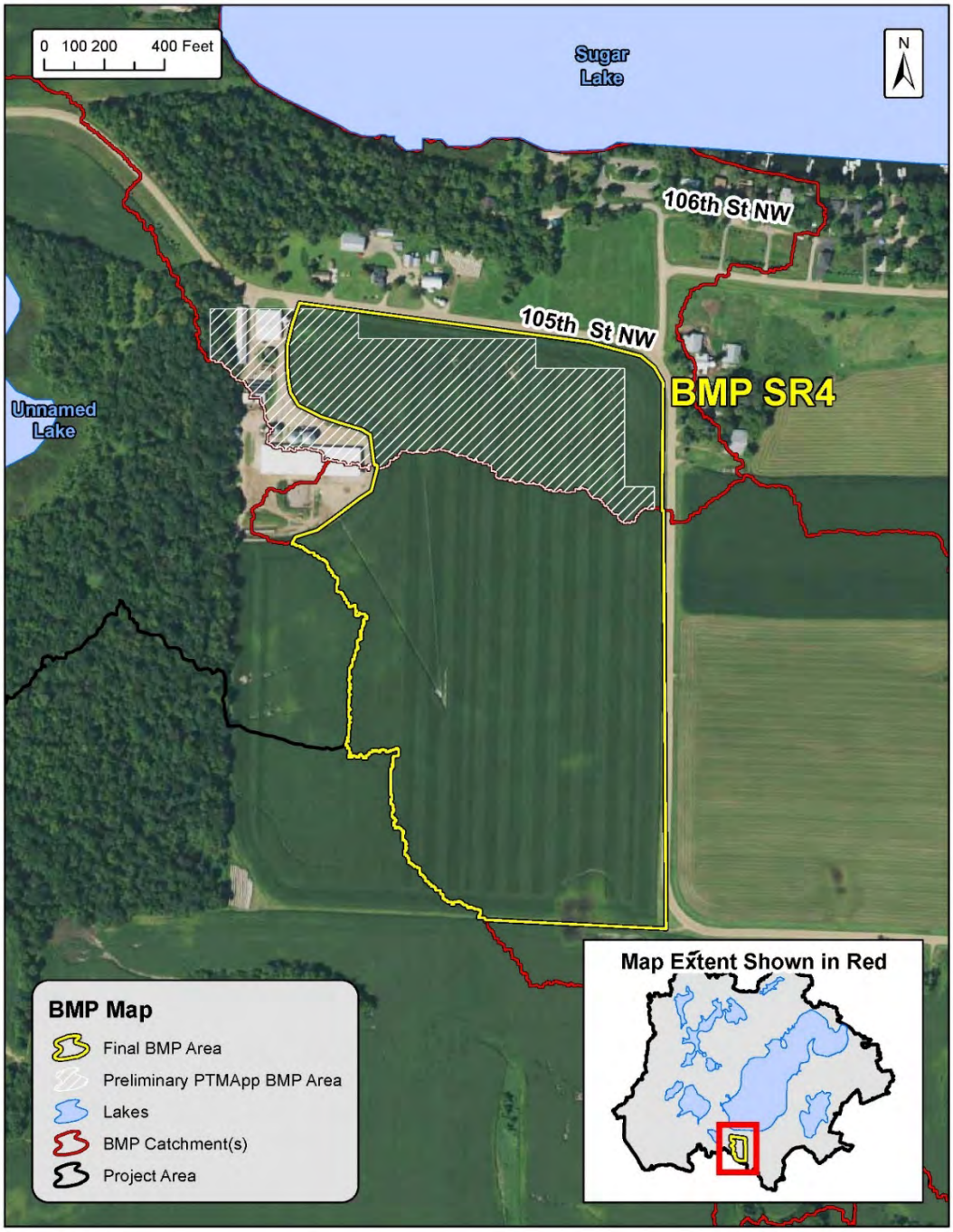

Figure 38. Field scale map of BMP SR4, a management BMP. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: SR4 is a source reduction BMP on the south side of Sugar Lake. It comes within 700ft of the lakeshore. This site is also on the edge of the watershed boundary, so the actual size of the BMP may be larger but further benefits from the BMP would be directed to another waterbody. Primary onsite surface soil textures are loam and sandy loam. The BMP is on a single parcel that is privately owned.

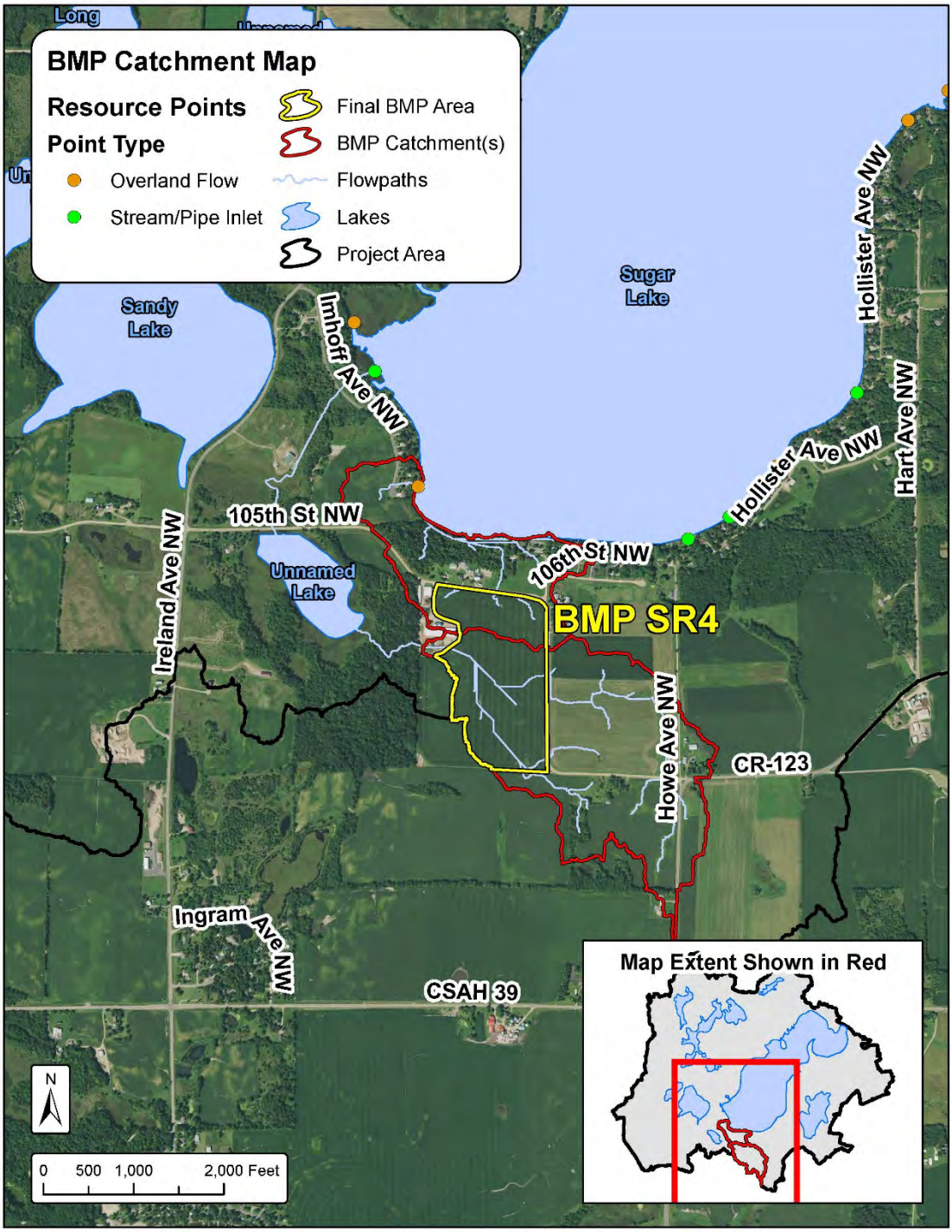

Figure 39. Catchments and flowpaths for BMP SR4

Catchment Description: SR4 occurs in two different catchments. The northern catchment flows north into the lake via overland flow. The southern catchment flows northwest to a ditch and enters Sugar Lake via a culvert. Landuse among both catchments is dominated by farmland (58.89% cultivated crops and 16.27%). Forest cover is 11.34% and 11.35% is developed).

Table 34. Ranking parameters for BMP SR4

BMP Name	SR4
Rank	2
Project Type	Source Reduction
Project Size (acres)	43.51
Cost Estimate	$1,522.85 - $3,045.70
BMP TSS Load Reduction (tons/year)	14.03
BMP TP Load Reduction (lbs/year)	2.88
Catchment Number(s)	500648, 9922
Catchment Size (acres)	185.15
Catchment TSS Load (tons/year/acre)	0.64
Catchment TP Load (lbs/year/acre)	0.27

Table 35. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP SR4

	PTMApp Design	Staff Design
Project Size (acres)	13.12	46.12
10 year 24 hour storm event		
TSS-Q1(tons/year)	2.43	3.51
TSS-Q2 (tons/year)	9.74	14.03
TSS-Q3 (tons/year)	13.11	18.89
TP-Q1 (lbs /year)	0.04	0.07
TP-Q2 (lbs /year)	1.73	2.88
TP-Q3 (lbs /year)	2.06	3.44
2 year 24 hour storm event		
TSS-Q1(tons/year)	2.43	3.51
TSS-Q2 (tons/year)	9.74	14.03
TSS-Q3 (tons/year)	13.11	18.89
TP-Q1 (lbs /year)	0.04	0.07
TP-Q2 (lbs /year)	1.73	2.88
TP-Q3 (lbs /year)	2.06	3.44

SR5

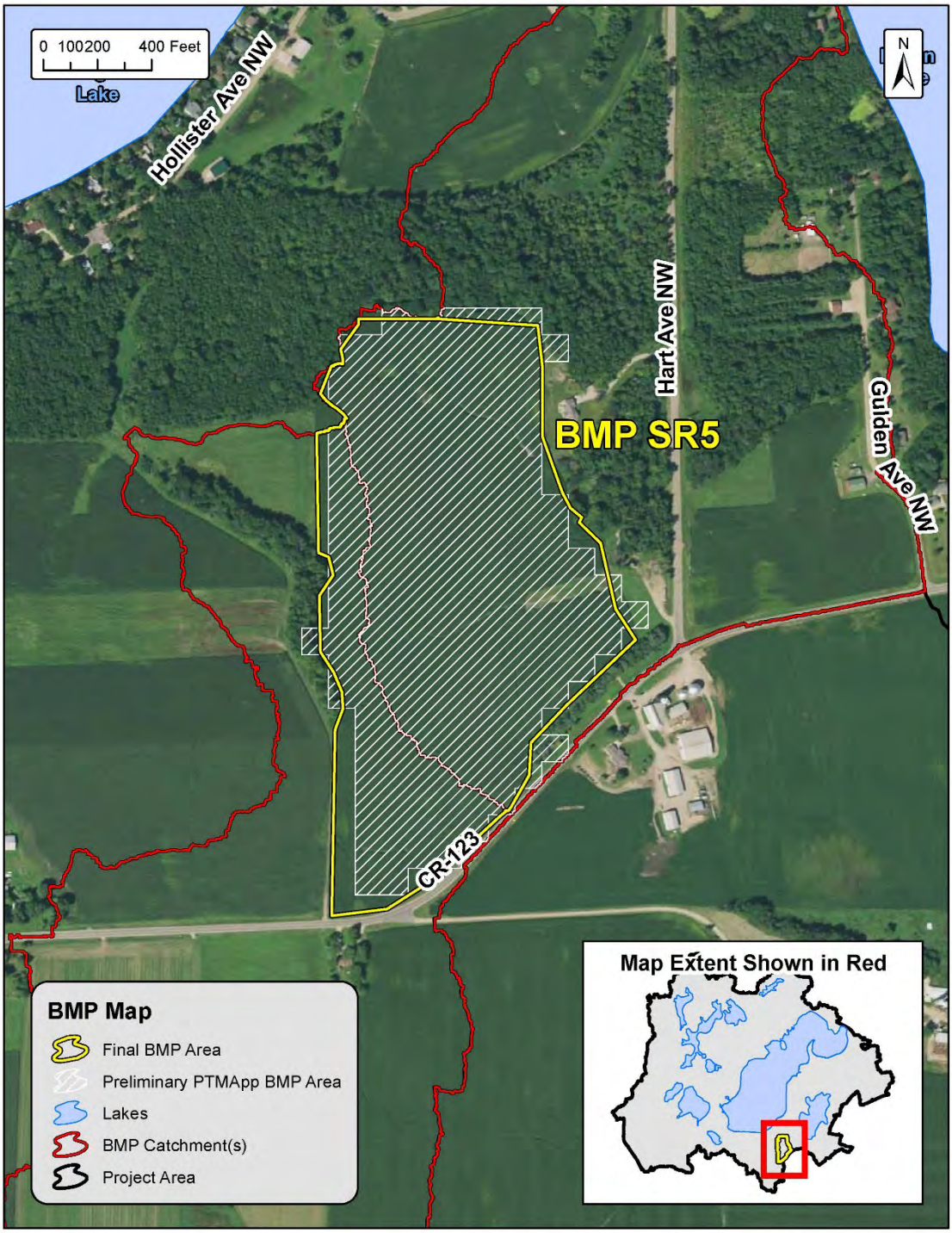

Figure 40. Field scale map of BMP SR5, a management BMP. The white shaded area is what PTMApp originally delineated and the yellow outline is Wright SWCD staff estimate

BMP Description: SR5 is a source reduction BMP on the south side of Sugar Lake. Its location is just over 1,000ft from the lakeshore. Primary onsite surface soil texture is loam. The field is location within one parcel that is privately owned.

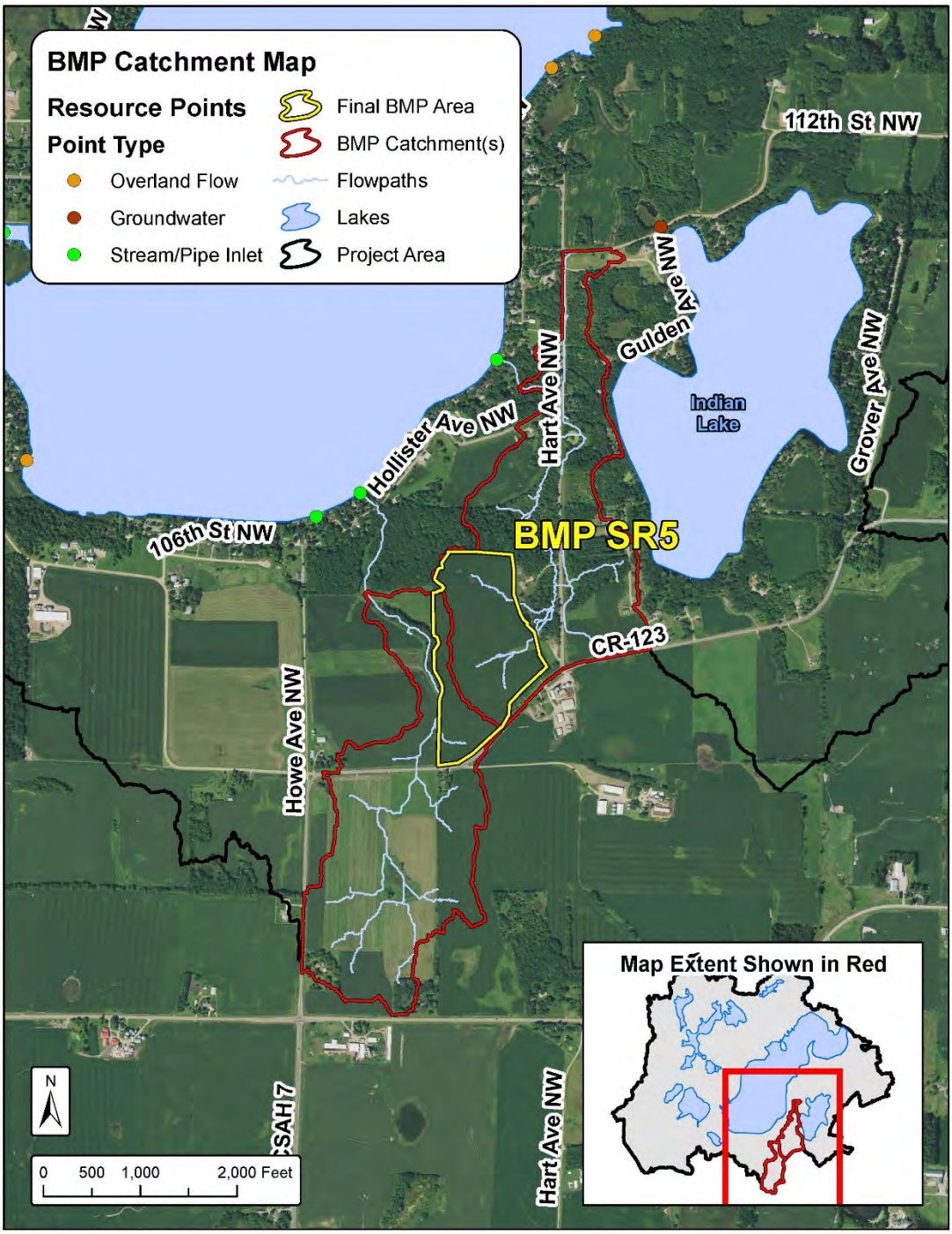

Figure 41. Catchments and flowpaths for BMP SR5

Catchment Description: SR5 is located within 2 catchments. The western catchment flows north to Sugar Lake and enters via a culvert. The eastern catchment flows east then north and enters Sugar Lake via a culvert. Landuse between the two catchments is primarily farmland (26.48% cultivated crops and 36.67% hay/pasture). They are also 16.58% forest and 10.52% developed.

Table 36. Ranking parameters for BMP SR5

BMP Name	SR5
Rank	3
Project Type	Source Reduction
Project Size (acres)	40.18
Cost Estimate	$1,406.30 - $2,812.60
BMP TSS Load Reduction (tons/year)	17.46
BMP TP Load Reduction (lbs/year)	2.61
Catchment Number(s)	500648, 9922
Catchment Size (acres)	235.26
Catchment TSS Load (tons/year/acre)	0.64
Catchment TP Load (lbs/year/acre)	0.27

Table 37. Comparison of size and estimated reduction between the PTMApp computer design and Wright SWCD staff design for BMP SR5

	PTMApp Design	Staff Design
Project Size (acres)	38.79	40.18
Load Reduction in a 10 year 24 hour storm event		
TSS-Q1(tons/year)	9.86	4.37
TSS-Q2 (tons/year)	39.47	17.46
TSS-Q3 (tons/year)	39.14	23.51
TP-Q1 (lbs /year)	0.13	0.06
TP-Q2 (lbs /year)	5.15	2.61
TP-Q3 (lbs /year)	6.15	3.12
Load Reduction 2 year 24 hour storm event		
TSS-Q1(tons/year)	9.86	4.37
TSS-Q2 (tons/year)	39.47	17.46
TSS-Q3 (tons/year)	39.14	23.51
TP-Q1 (lbs /year)	0.13	0.06
TP-Q2 (lbs /year)	5.15	2.61
TP-Q3 (lbs /year)	6.15	3.12

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Appendix A. Full List of PTMApp BMPs

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500007	255_500007_1	Storage	0.24	0.01	0.05
500007	270_500007_1	Storage	0.37	0.02	0.04
9927	327_9927_1	Storage	0.50	0.01	0.01
9927	590_9927_1	Storage	0.93	0.05	0.05
500017	1197_500017_1	Storage	0.24	0.02	0.05
500090	738_500090_1	Storage	0.25	0.00	0.02
500017	1246_500017_1	Storage	0.32	0.02	0.09
500054	1158_500054_1	Storage	0.16	0.08	0.05
500054	1084_500054_1	Storage	0.90	0.55	0.28
9927	1212_9927_1	Storage	0.89	0.05	0.06
500043	1_500043_1	Storage	97.09	15.30	1.70
500054	1145_500054_1	Storage	7.44	0.77	0.41
500047	2048_500047_1	Storage	9.20	0.91	0.16
500079	1400_500079_1	Storage	5.10	0.41	0.13
500079	3437_500079_1	Storage	0.24	0.43	0.13
500143	2957_500143_1	Storage	1.51	0.28	0.11
71	2220_71_1	Storage	6.79	0.44	0.07
110	3495_110_1	Storage	0.31	0.00	0.02
72	3232_72_1	Storage	0.84	0.07	0.15
500061	3507_500061_1	Storage	1.28	0.03	0.07
500148	3674_500148_1	Storage	0.80	0.05	0.09
500061	3214_500061_1	Storage	3.09	0.03	0.05
500148	3624_500148_1	Storage	0.51	0.05	0.09
72	3231_72_1	Storage	0.36	0.02	0.02
500090	5586_500090_1	Storage	0.11	0.02	0.03
500090	4440_500090_1	Storage	0.16	0.01	0.05
500143	5333_500143_1	Storage	0.53	1.19	0.41
500078	6266_500078_1	Storage	0.30	0.16	0.08
500148	6160_500148_1	Storage	0.50	0.29	0.08
500079	3511_500079_1	Storage	1.23	0.63	0.16
500090	6721_500090_1	Storage	1.10	1.38	0.96
71	7165_71_1	Storage	0.13	0.00	0.01
500143	3705_500143_1	Storage	1.26	0.99	0.67
500148	4897_500148_1	Storage	2.23	1.08	1.05
500079	8513_500079_1	Storage	0.06	0.01	0.03
9916	8563_9916_1	Storage	1.53	0.70	0.49
500148	7048_500148_1	Storage	2.41	0.17	0.52
500143	8573_500143_1	Storage	0.89	0.01	0.02

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500152	9146_500152_1	Storage	1.02	0.01	0.02
9914	9694_9914_1	Storage	0.19	0.72	0.26
9928	9615_9928_1	Storage	0.21	0.00	0.01
500148	9916_500148_1	Storage	2.05	2.26	1.58
116	10428_116_1	Storage	0.52	0.02	0.02
500128	11448_500128_1	Storage	0.05	0.00	0.01
9916	10702_9916_1	Storage	0.76	0.01	0.05
9914	10496_9914_1	Storage	1.21	0.91	0.84
500219	11195_500219_1	Storage	0.61	0.34	0.10
102	9774_102_1	Storage	2.19	0.01	0.04
500128	11416_500128_1	Storage	0.21	0.00	0.00
500152	10565_500152_1	Storage	1.23	0.04	0.07
500128	11542_500128_1	Storage	0.23	0.92	0.90
9938	11023_9938_1	Storage	3.14	0.20	1.00
500112	11631_500112_1	Storage	0.17	0.20	1.01
500143	10378_500143_1	Storage	0.97	0.02	0.05
500219	11445_500219_1	Storage	2.33	0.54	0.29
110	8514_110_1	Storage	1.96	0.01	0.02
9916	11555_9916_1	Storage	2.60	0.02	0.16
500103	10012_500103_1	Storage	4.40	2.95	1.52
9917	11681_9917_1	Storage	0.56	0.05	0.06
9926	11616_9926_1	Storage	0.44	0.06	0.06
125	11702_125_1	Storage	0.48	0.01	0.01
500219	11670_500219_1	Storage	1.78	0.60	0.46
125	11687_125_1	Storage	1.33	0.00	0.02
9917	10630_9917_1	Storage	2.91	0.15	0.29
500104	11754_500104_1	Storage	1.11	0.04	0.15
500148	10278_500148_1	Storage	2.90	2.32	1.31
9926	11841_9926_1	Storage	0.11	0.05	0.03
500152	11642_500152_1	Storage	1.61	0.08	0.18
9916	11563_9916_1	Storage	2.46	0.05	0.27
500119	11711_500119_1	Storage	4.01	0.06	0.25
9931	11694_9931_1	Storage	2.44	0.01	0.01
9926	12095_9926_1	Storage	1.47	0.03	0.19
9929	12086_9929_1	Storage	1.40	0.00	0.05
500117	11322_500117_1	Storage	10.97	0.34	0.04
9931	11688_9931_1	Storage	5.19	0.01	0.03
500213	11889_500213_1	Storage	3.85	0.05	0.18
500152	12246_500152_1	Storage	1.08	0.01	0.04

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
9902	12236_9902_1	Storage	0.91	0.03	0.24
9917	11537_9917_1	Storage	4.63	0.51	2.38
500159	12143_500159_1	Storage	2.39	0.07	0.16
500219	12315_500219_1	Storage	1.20	0.01	0.03
9902	15328_9902_1	Storage	0.19	0.06	0.30
163	12138_163_1	Storage	2.25	0.01	0.02
500168	12283_500168_1	Storage	2.46	0.03	0.08
500145	11814_500145_1	Storage	2.84	0.09	0.15
9915	12225_9915_1	Storage	5.24	0.19	0.52
500186	14419_500186_1	Storage	0.40	0.19	0.53
9930	13153_9930_1	Storage	0.37	0.00	0.00
203	12867_203_1	Storage	1.42	0.02	0.08
500106	3476_500106_1	Storage	75.90	6.13	1.12
500207	17318_500207_1	Storage	0.06	0.00	0.02
500219	11915_500219_1	Storage	3.57	1.43	1.22
163	17011_163_1	Storage	0.45	0.03	0.03
9902	17438_9902_1	Storage	0.80	0.06	0.20
9902	17268_9902_1	Storage	2.24	0.11	0.59
500213	17205_500213_1	Storage	1.75	0.00	0.00
500207	17624_500207_1	Storage	0.59	0.36	0.66
500228	17706_500228_1	Storage	1.06	0.02	0.09
500218	17834_500218_1	Storage	1.06	0.05	0.18
500228	16897_500228_1	Storage	1.55	0.08	0.17
500222	17785_500222_1	Storage	0.15	0.00	<Null>
163	18100_163_1	Storage	0.02	0.14	0.03
500207	17851_500207_1	Storage	3.72	0.36	0.66
9902	17662_9902_1	Storage	3.35	0.03	0.19
500228	17750_500228_1	Storage	7.53	2.04	0.55
500272	18271_500272_1	Storage	0.03	0.00	0.00
500117	17687_500117_1	Storage	13.93	0.81	0.32
9926	12083_9926_1	Storage	7.75	0.20	0.53
500228	18438_500228_1	Storage	0.53	0.01	0.04
500232	17631_500232_1	Storage	5.09	0.08	0.51
500166	18533_500166_1	Storage	0.21	0.00	0.00
235	18425_235_1	Storage	0.60	0.06	0.11
500369	18500_500369_1	Storage	1.70	2.51	0.91
500369	19172_500369_1	Storage	0.29	0.45	0.12
163	19019_163_1	Storage	0.33	0.01	0.06
203	17428_203_1	Storage	10.63	0.43	0.20

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
9903	18347_9903_1	Storage	2.54	2.55	1.40
500274	18909_500274_1	Storage	0.98	0.01	0.03
163	18832_163_1	Storage	1.37	0.00	0.02
500290	18404_500290_1	Storage	12.05	6.22	0.71
500270	20388_500270_1	Storage	0.87	0.00	0.04
500228	15130_500228_1	Storage	30.61	5.96	3.68
9904	20015_9904_1	Storage	5.86	22.82	3.91
500307	20546_500307_1	Storage	0.33	0.02	0.04
500356	21010_500356_1	Storage	1.65	0.41	0.10
500256	18259_500256_1	Storage	21.66	3.41	0.63
500308	20714_500308_1	Storage	2.15	0.05	0.36
235	18555_235_1	Storage	9.11	1.40	0.20
500347	22340_500347_1	Storage	0.06	0.00	0.02
500307	18183_500307_1	Storage	23.81	2.74	1.28
9923	22706_9923_1	Storage	1.13	0.10	0.23
9933	20818_9933_1	Storage	6.26	0.03	0.02
500308	23030_500308_1	Storage	1.40	0.04	0.30
500366	17683_500366_1	Storage	74.58	10.36	2.17
9933	23464_9933_1	Storage	1.15	0.01	0.02
500356	22466_500356_1	Storage	1.16	0.88	0.64
500347	23496_500347_1	Storage	0.12	0.00	0.03
9923	17762_9923_1	Storage	23.92	1.98	2.18
329	21814_329_1	Storage	2.65	0.83	0.12
500369	18882_500369_1	Storage	42.71	18.37	5.25
423	24191_423_1	Storage	2.35	0.02	0.04
359	23961_359_1	Storage	1.86	0.17	0.10
500386	25301_500386_1	Storage	0.02	0.00	0.02
500460	24905_500460_1	Storage	0.42	0.03	0.01
500330	23635_500330_1	Storage	8.56	2.10	0.46
500474	24876_500474_1	Storage	2.53	0.34	0.07
500460	24869_500460_1	Storage	4.64	0.52	0.05
9904	24245_9904_1	Storage	12.47	3.06	0.22
500460	26191_500460_1	Storage	0.07	0.00	0.05
500460	24874_500460_1	Storage	3.65	0.29	0.02
500390	24030_500390_1	Storage	2.52	0.43	0.65
500389	24729_500389_1	Storage	1.15	0.06	0.19
9912	26207_9912_1	Storage	1.30	0.43	0.13
9921	24706_9921_1	Storage	0.82	3.29	0.69
9918	24507_9918_1	Storage	4.49	1.31	0.06

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500386	22773_500386_1	Storage	24.94	4.21	0.69
500441	26386_500441_1	Storage	1.06	0.00	0.01
500395	25171_500395_1	Storage	4.26	0.13	0.28
9911	24270_9911_1	Storage	15.44	1.80	2.74
500424	28021_500424_1	Storage	0.50	0.08	0.04
500406	28524_500406_1	Storage	0.35	4.67	0.58
500406	25010_500406_1	Storage	3.83	3.52	0.48
500406	26734_500406_1	Storage	3.81	0.91	0.19
500470	28537_500470_1	Storage	0.09	0.00	0.01
9921	24998_9921_1	Storage	5.66	1.54	0.18
500424	28147_500424_1	Storage	1.66	0.24	0.26
9921	24145_9921_1	Storage	0.85	2.97	0.93
9912	26701_9912_1	Storage	2.68	0.91	1.22
500465	29031_500465_1	Storage	0.26	0.01	0.03
9920	29054_9920_1	Storage	0.15	0.02	0.15
500306	26255_500306_1	Storage	0.41	0.00	0.00
9918	25066_9918_1	Storage	12.08	4.00	0.58
9911	28588_9911_1	Storage	8.55	1.84	3.02
397	29105_397_1	Storage	0.24	0.01	0.03
500465	29060_500465_1	Storage	0.58	0.02	0.06
397	26417_397_1	Storage	4.29	0.01	0.01
500474	28774_500474_1	Storage	4.00	1.03	0.32
500454	27362_500454_1	Storage	9.31	1.08	0.28
500460	27281_500460_1	Storage	22.31	6.97	1.48
446	28942_446_1	Storage	1.28	0.01	0.01
500460	29108_500460_1	Storage	2.07	1.62	0.38
500462	29221_500462_1	Storage	0.33	0.05	0.14
500359	24068_500359_1	Storage	93.80	53.94	5.40
9906	29185_9906_1	Storage	1.02	1.52	1.30
469	29494_469_1	Storage	1.24	0.26	0.03
500450	23780_500450_1	Storage	56.72	9.78	1.82
460	29154_460_1	Storage	2.61	0.03	0.05
469	29145_469_1	Storage	15.94	11.09	2.11
500462	29428_500462_1	Storage	4.51	0.04	0.11
500524	31771_500524_1	Storage	0.21	0.16	0.04
500511	29539_500511_1	Storage	8.71	0.98	0.40
500481	28955_500481_1	Storage	21.70	3.55	0.69
500460	26725_500460_1	Storage	33.88	0.65	0.14
473	29735_473_1	Storage	2.27	0.01	0.05

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
9905	29659_9905_1	Storage	1.58	0.04	0.09
521	33001_521_1	Storage	0.96	0.26	0.04
525	32974_525_1	Storage	1.55	0.03	0.10
500499	33518_500499_1	Storage	0.06	<Null>	<Null>
469	29598_469_1	Storage	6.88	1.42	0.20
500524	30488_500524_1	Storage	10.74	1.22	0.61
518	30809_518_1	Storage	1.33	0.00	0.02
500563	33765_500563_1	Storage	1.08	0.02	0.27
543	33978_543_1	Storage	0.14	0.25	0.12
500519	31379_500519_1	Storage	10.09	2.43	0.59
9910	32648_9910_1	Storage	3.88	0.02	0.28
500548	33740_500548_1	Storage	13.38	4.72	0.61
500524	29818_500524_1	Storage	41.67	12.05	3.13
500523	31103_500523_1	Storage	30.24	10.76	1.50
500504	29512_500504_1	Storage	38.98	8.27	1.56
500531	33117_500531_1	Storage	9.64	2.25	0.41
551	34073_551_1	Storage	12.88	1.44	0.14
551	33776_551_1	Storage	9.22	1.10	0.09
500563	34749_500563_1	Storage	1.42	0.00	0.12
536	34950_536_1	Storage	0.20	0.45	0.23
536	34087_536_1	Storage	5.96	0.82	0.14
500553	34029_500553_1	Storage	6.59	1.90	0.73
500500	35243_500500_1	Storage	0.04	0.00	0.02
9907	34543_9907_1	Storage	0.92	0.06	0.05
9907	34958_9907_1	Storage	1.47	0.01	0.05
9909	35478_9909_1	Storage	0.20	0.03	0.18
601	35208_601_1	Storage	0.96	0.01	0.04
601	35197_601_1	Storage	1.78	0.02	0.06
9937	35150_9937_1	Storage	0.90	0.01	0.05
9937	35143_9937_1	Storage	0.37	0.52	0.29
601	35555_601_1	Storage	1.56	0.97	0.25
9937	35654_9937_1	Storage	1.51	0.10	0.39
9937	35724_9937_1	Storage	1.20	0.01	0.02
500542	33580_500542_1	Storage	2.57	0.01	0.04
500553	36842_500553_1	Storage	0.40	0.15	0.06
500588	35121_500588_1	Storage	8.93	2.21	0.51
500523	34897_500523_1	Storage	23.06	3.20	0.80
500544	35049_500544_1	Storage	1.98	6.90	1.60
500575	34618_500575_1	Storage	6.42	6.09	1.44

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
551	35134_551_1	Storage	11.92	1.36	0.27
500589	34527_500589_1	Storage	28.39	10.35	1.17
500553	35665_500553_1	Storage	15.60	1.02	0.37
500524	34850_500524_1	Storage	14.09	1.77	0.83
500613	37236_500613_1	Storage	0.36	0.07	0.21
9937	36773_9937_1	Storage	1.27	0.27	0.09
500613	36449_500613_1	Storage	1.49	0.31	0.61
500621	37037_500621_1	Storage	1.05	1.41	0.49
500611	36099_500611_1	Storage	17.27	4.05	0.62
500632	36561_500632_1	Storage	14.31	3.05	0.48
9937	39173_9937_1	Storage	0.53	0.02	0.03
500544	37367_500544_1	Storage	8.19	1.98	0.27
500621	39261_500621_1	Storage	0.98	1.38	0.44
500602	40597_500602_1	Storage	0.59	0.15	0.08
551	38672_551_1	Storage	4.33	1.06	0.10
500575	39785_500575_1	Storage	2.74	0.16	0.06
551	36114_551_1	Storage	12.36	1.71	0.18
500621	40855_500621_1	Storage	4.35	1.33	0.35
500648	48045_500648_1	Storage	0.11	0.13	0.08
500575	37902_500575_1	Storage	59.19	5.84	1.23
500602	48102_500602_1	Storage	1.25	1.13	0.29
500662	35320_500662_1	Storage	42.91	9.70	1.75
500663	39204_500663_1	Storage	87.82	18.20	2.35
500602	35585_500602_1	Storage	75.70	28.15	3.79
500648	48119_500648_1	Storage	63.86	30.30	5.89
500647	48137_500647_1	Storage	36.65	18.63	3.19
9919	50000_9919_1	Storage	0.51	2.72	0.17
500544	50001_500544_1	Storage	5.41	31.65	4.43
9922	50002_9922_1	Storage	1.42	3.81	0.54
9922	50003_9922_1	Storage	3.22	5.87	1.39
500534	50004_500534_1	Storage	2.31	0.94	0.25
500043	1_500043_2	Filtration	1.67	0.28	-0.10
500054	3_500054_2	Filtration	0.39	0.02	-0.02
500054	6_500054_2	Filtration	0.22	0.11	-0.09
500090	7_500090_2	Filtration	0.12	0.07	-0.23
500090	4_500090_2	Filtration	1.44	0.07	-0.29
500054	8_500054_2	Filtration	0.36	0.06	-0.04
500043	9_500043_2	Filtration	0.13	0.26	-0.02
500054	10_500054_2	Filtration	0.15	0.21	-0.18

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500054	11_500054_2	Filtration	0.54	0.00	-0.02
500054	12_500054_2	Filtration	0.75	0.11	-0.02
72	14_72_2	Filtration	2.04	0.03	-0.09
500143	27_500143_2	Filtration	0.15	0.45	-0.22
500017	16_500017_2	Filtration	8.74	0.49	-0.08
500143	44_500143_2	Filtration	0.44	0.02	-0.15
500103	28_500103_2	Filtration	5.15	0.59	-0.09
9914	42_9914_2	Filtration	1.47	0.35	-0.05
9916	29_9916_2	Filtration	4.42	0.39	-0.07
500143	56_500143_2	Filtration	0.91	0.00	-0.06
500104	178_500104_2	Filtration	1.29	0.47	-0.48
500104	169_500104_2	Filtration	0.51	0.59	-0.72
500219	246_500219_2	Filtration	0.47	0.45	-0.51
500228	256_500228_2	Filtration	0.64	0.04	-0.09
500228	261_500228_2	Filtration	0.12	0.06	-0.15
500145	260_500145_2	Filtration	0.53	0.06	-0.12
500145	262_500145_2	Filtration	1.45	0.06	-0.10
500228	263_500228_2	Filtration	0.67	0.10	-0.26
500228	265_500228_2	Filtration	0.12	0.01	-0.05
500228	269_500228_2	Filtration	0.53	0.46	-0.11
500207	266_500207_2	Filtration	1.90	0.14	-0.24
500207	270_500207_2	Filtration	0.01	0.02	-0.06
500207	271_500207_2	Filtration	1.32	0.08	-0.04
163	277_163_2	Filtration	0.87	0.34	-0.14
500369	274_500369_2	Filtration	4.46	0.71	-0.22
9904	296_9904_2	Filtration	1.16	0.58	-0.08
9904	295_9904_2	Filtration	4.07	0.69	-0.14
9904	293_9904_2	Filtration	19.63	1.43	-0.68
9932	301_9932_2	Filtration	1.86	0.01	-0.04
9904	299_9904_2	Filtration	9.25	0.96	-0.23
9923	305_9923_2	Filtration	2.40	0.29	-0.06
500389	321_500389_2	Filtration	0.35	0.03	-0.14
500395	318_500395_2	Filtration	1.40	0.08	-0.21
500474	316_500474_2	Filtration	2.40	0.24	-0.06
500406	414_500406_2	Filtration	1.47	0.27	-0.05
9911	346_9911_2	Filtration	3.40	0.59	-0.71
500460	463_500460_2	Filtration	0.22	0.01	-0.02
500460	470_500460_2	Filtration	0.29	0.01	-0.05
500474	440_500474_2	Filtration	4.11	0.30	-0.09

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
9918	330_9918_2	Filtration	3.84	0.64	-0.06
9906	478_9906_2	Filtration	3.04	0.39	-0.06
500544	542_500544_2	Filtration	0.06	0.14	-0.16
500534	567_500534_2	Filtration	3.09	0.58	-0.16
500563	588_500563_2	Filtration	0.44	0.02	-0.43
500563	579_500563_2	Filtration	1.69	0.02	-0.06
500548	586_500548_2	Filtration	1.25	0.69	-0.11
500544	609_500544_2	Filtration	0.97	0.63	-0.06
9919	607_9919_2	Filtration	3.19	0.41	-0.13
9922	651_9922_2	Filtration	2.15	0.63	-0.11
9922	657_9922_2	Filtration	0.16	0.03	-0.06
500575	668_500575_2	Filtration	2.19	0.12	-0.08
9922	664_9922_2	Filtration	8.17	0.97	-0.17
500575	681_500575_2	Filtration	0.06	0.02	-0.02
500648	669_500648_2	Filtration	5.95	0.37	-0.08
500648	688_500648_2	Filtration	0.28	0.50	-0.04
500631	679_500631_2	Filtration	4.64	0.63	-0.10
500647	680_500647_2	Filtration	2.73	0.67	-0.06
500631	673_500631_2	Filtration	7.86	1.32	-0.22
500647	666_500647_2	Filtration	8.96	0.84	-0.17
500648	695_500648_2	Filtration	3.63	0.67	-0.36
500228	700_500228_2	Filtration	0.48	1.79	-0.44
500474	701_500474_2	Filtration	0.47	0.69	-0.19
500511	702_500511_2	Filtration	0.33	0.61	-0.20
500504	703_500504_2	Filtration	0.76	3.46	-0.61
500504	704_500504_2	Filtration	0.52	1.67	-0.39
500648	705_500648_2	Filtration	0.60	5.34	-1.13
500454	706_500454_2	Filtration	0.40	0.72	-0.21
469	707_469_2	Filtration	0.10	15.52	-2.15
500054	182_500054_3	Biofiltration	0.11	0.21	0.16
500054	284_500054_3	Biofiltration	0.13	0.10	0.06
500017	788_500017_3	Biofiltration	0.01	0.57	0.09
500078	1067_500078_3	Biofiltration	0.01	0.14	0.07
500219	1635_500219_3	Biofiltration	0.35	0.76	0.78
500145	1661_500145_3	Biofiltration	0.02	0.04	0.07
500145	1775_500145_3	Biofiltration	0.09	0.12	0.21
500290	2169_500290_3	Biofiltration	0.03	6.75	0.84
500290	2177_500290_3	Biofiltration	0.08	6.52	0.82
500307	2495_500307_3	Biofiltration	0.41	0.23	0.45

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500290	2910_500290_3	Biofiltration	0.03	0.90	0.20
500330	5538_500330_3	Biofiltration	0.07	0.25	0.06
9904	5502_9904_3	Biofiltration	0.05	0.63	0.11
9904	5611_9904_3	Biofiltration	0.03	1.09	0.24
500330	5614_500330_3	Biofiltration	0.51	5.56	2.13
359	6113_359_3	Biofiltration	0.06	0.01	0.04
9911	7099_9911_3	Biofiltration	0.13	0.38	1.02
500504	9268_500504_3	Biofiltration	0.07	6.62	1.36
500589	10885_500589_3	Biofiltration	0.13	12.13	1.61
500575	13129_500575_3	Biofiltration	0.28	0.04	0.03
500090	3_500090_4	Infiltration	5.76	0.55	0.08
500106	9_500106_4	Infiltration	1.87	0.13	0.02
125	25_125_4	Infiltration	0.15	0.00	0.00
500152	30_500152_4	Infiltration	0.30	0.00	0.00
203	37_203_4	Infiltration	2.21	0.02	0.03
500117	47_500117_4	Infiltration	13.59	1.07	0.20
500386	110_500386_4	Infiltration	0.75	0.16	0.03
500470	124_500470_4	Infiltration	0.42	2.62	1.46
500563	167_500563_4	Infiltration	1.75	0.03	0.16
500523	178_500523_4	Infiltration	0.84	0.11	0.02
500662	176_500662_4	Infiltration	4.44	0.92	0.11
500632	184_500632_4	Infiltration	4.04	0.80	0.09
500524	186_500524_4	Infiltration	2.02	0.25	0.10
500043	63_500043_5	Protection	0.02	0.01	0.00
500043	66_500043_5	Protection	0.01	0.01	0.00
500043	61_500043_5	Protection	0.02	0.01	0.00
500043	24_500043_5	Protection	0.02	0.01	0.00
500043	49_500043_5	Protection	0.01	0.01	0.00
500043	46_500043_5	Protection	0.02	0.01	0.00
500043	70_500043_5	Protection	0.02	0.01	0.00
500043	68_500043_5	Protection	0.01	0.01	0.00
500043	35_500043_5	Protection	0.02	0.02	0.00
500043	82_500043_5	Protection	0.20	0.18	0.01
500043	105_500043_5	Protection	0.04	0.03	0.00
500043	106_500043_5	Protection	0.35	0.24	0.01
500043	172_500043_5	Protection	0.02	0.02	0.00
500043	90_500043_5	Protection	0.03	0.00	0.00
500043	259_500043_5	Protection	0.01	0.01	0.00
500043	80_500043_5	Protection	1.10	0.45	0.04

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500043	384_500043_5	Protection	0.02	0.00	0.00
500043	699_500043_5	Protection	0.02	0.01	0.00
500043	457_500043_5	Protection	0.74	0.16	0.03
500043	823_500043_5	Protection	0.01	0.00	0.00
500043	847_500043_5	Protection	0.02	0.00	0.00
500043	1219_500043_5	Protection	0.02	0.00	0.00
500090	1172_500090_5	Protection	0.01	<Null>	0.00
500043	1453_500043_5	Protection	0.02	0.00	0.00
500054	2139_500054_5	Protection	0.01	0.00	0.00
500043	2267_500043_5	Protection	0.01	0.00	0.00
500043	2431_500043_5	Protection	0.02	0.00	0.00
500043	2494_500043_5	Protection	0.02	0.00	0.00
500043	2711_500043_5	Protection	0.01	0.00	0.00
500043	2670_500043_5	Protection	0.03	0.01	0.00
500043	1393_500043_5	Protection	2.03	1.38	0.08
500043	2851_500043_5	Protection	0.02	0.00	0.00
500047	3281_500047_5	Protection	0.01	0.00	0.00
500079	3386_500079_5	Protection	0.01	0.00	0.00
500079	2935_500079_5	Protection	0.04	0.00	0.00
71	3438_71_5	Protection	0.01	0.00	0.00
500043	3092_500043_5	Protection	0.02	0.01	0.00
71	3649_71_5	Protection	0.01	0.01	0.00
500106	4484_500106_5	Protection	0.01	0.00	0.00
500106	4564_500106_5	Protection	0.01	0.00	0.00
500106	5332_500106_5	Protection	0.01	0.00	0.00
500143	5415_500143_5	Protection	0.01	0.01	0.00
500106	5432_500106_5	Protection	0.01	0.01	0.00
500106	5574_500106_5	Protection	0.02	0.00	0.00
500106	5600_500106_5	Protection	0.01	0.00	0.00
500106	5663_500106_5	Protection	0.01	0.00	0.00
500106	5689_500106_5	Protection	0.01	0.01	0.00
500106	6149_500106_5	Protection	0.01	0.01	0.00
500106	6193_500106_5	Protection	0.02	0.01	0.00
500106	6214_500106_5	Protection	0.01	0.00	0.00
500106	6221_500106_5	Protection	0.02	0.00	0.00
500106	6427_500106_5	Protection	0.01	0.01	0.00
500106	6511_500106_5	Protection	0.01	0.00	0.00
500106	6055_500106_5	Protection	0.03	0.00	0.00
500106	6242_500106_5	Protection	0.46	0.14	0.02

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500106	6627_500106_5	Protection	0.02	0.01	0.00
500106	6657_500106_5	Protection	0.02	0.01	0.00
500106	6814_500106_5	Protection	0.02	0.03	0.00
500106	6787_500106_5	Protection	0.02	0.04	0.00
500106	6894_500106_5	Protection	0.02	0.02	0.00
500106	6870_500106_5	Protection	0.02	0.05	0.00
500106	6697_500106_5	Protection	0.54	0.27	0.02
500117	7088_500117_5	Protection	0.01	0.08	0.00
500106	7085_500106_5	Protection	0.02	0.00	0.00
500119	7571_500119_5	Protection	0.01	0.00	0.00
500119	7655_500119_5	Protection	0.01	0.00	0.00
500119	7755_500119_5	Protection	0.02	0.00	0.00
500119	7781_500119_5	Protection	0.01	0.00	0.00
500119	7813_500119_5	Protection	0.03	0.00	0.00
500117	8075_500117_5	Protection	0.01	0.00	0.00
500117	7974_500117_5	Protection	0.02	0.00	0.00
500117	8118_500117_5	Protection	0.01	0.00	0.00
500117	8432_500117_5	Protection	0.01	0.00	0.00
500117	8455_500117_5	Protection	0.01	0.00	0.00
500117	9286_500117_5	Protection	0.02	0.00	0.00
500117	9687_500117_5	Protection	0.01	0.00	0.00
500117	9722_500117_5	Protection	0.02	0.00	0.00
500117	9357_500117_5	Protection	0.02	0.00	0.00
500117	9782_500117_5	Protection	0.02	0.00	0.00
500117	10129_500117_5	Protection	0.01	0.00	0.00
500117	10184_500117_5	Protection	0.02	0.00	0.00
500117	10255_500117_5	Protection	0.02	0.00	0.00
500117	10312_500117_5	Protection	0.02	0.00	0.00
500117	10408_500117_5	Protection	0.02	0.00	0.00
500117	10441_500117_5	Protection	0.01	0.00	0.00
500117	10538_500117_5	Protection	0.02	0.00	0.00
500228	10280_500228_5	Protection	0.16	0.01	0.02
500228	10639_500228_5	Protection	0.02	0.00	0.00
500117	10517_500117_5	Protection	0.01	0.00	0.00
500290	11589_500290_5	Protection	0.01	0.02	0.00
500207	11373_500207_5	Protection	0.01	0.00	0.00
500366	10875_500366_5	Protection	0.04	0.01	0.00
500369	12332_500369_5	Protection	0.01	<Null>	0.00
500366	11953_500366_5	Protection	0.02	0.02	0.00

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500366	12968_500366_5	Protection	0.01	0.00	0.00
500366	12859_500366_5	Protection	0.02	0.00	0.00
500366	12789_500366_5	Protection	0.02	0.00	0.00
500366	12806_500366_5	Protection	0.02	0.01	0.00
500307	13539_500307_5	Protection	0.01	<Null>	0.00
500307	13578_500307_5	Protection	0.01	0.00	0.00
500366	14398_500366_5	Protection	0.01	0.01	0.00
500366	13483_500366_5	Protection	0.83	0.21	0.06
500366	14266_500366_5	Protection	0.05	0.01	0.00
500369	14595_500369_5	Protection	0.02	0.01	0.00
500366	16033_500366_5	Protection	0.02	0.02	0.00
9904	15557_9904_5	Protection	0.06	0.00	0.01
9904	16762_9904_5	Protection	0.01	<Null>	0.00
500356	16501_500356_5	Protection	0.01	0.00	0.00
9904	17058_9904_5	Protection	0.01	<Null>	0.00
9904	17085_9904_5	Protection	0.02	0.00	0.00
500369	16633_500369_5	Protection	0.02	0.00	0.00
9904	16774_9904_5	Protection	0.27	0.00	0.05
9904	17740_9904_5	Protection	0.02	0.01	0.00
9932	17853_9932_5	Protection	0.02	<Null>	0.00
9932	17914_9932_5	Protection	0.04	<Null>	0.00
9932	17993_9932_5	Protection	0.06	<Null>	0.00
9932	18134_9932_5	Protection	0.03	<Null>	0.00
9932	18154_9932_5	Protection	0.03	0.00	0.00
9932	18208_9932_5	Protection	0.01	0.00	0.00
500330	18902_500330_5	Protection	0.01	<Null>	0.00
500359	19770_500359_5	Protection	0.01	0.09	0.00
500450	19595_500450_5	Protection	0.01	0.00	0.00
500359	19343_500359_5	Protection	0.07	0.31	0.01
500359	20042_500359_5	Protection	0.01	0.06	0.00
500359	20062_500359_5	Protection	0.02	0.08	0.00
500359	19618_500359_5	Protection	0.01	<Null>	0.00
500359	19619_500359_5	Protection	0.01	<Null>	0.00
359	19620_359_5	Protection	0.01	<Null>	0.00
500386	19821_500386_5	Protection	0.02	0.02	0.00
500359	20080_500359_5	Protection	0.08	0.18	0.01
500359	20518_500359_5	Protection	0.02	0.02	0.00
500359	20502_500359_5	Protection	0.02	0.03	0.00
500359	20389_500359_5	Protection	0.01	0.05	0.00

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500359	20410_500359_5	Protection	0.01	0.06	0.00
500359	21323_500359_5	Protection	0.01	0.01	0.00
500359	21385_500359_5	Protection	0.02	0.03	0.00
500474	21467_500474_5	Protection	0.02	0.01	0.00
500386	20857_500386_5	Protection	0.01	0.00	0.00
500359	21898_500359_5	Protection	0.01	0.03	0.00
500474	21584_500474_5	Protection	0.05	0.03	0.00
500359	21719_500359_5	Protection	0.03	0.05	0.00
500460	22996_500460_5	Protection	0.01	0.01	0.00
500460	23041_500460_5	Protection	0.02	0.00	0.00
500359	24090_500359_5	Protection	0.01	0.05	0.00
500450	26269_500450_5	Protection	0.01	0.00	0.00
500450	26312_500450_5	Protection	0.02	0.00	0.00
500450	26387_500450_5	Protection	0.02	0.00	0.00
500450	25881_500450_5	Protection	0.01	0.01	0.00
500450	25924_500450_5	Protection	0.01	0.00	0.00
500460	27140_500460_5	Protection	0.02	0.00	0.00
500450	27174_500450_5	Protection	0.01	0.00	0.00
9918	26974_9918_5	Protection	0.01	0.00	0.00
500359	27320_500359_5	Protection	0.03	0.03	0.01
500450	27737_500450_5	Protection	0.02	0.01	0.00
500450	27387_500450_5	Protection	0.03	0.01	0.00
469	27994_469_5	Protection	0.01	0.01	0.00
469	29184_469_5	Protection	0.44	0.26	0.03
500481	29671_500481_5	Protection	0.03	0.04	0.00
500504	29877_500504_5	Protection	0.02	0.01	0.00
500524	29682_500524_5	Protection	0.19	0.13	0.01
500460	29957_500460_5	Protection	0.01	0.00	0.00
500523	29719_500523_5	Protection	0.01	0.01	0.00
500504	30195_500504_5	Protection	0.01	0.00	0.00
469	29899_469_5	Protection	0.01	0.00	0.00
500460	30339_500460_5	Protection	0.09	0.02	0.00
500524	30191_500524_5	Protection	0.70	0.09	0.05
500524	29980_500524_5	Protection	0.24	0.18	0.02
500504	30955_500504_5	Protection	0.01	0.00	0.00
500504	31066_500504_5	Protection	0.01	0.01	0.00
500524	30376_500524_5	Protection	0.21	0.05	0.01
500534	31146_500534_5	Protection	0.01	<Null>	0.00
500504	31835_500504_5	Protection	0.01	0.00	0.00

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500548	31675_500548_5	Protection	0.01	0.01	0.00
500524	31273_500524_5	Protection	0.02	0.01	0.00
500524	31603_500524_5	Protection	0.02	0.01	0.00
500524	31467_500524_5	Protection	0.02	0.01	0.00
500524	31432_500524_5	Protection	0.02	0.01	0.00
500524	30493_500524_5	Protection	0.65	0.86	0.04
500548	32199_500548_5	Protection	0.02	0.01	0.00
500548	32619_500548_5	Protection	0.03	0.01	0.00
500548	32039_500548_5	Protection	0.72	0.44	0.07
500548	32701_500548_5	Protection	0.02	0.01	0.00
500548	32736_500548_5	Protection	0.01	0.00	0.00
500504	32424_500504_5	Protection	0.02	0.01	0.00
500504	32264_500504_5	Protection	0.01	0.00	0.00
500504	32374_500504_5	Protection	0.01	0.00	0.00
500504	32306_500504_5	Protection	0.01	0.01	0.00
500504	31953_500504_5	Protection	0.19	0.07	0.01
500523	34163_500523_5	Protection	0.02	0.00	0.00
500589	34343_500589_5	Protection	0.01	0.01	0.00
500523	34876_500523_5	Protection	0.01	0.01	0.00
500523	35632_500523_5	Protection	0.02	0.00	0.00
500589	35229_500589_5	Protection	0.02	0.01	0.00
500589	35173_500589_5	Protection	0.01	0.01	0.00
500589	35156_500589_5	Protection	0.01	0.02	0.00
500589	35202_500589_5	Protection	0.01	0.01	0.00
500589	35268_500589_5	Protection	0.01	0.01	0.00
500523	35518_500523_5	Protection	0.01	0.00	0.00
500524	34717_500524_5	Protection	0.65	0.18	0.04
500602	36002_500602_5	Protection	0.01	0.00	0.00
500523	35419_500523_5	Protection	0.01	0.01	0.00
500589	35820_500589_5	Protection	0.01	0.04	0.00
500589	35606_500589_5	Protection	0.10	0.21	0.01
551	35642_551_5	Protection	0.02	0.05	0.00
500589	35895_500589_5	Protection	0.04	0.07	0.01
500589	36104_500589_5	Protection	0.03	0.05	0.00
551	36454_551_5	Protection	0.01	0.02	0.00
500523	36226_500523_5	Protection	0.01	0.00	0.00
551	35263_551_5	Protection	0.24	0.49	0.02
500523	36567_500523_5	Protection	0.01	0.00	0.00
500589	36246_500589_5	Protection	0.02	0.06	0.00

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500589	36688_500589_5	Protection	0.01	0.04	0.00
500523	36477_500523_5	Protection	0.01	0.00	0.00
500589	36423_500589_5	Protection	0.02	0.06	0.00
500611	36698_500611_5	Protection	0.01	0.01	0.00
9922	37698_9922_5	Protection	0.02	0.02	0.00
500632	38251_500632_5	Protection	0.01	0.00	0.00
500611	37480_500611_5	Protection	0.02	0.01	0.00
500602	39857_500602_5	Protection	0.01	0.02	0.00
500575	40196_500575_5	Protection	0.01	0.00	0.00
500575	40241_500575_5	Protection	0.01	0.00	0.00
500648	40466_500648_5	Protection	0.02	0.05	0.00
500575	41338_500575_5	Protection	0.01	0.00	0.00
500662	41617_500662_5	Protection	0.01	0.01	0.00
500575	41571_500575_5	Protection	0.01	0.00	0.00
551	41691_551_5	Protection	0.01	0.01	0.00
500662	41058_500662_5	Protection	0.02	0.00	0.00
500648	41498_500648_5	Protection	0.02	0.03	0.00
500575	40950_500575_5	Protection	0.01	0.00	0.00
500662	42678_500662_5	Protection	0.02	0.00	0.00
500662	41376_500662_5	Protection	0.01	0.01	0.00
551	41377_551_5	Protection	0.01	0.01	0.00
500575	41076_500575_5	Protection	0.02	0.00	0.00
500575	41743_500575_5	Protection	0.02	0.00	0.00
500575	43035_500575_5	Protection	0.01	0.00	0.00
500662	41430_500662_5	Protection	0.02	0.01	0.00
500662	42981_500662_5	Protection	0.03	0.03	0.00
500648	43592_500648_5	Protection	0.02	0.06	0.00
500575	43629_500575_5	Protection	0.01	0.00	0.00
551	42949_551_5	Protection	0.01	0.00	0.00
500648	44155_500648_5	Protection	0.02	0.01	0.00
500648	41924_500648_5	Protection	0.30	0.37	0.04
500648	44738_500648_5	Protection	0.01	0.01	0.00
500648	44335_500648_5	Protection	0.02	0.03	0.00
500662	43985_500662_5	Protection	0.01	0.00	0.00
500621	43839_500621_5	Protection	0.02	0.01	0.00
500621	43699_500621_5	Protection	0.02	0.01	0.00
500648	45211_500648_5	Protection	0.01	0.02	0.00
500621	43344_500621_5	Protection	0.15	0.17	0.02
551	44900_551_5	Protection	0.01	0.02	0.00

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500662	45748_500662_5	Protection	0.15	0.23	0.01
500662	45927_500662_5	Protection	0.20	0.22	0.02
500648	45349_500648_5	Protection	0.01	0.01	0.00
500662	44240_500662_5	Protection	0.41	0.80	0.03
500602	45660_500602_5	Protection	0.01	0.03	0.00
500648	45812_500648_5	Protection	0.01	0.02	0.00
500662	46151_500662_5	Protection	0.01	0.01	0.00
500648	45683_500648_5	Protection	0.01	0.01	0.00
500602	46236_500602_5	Protection	0.01	0.01	0.00
500602	45752_500602_5	Protection	0.02	0.03	0.00
500648	45555_500648_5	Protection	0.02	0.01	0.00
500602	45776_500602_5	Protection	0.02	0.07	0.00
500648	45432_500648_5	Protection	0.02	0.02	0.00
500602	46316_500602_5	Protection	0.01	0.01	0.00
500575	44609_500575_5	Protection	0.03	0.01	0.00
500602	46339_500602_5	Protection	0.02	0.01	0.00
500648	45766_500648_5	Protection	0.02	0.03	0.00
500602	46402_500602_5	Protection	0.02	0.01	0.00
500602	46468_500602_5	Protection	0.01	0.00	0.00
500662	46308_500662_5	Protection	0.26	0.24	0.02
500663	46176_500663_5	Protection	0.01	0.00	0.00
500662	46700_500662_5	Protection	0.02	0.02	0.00
500602	46544_500602_5	Protection	0.02	0.01	0.00
500602	46712_500602_5	Protection	0.02	0.01	0.00
500575	46640_500575_5	Protection	0.03	0.00	0.00
500663	44242_500663_5	Protection	1.80	2.63	0.14
500575	46626_500575_5	Protection	0.02	0.00	0.00
500575	46381_500575_5	Protection	0.02	0.00	0.00
500663	46947_500663_5	Protection	0.08	0.01	0.01
500648	47210_500648_5	Protection	0.02	0.01	0.00
500662	47185_500662_5	Protection	0.02	0.00	0.00
500663	47149_500663_5	Protection	0.02	0.00	0.00
500662	47108_500662_5	Protection	0.03	0.01	0.00
500602	48649_500602_5	Source Reduction	0.01	0.01	0.00
500054	4_500054_6	Source Reduction	0.44	0.00	0.01
500054	7_500054_6	Source Reduction	0.22	0.00	0.00
500090	5_500090_6	Source Reduction	0.44	0.00	0.01
500054	9_500054_6	Source Reduction	0.22	0.00	0.00
500090	6_500090_6	Source Reduction	2.71	0.05	0.07

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500090	13_500090_6	Source Reduction	0.62	0.00	0.02
500043	1_500043_6	Source Reduction	111.56	11.45	1.77
500054	3_500054_6	Source Reduction	29.00	0.90	0.47
500061	16_500061_6	Source Reduction	0.37	0.01	0.01
500090	2_500090_6	Source Reduction	35.17	1.15	0.97
500143	18_500143_6	Source Reduction	0.12	0.02	0.01
500047	22_500047_6	Source Reduction	0.02	0.00	0.00
500061	25_500061_6	Source Reduction	0.12	0.00	0.00
500090	23_500090_6	Source Reduction	0.20	0.00	0.01
500090	24_500090_6	Source Reduction	0.22	0.00	0.01
500143	12_500143_6	Source Reduction	1.69	0.15	0.08
500017	26_500017_6	Source Reduction	0.50	0.00	0.02
500047	10_500047_6	Source Reduction	10.67	0.68	0.17
71	11_71_6	Source Reduction	6.72	0.50	0.11
500079	8_500079_6	Source Reduction	10.48	0.30	0.17
500061	28_500061_6	Source Reduction	0.06	0.00	0.00
110	21_110_6	Source Reduction	1.30	0.00	0.02
71	32_71_6	Source Reduction	0.04	<Null>	0.00
72	17_72_6	Source Reduction	2.42	0.05	0.16
500106	30_500106_6	Source Reduction	1.70	0.08	0.03
500017	15_500017_6	Source Reduction	13.75	1.73	0.56
500143	41_500143_6	Source Reduction	0.44	0.00	0.02
72	42_72_6	Source Reduction	0.16	0.00	0.01
9916	36_9916_6	Source Reduction	4.88	0.58	0.33
500143	43_500143_6	Source Reduction	1.11	0.00	0.05
72	44_72_6	Source Reduction	0.64	0.01	0.04
500103	35_500103_6	Source Reduction	5.82	2.09	0.40
9914	40_9914_6	Source Reduction	1.89	0.62	0.13
9914	47_9914_6	Source Reduction	0.49	0.00	0.03
500143	20_500143_6	Source Reduction	20.89	1.42	0.97
500148	19_500148_6	Source Reduction	16.79	1.10	0.78
9916	45_9916_6	Source Reduction	0.62	0.01	0.04
500078	27_500078_6	Source Reduction	12.61	0.18	0.85
9916	46_9916_6	Source Reduction	1.44	0.02	0.10
9916	48_9916_6	Source Reduction	0.48	0.01	0.03
9926	52_9926_6	Source Reduction	0.19	0.00	0.01
9916	51_9916_6	Source Reduction	0.40	0.00	0.03
500104	49_500104_6	Source Reduction	5.38	0.08	0.36
9916	57_9916_6	Source Reduction	0.22	0.00	0.02

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500148	50_500148_6	Source Reduction	4.44	0.39	0.21
102	55_102_6	Source Reduction	2.00	0.00	0.03
500119	63_500119_6	Source Reduction	0.34	0.00	0.01
500145	65_500145_6	Source Reduction	0.44	0.00	0.01
500119	64_500119_6	Source Reduction	1.16	0.00	0.02
500219	62_500219_6	Source Reduction	7.30	0.06	0.47
500219	66_500219_6	Source Reduction	0.67	0.00	0.04
500213	68_500213_6	Source Reduction	2.70	0.02	0.17
500213	70_500213_6	Source Reduction	0.22	0.00	0.01
500213	71_500213_6	Source Reduction	0.22	<Null>	0.01
500106	72_500106_6	Source Reduction	0.07	0.00	0.00
500159	69_500159_6	Source Reduction	0.66	0.00	0.03
500119	74_500119_6	Source Reduction	0.30	0.01	0.00
500228	73_500228_6	Source Reduction	1.56	0.02	0.09
500228	76_500228_6	Source Reduction	0.22	0.00	0.01
500106	31_500106_6	Source Reduction	63.76	4.04	1.00
500228	75_500228_6	Source Reduction	1.92	0.03	0.11
144	78_144_6	Source Reduction	1.71	0.00	0.05
500117	58_500117_6	Source Reduction	29.14	1.52	0.46
163	77_163_6	Source Reduction	1.48	0.00	0.04
500228	88_500228_6	Source Reduction	0.02	0.00	0.00
500228	86_500228_6	Source Reduction	0.05	0.00	0.00
500228	79_500228_6	Source Reduction	1.11	0.01	0.07
170	80_170_6	Source Reduction	0.86	0.00	0.02
500145	67_500145_6	Source Reduction	14.14	0.10	0.39
500228	87_500228_6	Source Reduction	0.34	0.00	0.02
500228	85_500228_6	Source Reduction	0.89	0.01	0.05
500228	91_500228_6	Source Reduction	0.36	0.01	0.02
500228	94_500228_6	Source Reduction	0.22	0.00	0.01
500274	99_500274_6	Source Reduction	0.03	0.00	0.00
500274	98_500274_6	Source Reduction	0.27	0.02	0.01
163	103_163_6	Source Reduction	0.02	0.00	0.00
500228	93_500228_6	Source Reduction	8.29	1.41	0.48
500117	90_500117_6	Source Reduction	14.90	0.55	0.23
500290	105_500290_6	Source Reduction	0.76	0.61	0.05
500274	104_500274_6	Source Reduction	0.29	0.03	0.01
163	97_163_6	Source Reduction	1.06	0.10	0.03
163	110_163_6	Source Reduction	0.01	0.00	0.00
500207	82_500207_6	Source Reduction	19.70	0.26	0.54

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500369	111_500369_6	Source Reduction	0.10	0.02	0.01
500274	112_500274_6	Source Reduction	0.05	0.00	0.00
500274	102_500274_6	Source Reduction	5.81	0.63	0.16
500307	96_500307_6	Source Reduction	8.34	0.04	0.21
500307	113_500307_6	Source Reduction	0.46	0.00	0.01
163	108_163_6	Source Reduction	10.20	0.38	0.28
500308	118_500308_6	Source Reduction	0.02	<Null>	0.00
500307	100_500307_6	Source Reduction	10.38	0.77	0.27
163	114_163_6	Source Reduction	1.09	0.00	0.03
500274	117_500274_6	Source Reduction	1.35	0.07	0.04
9932	121_9932_6	Source Reduction	0.17	0.00	0.00
500369	101_500369_6	Source Reduction	12.49	1.50	0.82
500274	124_500274_6	Source Reduction	0.08	0.00	0.00
9932	123_9932_6	Source Reduction	0.26	0.00	0.00
9933	122_9933_6	Source Reduction	0.07	0.00	0.00
500228	128_500228_6	Source Reduction	0.12	0.00	0.01
9932	125_9932_6	Source Reduction	0.26	0.01	0.00
500228	116_500228_6	Source Reduction	8.13	2.02	0.48
9932	132_9932_6	Source Reduction	0.05	0.00	0.00
9904	133_9904_6	Source Reduction	0.22	0.00	0.02
500256	129_500256_6	Source Reduction	1.39	0.12	0.09
500307	135_500307_6	Source Reduction	0.17	0.00	0.00
500274	131_500274_6	Source Reduction	1.94	0.07	0.05
500308	138_500308_6	Source Reduction	0.44	0.00	0.01
9933	126_9933_6	Source Reduction	2.58	0.02	0.01
9933	140_9933_6	Source Reduction	0.10	0.00	0.00
500356	130_500356_6	Source Reduction	4.65	0.59	0.31
500356	141_500356_6	Source Reduction	0.22	0.00	0.01
500308	136_500308_6	Source Reduction	2.47	0.01	0.06
9933	142_9933_6	Source Reduction	0.31	0.00	0.00
500356	145_500356_6	Source Reduction	0.22	0.00	0.01
500369	147_500369_6	Source Reduction	0.22	0.01	0.01
500356	148_500356_6	Source Reduction	0.22	0.00	0.01
9904	134_9904_6	Source Reduction	26.46	8.18	1.82
500366	95_500366_6	Source Reduction	61.35	5.84	1.84
500330	151_500330_6	Source Reduction	0.05	0.00	0.00
500389	158_500389_6	Source Reduction	0.15	0.00	0.01
9932	137_9932_6	Source Reduction	3.16	0.02	0.03
500330	156_500330_6	Source Reduction	0.49	0.01	0.03

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500330	160_500330_6	Source Reduction	0.17	0.05	0.01
9932	149_9932_6	Source Reduction	4.01	0.01	0.03
500369	115_500369_6	Source Reduction	39.30	9.52	2.59
500308	146_500308_6	Source Reduction	4.62	0.01	0.12
500386	167_500386_6	Source Reduction	0.06	0.00	0.00
500366	157_500366_6	Source Reduction	1.05	0.06	0.03
500369	168_500369_6	Source Reduction	0.67	0.01	0.04
9904	169_9904_6	Source Reduction	0.32	0.06	0.02
9904	150_9904_6	Source Reduction	9.25	3.00	0.63
500330	159_500330_6	Source Reduction	1.79	0.58	0.12
500390	173_500390_6	Source Reduction	0.05	0.00	0.00
500366	170_500366_6	Source Reduction	0.90	0.00	0.03
500389	171_500389_6	Source Reduction	0.47	0.00	0.02
9923	161_9923_6	Source Reduction	2.40	0.74	0.16
9904	174_9904_6	Source Reduction	0.89	0.41	0.06
423	175_423_6	Source Reduction	0.59	0.00	0.02
9923	178_9923_6	Source Reduction	0.59	0.07	0.04
500389	179_500389_6	Source Reduction	0.54	0.00	0.02
500395	188_500395_6	Source Reduction	0.05	0.00	0.00
500441	186_500441_6	Source Reduction	0.18	0.00	0.01
9934	177_9934_6	Source Reduction	4.34	0.01	0.13
500395	163_500395_6	Source Reduction	4.01	0.02	0.16
500424	190_500424_6	Source Reduction	0.07	0.00	0.00
9911	189_9911_6	Source Reduction	0.10	0.00	0.01
500474	183_500474_6	Source Reduction	2.40	0.18	0.04
500395	191_500395_6	Source Reduction	0.06	0.00	0.00
500369	172_500369_6	Source Reduction	4.23	0.94	0.28
500390	180_500390_6	Source Reduction	1.53	0.23	0.10
500424	192_500424_6	Source Reduction	0.61	0.00	0.02
500424	194_500424_6	Source Reduction	0.22	0.00	0.01
500406	184_500406_6	Source Reduction	3.02	1.85	0.19
500474	197_500474_6	Source Reduction	0.19	0.02	0.00
500460	198_500460_6	Source Reduction	0.04	0.00	0.00
500386	143_500386_6	Source Reduction	20.84	1.93	0.63
500406	196_500406_6	Source Reduction	1.47	0.39	0.09
9912	204_9912_6	Source Reduction	0.22	0.00	0.02
500460	206_500460_6	Source Reduction	0.22	0.00	0.00
9911	210_9911_6	Source Reduction	0.02	0.00	0.00
9912	200_9912_6	Source Reduction	2.62	0.26	0.18

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
9912	207_9912_6	Source Reduction	0.22	0.00	0.02
500460	208_500460_6	Source Reduction	0.22	0.00	0.00
9911	185_9911_6	Source Reduction	7.73	0.68	0.51
500460	211_500460_6	Source Reduction	0.22	0.00	0.00
500460	212_500460_6	Source Reduction	0.29	0.00	0.00
500460	199_500460_6	Source Reduction	6.00	0.89	0.10
500424	201_500424_6	Source Reduction	1.57	0.05	0.06
500465	215_500465_6	Source Reduction	0.04	0.00	0.00
500474	219_500474_6	Source Reduction	0.04	0.00	0.00
500460	217_500460_6	Source Reduction	0.17	0.00	0.00
9921	181_9921_6	Source Reduction	8.13	2.67	0.55
500450	218_500450_6	Source Reduction	0.39	0.01	0.01
500406	195_500406_6	Source Reduction	2.36	1.01	0.15
500474	203_500474_6	Source Reduction	4.21	0.34	0.08
9918	220_9918_6	Source Reduction	0.48	0.15	0.03
500481	221_500481_6	Source Reduction	1.07	0.10	0.03
9906	213_9906_6	Source Reduction	3.04	0.93	0.20
9918	176_9918_6	Source Reduction	15.72	13.96	1.06
500544	228_500544_6	Source Reduction	0.06	0.00	0.00
500462	230_500462_6	Source Reduction	0.09	0.00	0.00
500454	193_500454_6	Source Reduction	10.77	1.00	0.32
500544	229_500544_6	Source Reduction	0.86	0.10	0.06
500462	231_500462_6	Source Reduction	0.66	0.00	0.01
500462	239_500462_6	Source Reduction	0.11	0.00	0.00
500524	233_500524_6	Source Reduction	0.38	0.01	0.01
500481	225_500481_6	Source Reduction	2.18	0.15	0.06
500511	240_500511_6	Source Reduction	0.22	0.00	0.01
500450	165_500450_6	Source Reduction	43.19	4.62	1.19
500511	241_500511_6	Source Reduction	0.22	0.00	0.01
469	232_469_6	Source Reduction	6.21	0.70	0.18
500524	242_500524_6	Source Reduction	0.30	0.06	0.01
500524	250_500524_6	Source Reduction	0.07	0.01	0.00
500524	244_500524_6	Source Reduction	0.38	0.01	0.01
500524	247_500524_6	Source Reduction	0.19	0.04	0.00
500481	223_500481_6	Source Reduction	11.77	1.23	0.32
500524	252_500524_6	Source Reduction	0.28	0.03	0.01
500511	238_500511_6	Source Reduction	8.90	1.05	0.36
500524	251_500524_6	Source Reduction	2.41	0.48	0.07
9910	254_9910_6	Source Reduction	0.22	0.00	0.01

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
515	261_515_6	Source Reduction	0.10	0.00	0.01
9910	266_9910_6	Source Reduction	0.02	0.00	0.00
9910	260_9910_6	Source Reduction	0.79	0.00	0.05
525	259_525_6	Source Reduction	1.58	0.02	0.10
500524	243_500524_6	Source Reduction	5.32	1.28	0.14
9910	267_9910_6	Source Reduction	0.08	0.00	0.01
469	227_469_6	Source Reduction	18.51	3.91	0.55
521	257_521_6	Source Reduction	1.62	0.26	0.07
500524	253_500524_6	Source Reduction	2.19	0.19	0.06
500519	263_500519_6	Source Reduction	1.95	0.18	0.08
500519	271_500519_6	Source Reduction	0.11	0.00	0.00
500519	246_500519_6	Source Reduction	11.47	1.60	0.47
500563	272_500563_6	Source Reduction	0.44	0.00	0.03
500563	258_500563_6	Source Reduction	3.98	0.04	0.26
500563	279_500563_6	Source Reduction	0.04	0.00	0.00
536	262_536_6	Source Reduction	3.34	0.03	0.22
500548	286_500548_6	Source Reduction	0.15	0.01	0.01
500524	280_500524_6	Source Reduction	1.77	0.06	0.05
500524	275_500524_6	Source Reduction	3.52	0.38	0.09
500523	285_500523_6	Source Reduction	0.12	0.01	0.00
500589	288_500589_6	Source Reduction	0.07	0.00	0.00
500589	289_500589_6	Source Reduction	0.01	0.00	0.00
500548	268_500548_6	Source Reduction	15.37	3.42	0.61
500523	245_500523_6	Source Reduction	11.43	1.66	0.32
500504	235_500504_6	Source Reduction	53.40	6.19	1.58
500589	283_500589_6	Source Reduction	2.30	1.55	0.11
551	269_551_6	Source Reduction	25.14	7.71	1.00
500589	284_500589_6	Source Reduction	1.29	0.27	0.06
500589	298_500589_6	Source Reduction	0.22	0.03	0.01
500589	292_500589_6	Source Reduction	0.32	0.09	0.02
500531	264_500531_6	Source Reduction	11.68	1.93	0.47
500563	287_500563_6	Source Reduction	0.07	0.00	0.00
9922	299_9922_6	Source Reduction	0.22	0.00	0.01
500589	305_500589_6	Source Reduction	0.13	0.00	0.01
500524	295_500524_6	Source Reduction	0.48	0.01	0.01
500524	282_500524_6	Source Reduction	0.65	0.02	0.02
9937	315_9937_6	Source Reduction	3.53	0.57	0.19
9922	312_9922_6	Source Reduction	1.14	0.09	0.08
500575	316_500575_6	Source Reduction	0.10	0.00	0.00

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
9919	320_9919_6	Source Reduction	0.10	0.02	0.01
500589	314_500589_6	Source Reduction	0.11	0.01	0.01
500602	322_500602_6	Source Reduction	0.01	0.00	0.00
9922	317_9922_6	Source Reduction	0.44	0.00	0.03
500602	328_500602_6	Source Reduction	0.02	0.01	0.00
500589	330_500589_6	Source Reduction	0.05	0.01	0.00
9922	325_9922_6	Source Reduction	0.22	0.00	0.01
500575	329_500575_6	Source Reduction	0.05	0.00	0.00
500575	335_500575_6	Source Reduction	0.08	0.00	0.00
500662	311_500662_6	Source Reduction	3.31	0.26	0.10
500588	300_500588_6	Source Reduction	10.48	1.41	0.39
500524	296_500524_6	Source Reduction	8.16	0.86	0.22
500523	297_500523_6	Source Reduction	24.97	2.11	0.69
9937	344_9937_6	Source Reduction	0.02	0.00	0.00
500632	327_500632_6	Source Reduction	5.70	0.70	0.19
500589	310_500589_6	Source Reduction	17.47	5.40	0.86
543	345_543_6	Source Reduction	0.46	0.01	0.01
500524	349_500524_6	Source Reduction	0.62	0.03	0.02
551	309_551_6	Source Reduction	20.55	5.73	0.82
500575	350_500575_6	Source Reduction	2.19	0.11	0.04
9908	355_9908_6	Source Reduction	0.04	0.00	0.00
9937	339_9937_6	Source Reduction	1.53	0.01	0.08
500611	321_500611_6	Source Reduction	18.38	3.05	0.65
500575	362_500575_6	Source Reduction	0.06	0.00	0.00
500632	337_500632_6	Source Reduction	3.44	0.62	0.12
601	324_601_6	Source Reduction	2.80	0.63	0.14
500544	373_500544_6	Source Reduction	0.03	0.00	0.00
551	369_551_6	Source Reduction	0.50	0.11	0.02
500602	323_500602_6	Source Reduction	4.38	0.88	0.22
500613	340_500613_6	Source Reduction	10.04	0.19	0.52
500575	363_500575_6	Source Reduction	3.07	0.09	0.05
551	372_551_6	Source Reduction	0.28	0.06	0.01
500647	361_500647_6	Source Reduction	2.73	1.12	0.18
551	375_551_6	Source Reduction	0.09	0.01	0.00
500631	356_500631_6	Source Reduction	12.58	6.18	0.84
551	348_551_6	Source Reduction	6.54	1.46	0.26
500663	371_500663_6	Source Reduction	2.84	0.73	0.09
9937	351_9937_6	Source Reduction	8.19	2.02	0.43
500575	368_500575_6	Source Reduction	5.91	0.21	0.10

Catchment	BMP ID	BMP Type	Size (acres)	Sediment Reduction (tons/yr)	Phosphorus Reduction (lbs/yr)
500621	370_500621_6	Source Reduction	7.56	1.01	0.39
551	376_551_6	Source Reduction	0.01	0.01	0.00
500648	374_500648_6	Source Reduction	17.97	2.47	0.91
500662	343_500662_6	Source Reduction	24.45	4.09	0.78
500662	378_500662_6	Source Reduction	1.88	0.25	0.06
500602	380_500602_6	Source Reduction	4.85	0.71	0.24
500602	336_500602_6	Source Reduction	43.53	7.77	2.14
500663	353_500663_6	Source Reduction	56.01	8.38	1.78
500602	381_500602_6	Source Reduction	3.17	0.51	0.16
500647	387_500647_6	Source Reduction	0.16	0.05	0.01
500647	383_500647_6	Source Reduction	7.90	1.18	0.52
500647	388_500647_6	Source Reduction	3.85	0.59	0.25
500534	400_500534_6	Source Reduction	6.72	1.14	0.39
9922	401_9922_6	Source Reduction	9.79	3.20	0.60
536	402_536_6	Source Reduction	5.80	1.79	0.43
500544	403_500544_6	Source Reduction	4.60	3.77	0.30
9919	404_9919_6	Source Reduction	0.73	0.24	0.06
9919	405_9919_6	Source Reduction	6.27	2.75	0.28
500544	406_500544_6	Source Reduction	2.31	1.72	0.14
9922	407_9922_6	Source Reduction	13.06	3.98	1.12
500648	408_500648_6	Source Reduction	33.06	10.06	1.76
500647	409_500647_6	Source Reduction	10.70	5.59	0.70
500544	410_500544_6	Source Reduction	29.48	11.87	1.91

Appendix B

$$\left(Catchment\ TSS\ Load\ \frac{\frac{tons}{acre}}{year} * 50\%\right) + \left(Catchment\ TP\ Load\ \frac{\frac{lbs}{acre}}{year} * 50\%\right) = Total\ Catchment\ Load\ Value$$

$$\frac{Total\ Catchment\ Load\ Value}{Highest\ Catchment\ Load} = Catchment\ Rank$$

$$\left(BMP\ TSS\ Reduction\ \frac{tons}{year} * 50\%\right) + \left(BMP\ TP\ Reduction \frac{lbs}{year} * 50\%\right) = Total\ BMP\ Reduction\ Value$$

$$\frac{Total\ BMP\ Reduction\ Value}{Highest\ BMP\ Reduction\ Value} = BMP\ Reduction\ Rank$$

$$PTMApp\ Given\ Value = Downstream\ Reduction\ Potential$$

$$If\ BMP\ Type\ is\ filtration\ or\ storage$$
$$BMP\ Value = 1$$

$$If\ BMP\ Type\ is\ Source\ Reduction$$
$$BMP\ Value = 0.5$$

$$(Catchment\ Rank * 30\%) + (BMP\ Reduction\ Rank * 30\%) + \big((1 - Downstream\ Reduction\ Potential) * 30\%\big) + (BMP\ Value * 10\%) = BMP\ Rank$$