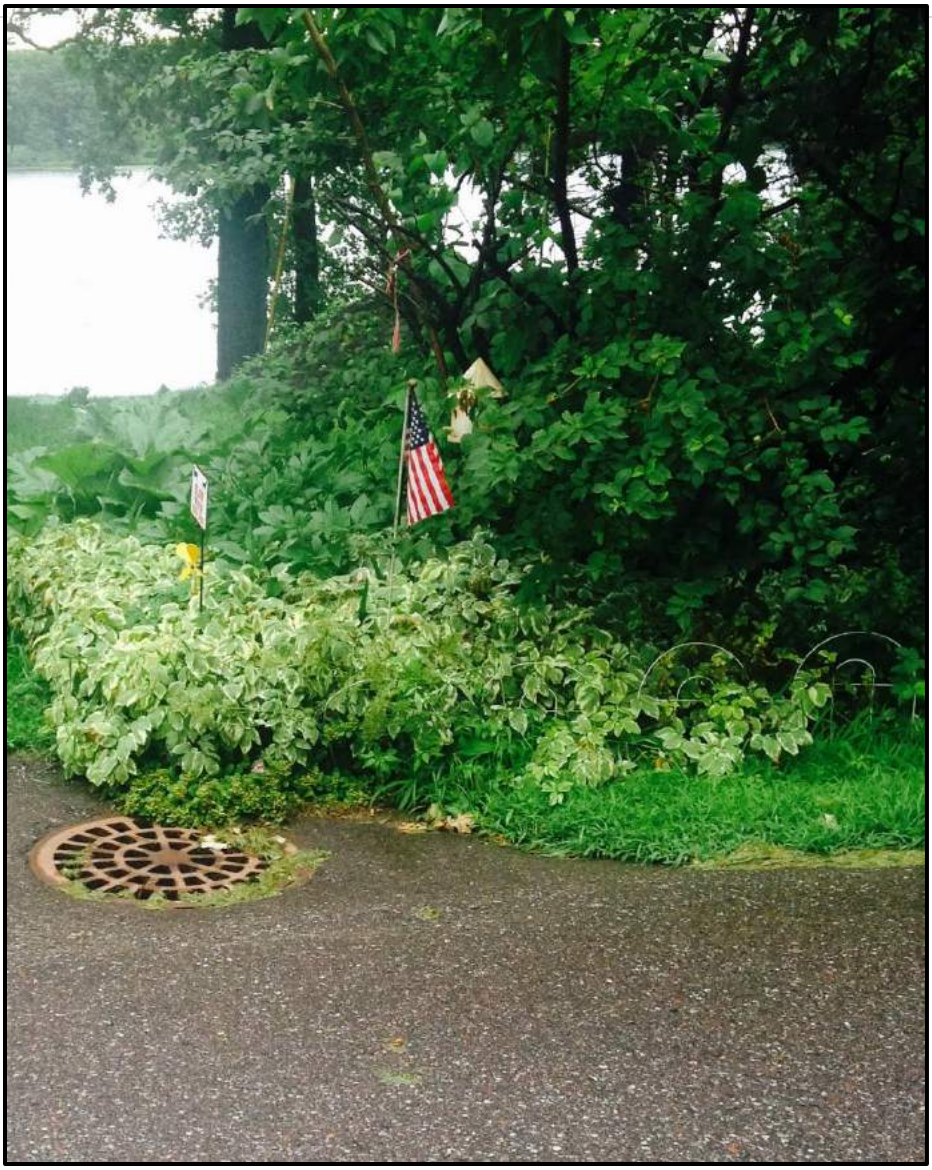

Blue Lake
Stormwater Retrofit Analysis

Prepared by:

Isanti Soil and Water Conservation District

And

Sherburne Soil and Water Conservation District

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Table of Contents

Executive Summary 4
Retrofit Ranking 8
Table 1: Urban Project Ranking 9
Table 2: Rural Project Ranking (continues through page 14) 10
About this Document 14
Document Organization 14
Methods: 16
Selection of Subwatershed 16
Subwatershed Assessment Methods 16
Treatment analysis 17
Cost Estimates 20
Evaluation and Ranking 21
Blue Lake Direct (Urban) Drainage Catchments 22
Catchment 2 23
Catchment 4 27
Catchment 5 31
Lakeshore Projects 35
Catchment Profiles Section 2: Rural Catchments 37
Priority Zone 1 38
Priority Zone 2 48
Priority Zone 3 63
Priority Zone 5 72
Priority Zone 6 89
Priority Zone 7a 108
Priority Zone 7b 126
Priority Zone 8 139
Priority Zone 9 145
Appendices: 149

CLEAN WATER LAND & LEGACY AMENDMENT

References:..... 149
Definitions:..... 149

Executive Summary

Blue Lake and its surrounding subwatershed are located within both Isanti County and Sherburne County, Minnesota. This study provides recommendations for cost effectively improving treatment of stormwater from areas draining directly to Blue Lake (considered urban) and those outside of the direct drainage area (considered rural). The lake itself and the subwatersheds draining directly to the lake are located in Stanford and Spencer Brook Townships within Isanti County. The Rural subwatershed covers areas in Spencer Brook and Stanford Township in Isanti County and also Baldwin and Livonia Townships in Sherburne County. This report provides sufficient detail to identify projects, rank projects by cost effectiveness at removing phosphorus and begin project planning. It includes project concepts and relative cost estimates for project selection. Site specific planning, designs and refined cost estimates should be done after committed partnerships for project installation are in place.

At 251 acres Blue Lake, the seventh largest lake in the county, is used regularly for recreation such as boating, swimming and fishing. The land directly surrounding Blue Lake is 75% developed, 5% undeveloped and privately owned forested land and 20% lowland marsh or wetland. Blue Lake sits at the threshold for being designated as "impaired" for not meeting state water quality standards for excess nutrients. Recent water quality monitoring data has depicted total phosphorus levels exceeding the Minnesota clean water goals for deep lakes (less than 40 µg/L) by 16% in 2015 and 4% in 2016. The lakeshore homeowners have formed a lake improvement district to organize and fund aquatic invasive species treatment and water quality improvement efforts. Recent efforts to help understand lake trends include surface water monitoring for total phosphorus and total suspended solids in both bays of the lake and four tributary inlets. Other variables being monitored include ortho-phosphorus PH, temperature, dissolved oxygen, conductivity, flow and stage.

This stormwater analysis focuses on "stormwater retrofitting" and ranking projects on cost effectiveness. Stormwater retrofitting refers to adding stormwater treatment to an already developed area or areas being used for production. This process is investigative and creative. Stormwater retrofitting success is sometimes improperly judged by the number of projects installed or by comparing costs alone. Those approaches neglect to consider how much pollution is removed per dollar spent. In this stormwater analysis we estimated both costs and pollutant reductions and used them to calculate cost effectiveness of each possible project.

The 412 acre urban watershed was delineated using available GIS subwatershed information, on site analysis and maps of stormwater conveyance features. Those areas were then divided into nine smaller stormwater drainage areas, or catchments. Within eight of the nine catchments, smaller sub-catchments were identified to benefit from implementing best management practices. For each sub-catchment, modeling of stormwater volume and pollutants was completed using the software WinSLAMM. Base and existing conditions were modeled, including existing stormwater treatment practices. The catchment not addressed in this document (catchment 8) consists of some low density residential but mostly marshy undeveloped land. Incorporating that information, along with computer analysis and site investigation, areas of concern were not identified in that catchment.

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The 6,788 acre rural watershed was delineated through the use of NRCS Engineering Tools. Priority zones were determined using Chisago SWCD protocol (Rural Subwatershed Analysis Protocol Part 1 – Targeting). Once priority zones were established, these were focused upon for Best Management Practice (BMP) implementation through a desktop search using various GIS tools and areal imagery. Field verifications were made when possible, however limited access to private property lots hindered verification in most cases. Zone four identified no beneficial BMPs therefore it is not addressed in this Report. Zone four can be readdressed in the future to track any landscape changes. The Chisago SWCD "Rural Subwatershed Analysis Protocol Part 2 - Prioritizing" was utilized to direct BMP site selection and modeling.

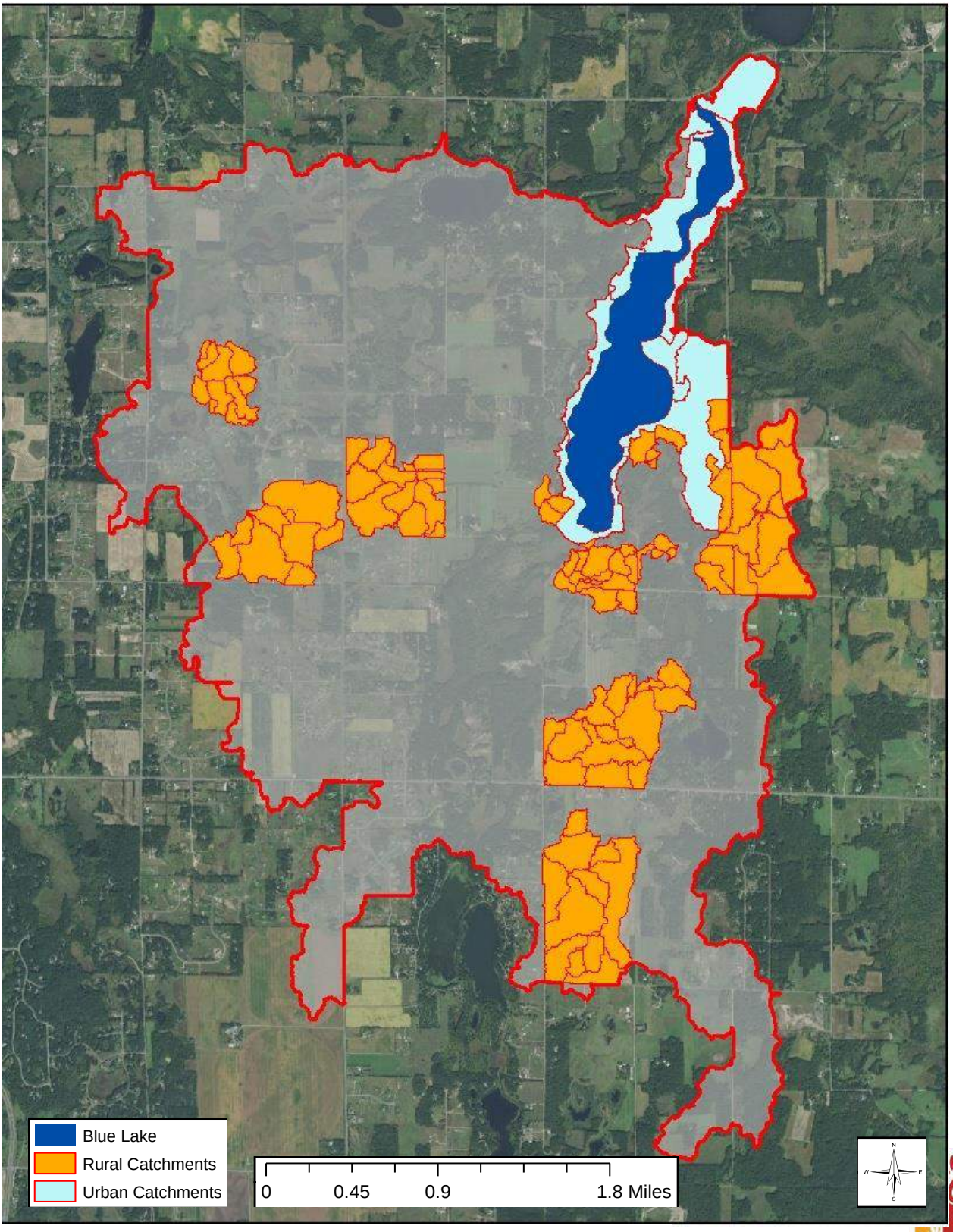
Potential urban and rural stormwater retrofits identified during this analysis were then modeled to estimate reductions in volume, total phosphorus, and total suspended solids. Finally, cost estimates were developed for each retrofit project, including 10-30 years of operations and maintenance. Projects were ranked by cost effectiveness with respect to their reduction of total phosphorus.

A variety of stormwater retrofit approaches were identified. They included:

- Maintenance of, or alterations to, existing stormwater treatment practices,
- Residential curb-cut raingardens,
- Diverting water to catch basins,
- Residential shoreline bioengineering,
- Hillside and gully erosion restoration and stabilization,
- Iron enhanced sand filter (IESF) and sediment pond,
- Stormdrain sediment catch basins,
- Water and sediment control basins,
- Grassed waterways,
- Permanent vegetation,
- Improved infiltration,
- Small farm runoff reduction,
- Wetland restoration.

If a project is selected, site-specific designs must be prepared. In addition, many of the proposed retrofits (e.g. IESF and Sediment Pond) will require engineered plan sets if selected. This typically occurs after committed partnerships are formed to install the project. Committed partnerships must include willing landowners when installed on private property. Other factors, including a project's educational value/visibility, construction timing, total cost, or non-target pollutant reduction also affect project installation decisions and will need to be weighed by resource managers when selecting projects to pursue.

This document will be modified to include updates as needed.



Blue Lake Rural Priority Zones and Urban Catchments.

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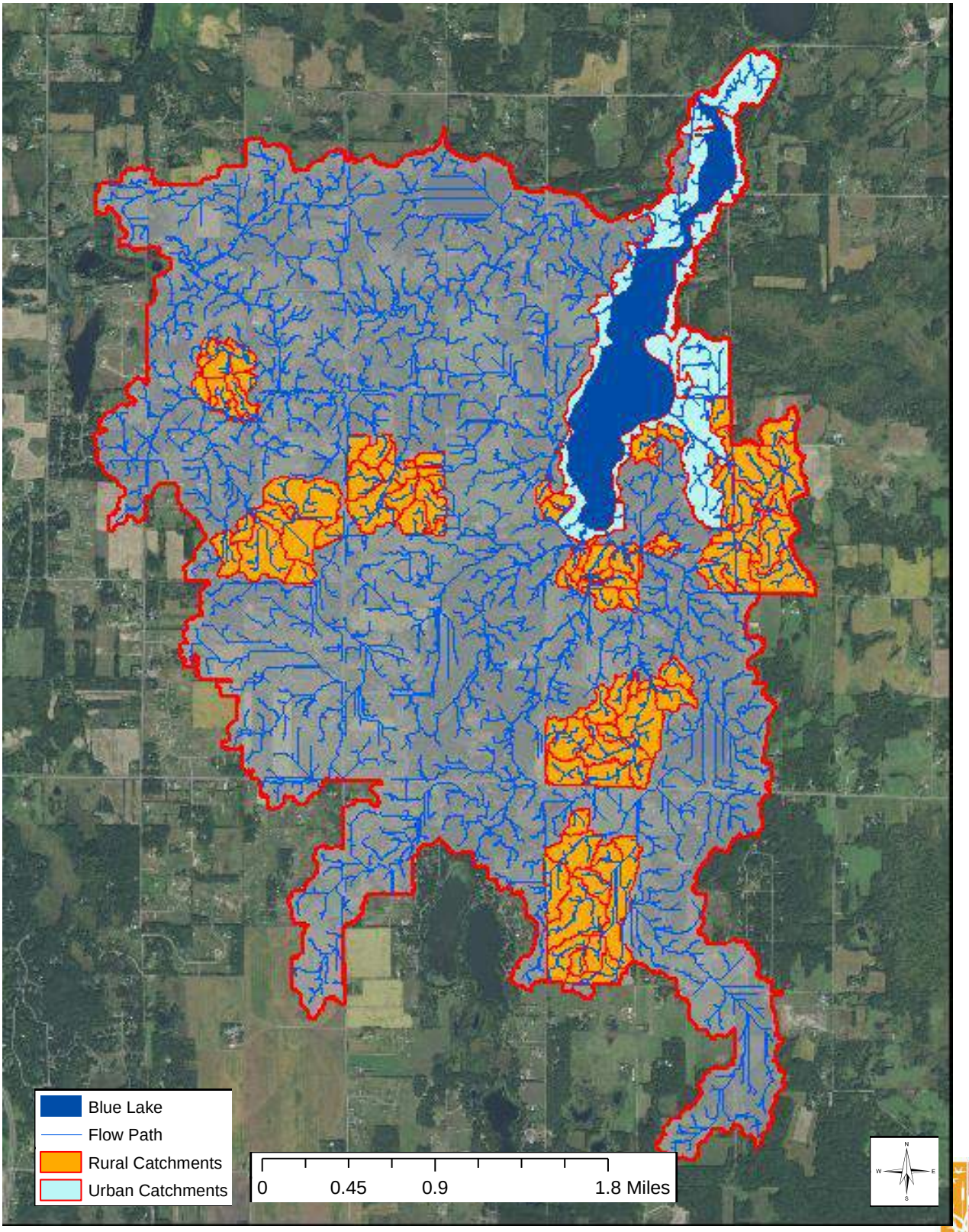

Blue Lake Watershed's Concentrated Flow Paths.

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Retrofit Ranking

The tables on the next pages summarize potential projects organized from most cost effective to least, based on cost per pound of total phosphorus removed. Reported treatment levels are dependent upon optimal siting and sizing. More detail about each project can be found in the catchment profile pages of this report. Projects that were deemed unfeasible due to prohibitive size, number, or were too expensive to justify installation are not included in the tables on the next pages.

Installing all of these projects is unlikely due to funding limitation and landowner interest. Instead, it is recommended that projects be installed in order of cost-effectiveness (points of pollution reduced per dollar spent). Other factors, including a projects educational value, visibility, construction timing, total cost, focusing on upstream projects that benefit all lakes, or non-target pollutant reduction also affect project installation decisions and will need to be weighted by resource managers when selecting projects.

Urban retrofit projects are ranked against projects in the direct watershed (urban) projects only and the rural retrofit projects are ranked against the rural watershed projects only.

Table 1: Urban Project Ranking

Summary of preferred stormwater retrofit opportunities ranked by cost-effectiveness with respect to total Phosphorus (TP) Reduction.

Project Rank	Project ID	Retrofit Type	Projects Identified	Catchment	TP Reduction (lb/yr)	TSS Reduction (lb/yr)	Volume Reduction (ac-ft/yr)	Probable Project Cost (2016 Dollars)	Estimated Annual Operations & Maintenance (2016 Dollars)	Estimated cost/ 1,000lb-TP/year (30-year)[1]	Estimated cost/ 1,000lb-TSS/year (30-year)[1]
1	5a	Gully/Hill Slump/Shoreline Repair and Restoration	3	5	6.24	13297.00	119.00	$23,298	$700	$237	$111
2	4a	Gully/Washout Repair	1	4	0.91	2140.00	0.00	$7,784	$75	$386	$156
3	Lakeshore	Lakeshore Restoration - 20 High Priority Sites	20	Lakeshore (1-9) Exclude 8	8.40	10498.34	0.00	$80,194	$195	$341	$273
4	Lakeshore	Lakeshore Restoration - 15 High Priority Sites	15	Lakeshore (1-9) Exclude 8	6.63	8288.16	0.00	$63,180	$195	$347	$278
5	Lakeshore	Lakeshore Restoration - 10 High Priority Sites	10	Lakeshore (1-9) Exclude 8	4.42	5525.44	0.00	$42,950	$195	$368	$294
6	Lakeshore	Lakeshore Restoration - 5 High Priority Sites	5	Lakeshore (1-9) Exclude 8	2.21	2762.72	0.00	$22,720	$195	$431	$345
7	5b	IESF with Settling Pond	1	5	24.1	9,885	2.7	$826,071	$2,090	$1,229	$2,997
8	2b	Rain Garden 300sq/ft	1	2	0.70	183.00	0.90	$12,284	$225	$906	$3,467
9	2a	Rain Garden 400sq/ft	1	2	0.50	140.00	0.56	$15,581	$225	$1,489	$5,317
10	4b	Stormwater Pond	1	4	0.72	254.00	3060.0	$113,163	$1,000	$6,656	$18,788
11	4c	Sump	2	4	0.10	36.00	0.00	$12,784	$1,750	$21,761	$60,448
12	2c	Sump	1	2	0.30	14.00	0.00	$13,784	$1,750	$7,365	$157,818

Table 2: Rural Project Ranking (continues through page 14)

Summary of preferred stormwater retrofit opportunities ranked by cost-effectiveness with respect to total Phosphorus (TP) reduction.								
BMP Characteristics						Cost-Benefit		
Project Rank	Priority Zone	Sub-Basin	Retrofit Type	Sediment reduction (t/yr)	Phosphorus reduction (lb/yr)	Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
1	5	7	Filter Strip	1.42	1.79	$74.58	1.79	$41.66
2	2	6	Filter Strip	2.73	3.83	$257.64	3.83	$67.27
3	5	5	Filter Strip	1.19	1.51	$108.48	1.51	$71.84
4	6	15	Filter Strip	1.60	2.3	$196.62	2.33	$84.39
5	2	11	Filter Strip	1.31	1.92	$189.84	1.92	$98.88
6	7a	5	Filter Strip	1.85	2.47	$250.86	2.47	$101.56
7	3	5	Filter Strip	2.85	3.41	$413.58	3.41	$121.28
8	2	10	Filter strip	0.72	1.06	$128.82	1.06	$121.53
9	7a	1	Filter Strip	1.65	2.25	$277.98	2.25	$123.55
10	6	2	Filter Strip	1.17	1.49	$196.62	1.49	$131.96
11	5	14	Filter Strip	1.01	1.11	$162.72	1.11	$146.59
12	5	6	Filter Strip	0.33	0.48	$74.58	0.48	$155.38
13	6	7	Filter Strip	0.82	1.11	$176.28	1.11	$158.81
14	7a	6	Filter Strip	2.97	4.01	$664.44	4.01	$165.70
15	6	13	Filter Strip	3.48	4.56	$759.36	4.56	$166.53
16	2	13	Filter Strip	1.33	1.77	$298.32	1.77	$168.54
17	5	16	Filter Strip	1.71	2.00	$359.34	2.00	$179.67
18	2	13	Filter Strip	1.26	1.68	$305.10	1.68	$181.61
19	6	10	Filter Strip	1.34	1.41	$277.98	1.41	$197.15
20	6	8	Filter Strip	2.88	3.00	$596.64	3.00	$198.88
21	2	9	Filter Strip	0.76	1.12	$223.74	1.12	$199.77
22	7a	11	Filter Strip	3.8	5.1	$1,064.46	5.13	$207.50
23	7a	13	Filter Strip	0.49	0.65	$142.38	0.65	$219.05
24	6	1	Filter Strip	0.69	0.85	$196.62	0.85	$231.32
25	7b	3	Filter Strip	1.10	1.49	$359.34	1.49	$241.17

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Summary of preferred stormwater retrofit opportunities ranked by cost-effectiveness with respect to total Phosphorus (TP) reduction.								
BMP Characteristics						Cost-Benefit		
Project Rank	Priority Zone	Sub-Basin	Retrofit Type	Sediment reduction (t/yr)	Phosphorus reduction (lb/yr)	Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
26	6	12	Filter Strip	3.10	4.24	$1,050.90	4.24	$247.85
27	9	3	Filter Strip	0.66	0.84	$210.18	0.84	$250.21
28	5	11	Filter Strip	1.33	1.70	$427.14	1.70	$251.26
29	3	6	Filter Strip	2.43	2.93	$745.80	2.93	$254.54
30	7a	8	Filter Strip	0.61	0.83	$216.96	0.83	$261.40
31	7a	5	Filter Strip	0.67	0.89	$244.08	0.89	$274.25
32	5	9	Filter Strip	0.80	0.96	$264.42	0.96	$275.44
33	1	8	Filter strip	0.23	0.36	$101.70	0.36	$282.50
34	5	10	Filter Strip	2.47	3.11	$915.30	3.11	$294.31
35	1	7	Filter strip	0.47	0.76	$223.74	0.76	$294.39
36	6	4	Filter Strip	0.62	0.91	$291.54	0.91	$320.37
37	9	1	Filter Strip	0.95	1.30	$454.26	1.30	$349.43
38	1	10	Filter strip	0.64	0.95	$332.22	0.95	$349.71
39	2	7	Filter Strip	0.57	0.88	$325.44	0.88	$369.82
40	1	1	Filter Strip	0.2	0.32	$122.04	0.32	$381.38
41	6	3	Filter Strip	0.40	0.53	$203.40	0.53	$383.77
42	8	4	Filter Strip	0.73	0.95	$366.12	0.95	$385.39
43	5	17	Filter Strip	0.35	0.47	$196.62	0.47	$418.34
44	3	2	Grassed waterway	7.81	6.63	$2,152.59	6.63	$324.67
45	1	9	Grassed waterway	4.03	3.43	$1,126.70	3.43	$328.48
46	2	12	Grassed waterway	4.04	3.44	$1,304.60	3.44	$379.24
47	7a	7	Grassed waterway	5.51	4.69	$1,779.00	4.69	$379.32
48	7a	14	Grassed waterway	4.41	3.75	$1,423.20	3.75	$379.52
49	7b	5	Grassed waterway	5.88	5.00	$1,897.60	5.00	$379.52
50	7b	5	Grassed waterway	8.64	7.34	$2,787.10	7.34	$379.71

Summary of preferred stormwater retrofit opportunities ranked by cost-effectiveness with respect to total Phosphorus (TP) reduction.								
BMP Characteristics						Cost-Benefit		
Project Rank	Priority Zone	Sub-Basin	Retrofit Type	Sediment reduction (t/yr)	Phosphorus reduction (lb/yr)	Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
51	5	8	Grassed waterway	2.25	1.91	$741.25	1.91	$388.09
52	7a	14	Grassed waterway	4.83	4.1	$1,630.75	4.1	$397.74
53	7a	2	Grassed waterway	7.28	6.19	$2,490.60	6.19	$402.36
54	3	4	Grassed waterway	3.61	3.07	$1,245.30	3.07	$405.64
55	6	4	Grassed waterway	4.14	3.52	$1,452.85	3.52	$412.74
56	5	4	Grassed waterway	6.85	5.82	$2,549.90	5.82	$438.13
57	5	15	Grassed waterway	2.71	2.30	$1,008.10	2.30	$438.30
58	7b	1	Grassed waterway	3.16	2.69	$1,186.00	2.69	$440.89
59	7b	4	Grassed waterway	3.16	2.69	$1,186.00	2.69	$440.89
60	6	1	Grassed waterway	4.26	3.62	$1,601.10	3.62	$442.29
61	7a	9	Grassed waterway	6.29	5.35	$2,401.65	5.35	$448.91
62	6	14	Grassed waterway	6.5	5.5	$2,905.70	5.51	$527.35
63	1	6	Grassed waterway	5.82	4.95	$2,621.06	4.95	$529.51
64	6	11	Grassed waterway	2.18	1.85	$1,008.10	1.85	$544.92
65	6	6	Grassed waterway	4.18	3.55	$2,016.20	3.55	$567.94
66	2	2	Grassed waterway	5.44	4.62	$2,763.38	4.62	$598.13
67	7a	4	Grassed waterway	6.93	5.89	$3,528.35	5.89	$599.04
68	2	1	Grassed waterway	4.03	3.42	$2,134.80	3.42	$624.21
69	7b	10	Grassed waterway	3.27	2.78	$1,779.00	2.78	$639.93
70	1	3	Grassed waterway	2.66	2.26	$1,482.50	2.26	$655.97
71	7b	6	Grassed waterway	1.98	1.68	$1,186.00	1.68	$705.95
72	5	13	Gully stabilization	2.57	2.19	$622.65	2.19	$284.32
73	2	14	Gully stabilization	4.88	4.15	$1,363.90	4.15	$328.65
74	8	1	Gully stabilization	7.08	6.01	$2,283.05	6.01	$379.88
75	5	3	Gully stabilization	4.84	4.11	$1,779.00	4.11	$432.85

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Summary of preferred stormwater retrofit opportunities ranked by cost-effectiveness with respect to total Phosphorus (TP) reduction.								
BMP Characteristics						Cost-Benefit		
Project Rank	Priority Zone	Sub-Basin	Retrofit Type	Sediment reduction (t/yr)	Phosphorus reduction (lb/yr)	Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
70	1	3	Grassed waterway	2.66	2.26	$1,482.50	2.26	$655.97
71	7b	6	Grassed waterway	1.98	1.68	$1,186.00	1.68	$705.95
72	5	13	Gully stabilization	2.57	2.19	$622.65	2.19	$284.32
73	2	14	Gully stabilization	4.88	4.15	$1,363.90	4.15	$328.65
74	8	1	Gully stabilization	7.08	6.01	$2,283.05	6.01	$379.88
75	5	3	Gully stabilization	4.84	4.11	$1,779.00	4.11	$432.85
76	7a	10	Gully stabilization	2.49	2.12	$978.45	2.12	$461.53
77	3	7	Permanent Vegetation	15.37	23.96	$1,430.00	23.96	$59.68
78	1	9	Permanent Vegetation	0.40	0.81	$286.00	0.81	$353.09
79	8	3	Permanent vegetation	0.56	0.72	$407.00	0.72	$565.28
80	6	9	Permanent Vegetation	1.55	2.42	$1,408.00	2.42	$581.82
81	7b	11	Permanent vegetation	6.75	12.43	$14,300.00	12.43	$1,150.44
82	2	8	WASCOB	13.32	11.33	$9,803.70	11.33	$865.29
83	2	5	WASCOB	9.96	8.46	$9,803.70	8.46	$1,158.83
84	1	2	WASCOB	8.44	7.17	$9,803.70	7.17	$1,367.32
85	2	3	WASCOB	10.54	8.96	$13,087.50	8.96	$1,460.66
86	3	1	WASCOB	7.10	6.04	$9,803.70	6.04	$1,623.13
87	5	1	WASCOB	7.10	6.04	$13,087.50	6.04	$2,166.80
88	6	5	WASCOB	4.94	4.20	$9,803.70	4.20	$2,334.21
89	7a	12	WASCOB	6.37	5.41	$13,087.50	5.41	$2,419.13
90	8	2	WASCOB	4.48	3.80	$9,803.70	3.80	$2,579.92
91	7a	3	WASCOB	5.93	5.04	$13,087.50	5.04	$2,596.73
92	6	5	WASCOB	3.69	3.13	$9,803.70	3.13	$3,132.17
93	9	2	WASCOB	3.36	2.86	$9,803.70	2.86	$3,427.87
94	7b	2	WASCOB	4.48	3.80	$13,087.50	3.80	$3,444.08
95	7b	9	WASCOB	3.30	2.81	$13,087.50	2.81	$4,657.47
96	7b	7	WASCOB	1.89	1.61	$9,803.70	1.61	$6,089.25
97	7b	8	WASCOB	0.94	0.80	$9,803.70	0.80	$12,254.63
N.A.	3	3	Wetland Restoration	-	-			
N.A.	3	8	Wetland Restoration	-	-			
N.A.	8	4	Wetland Restoration	5.88	5.00			
N.A.	5	2	Manure mgmt	-	-			

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About this Document

This Stormwater Retrofit Analysis is a watershed management tool to help prioritize stormwater retrofit projects by performance and cost effectiveness. This process helps maximize the value of each dollar spent.

This document presents the findings of Blue Lake's watershed study.

Urban Catchments:
This report covers subwatersheds (catchments) adjacent to and directly draining to the lake. These areas are largely built-out residential. Modeling of each project was done with WinSLAMM. This section was completed by the Isanti Soil and Water Conservation District.

Rural Catchments:
This covers the subwatersheds (priority zones) not adjacent to or directly draining to the lake. The Chisago SWCD protocol "Rural Subwatershed Analysis Protocol Part 1-Targeting" was used to highlight the areas with the highest potential for contributing sediment and nutrients to Blue Lake. This section was completed by the Sherburne Soil and Water Conservation District.

Document Organization

This document is organized into three major sections plus references. Each section is briefly described below.

Methods

The methods section outlines general procedures used when analyzing the watershed. It overviews the processes of retrofit scoping, desktop analysis, retrofit reconnaissance investigation, cost/treatment analysis, and project ranking.

Catchment Profiles

The Blue Lake watershed was divided into stormwater catchments for the urban analysis and priority zones for the rural analysis. Each catchment and priority zone was given a unique ID number. For each catchment, the following information is detailed:

Catchment Description

Within each catchment profile is a table that summarizes basic catchment information including acres, and land cover. A brief description of the land cover, stormwater infrastructure, and any other important general information is also described. Existing stormwater practices are noted, and their estimated effectiveness presented.

Retrofit Recommendations

The recommendation section describes the conceptual retrofit(s) that were scrutinized. It includes tables outlining the estimated pollutant removals by each, as well as costs. A map provides promising locations for each retrofit approach.

Retrofit Ranking

This section ranks stormwater retrofit projects across all selected catchments to create a prioritized project list. The list is sorted by cost per pound of total phosphorus removed for each project. The final cost per pound treatment value includes installation and maintenance costs. The Urban practices are ranked against practices in the urban area

and the rural practices are ranked against the practices in the rural area. There were three wetland restorations and one manure management practices identified but not ranked.

There are many possible ways to prioritize projects, and the list provided in this report is merely a starting point. Other considerations for prioritizing installation may include:

- Non-target pollutant reductions
- Timing projects to occur with other road or utility work
- Project visibility
- Availability of funding
- Total project costs
- Educational value
- Landowner willingness

References

This section identifies various sources of information synthesized to produce the protocol utilized in this analysis.

Appendices

This section provides supplemental information and/or data used at various point along the assessment protocol

Methods:
Selection of Subwatershed

Many factors are considered when choosing which subwatershed to assess for stormwater retrofits, but always focus on the drainage to an important lake, river, or stream. Water quality monitoring data, non-degradation report modeling, and TMDL studies are just a few of the resources available to help determine which waterbodies are a priority. Assessments supported by a Local Government Unit with sufficient capacity (staff, funding, available GIS data, etc.) to greater facilitate the assessment also rank highly. The focus is always on a high priority waterbody.

Urban Subwatershed Selection

This assessment includes the area of land draining directly to Blue Lake. These areas were chosen because its proximity to the lake translates into direct water quality impacts, it is the area of densest development in the watershed, has little or no stormwater treatment and because near-lake landowners are often most vested in the lake's water quality and a Lake Improvement District (LID) covers this area and is a valuable partner for installing projects.

Rural Subwatershed Selection

This assessment includes the area of land draining to stream networks that eventually drain into Blue Lake. NRCS tools were used to identify subwatersheds and Chisago SWCD targeting protocol was utilized to identify subwatersheds that had the highest potential for pollutant loading.

Targeted pollutants for this study were total phosphorus and total suspended solids. Total phosphorus is a nutrient commonly associated with rural stormwater that causes excessive algae production and low oxygen levels in lakes and rivers. Total suspended solids was also chosen as a target pollutant because it is also commonly associated with stormwater and causes turbidity in lakes and rivers. Suspended solids are also important because many other pollutants, such as phosphorus or heavy metals, are attached to the particles.

Subwatershed Assessment Methods

Step 1: Retrofit Scoping

Retrofit scoping includes determining the objectives of the retrofits (volume reduction, target pollutant, etc.) and the level of treatment desired. It involves meeting with local land use managers and lake improvement district members to determine the issues in the subwatershed. This step also helps to define preferred retrofit treatment options and retrofit performance criteria. In order to create a manageable area to assess in large subwatersheds, a focus area may be determined.

Step 2: Desktop Retrofit Analysis

The desktop analysis involves computer-based scanning of the subwatershed for potential retrofit catchments and/or specific sites. This step also identifies areas that don't need to be assessed because of existing stormwater infrastructure or current land uses. Accurate GIS data is extremely valuable in conducting the desktop retrofit analysis. Some of the most important GIS layers include: 2-foot or finer topography, hydrology, soils, watershed/subwatershed boundaries, parcel boundaries, high-resolution aerial photography and the storm drainage infrastructure (with invert elevations).

Step 3: Retrofit Reconnaissance Field Investigation

After identifying potential retrofit sites through the desktop search, a field investigation was conducted to evaluate each site and identify additional opportunities. During the investigation, the drainage area and stormwater infrastructure mapping data were verified. Site constraints were assessed to determine the most feasible retrofit options as well as eliminate sites from consideration. The field investigation may have revealed additional retrofit opportunities that went unnoticed during the desktop search.

In addition to car and foot based field investigation, a survey of the lakeshore was completed for Blue Lake by boat. This allowed staff to document stormwater outfalls, inventory the shoreline condition and see potential project locations from a different perspective.

Step 4: Treatment Analysis/Cost Estimates

Sites most likely to be conducive to addressing the pollutant reduction goals and appearing to have feasible design, installation, and maintenance were chosen for a cost/benefit analysis. Estimated costs included design, installation, and maintenance annualized across the anticipated project lifespan (10-30 yrs). Estimated benefits included are pounds of phosphorus and total suspended solids removed, though projects were ranked only by cost per pound of phosphorus removed annually.

Treatment analysis

Urban Catchments:

For each potential project pollutant removal estimates were obtained using the BWSR Pollution Reduction Estimator and the stormwater model WinSLAMM. WinSLAMM uses an abundance of stormwater data from the upper Midwest and elsewhere to quantify runoff volumes and pollutant loads from urban areas. It is useful for determining the effectiveness of proposed stormwater control practices. It has detailed accounting of pollutant loading from various land uses, and allows the user to build a model "landscape" that reflects the actual landscape being considered. The user is allowed to place a variety of stormwater treatment practices that treat water from various parts of this landscape. It uses rainfall and temperature data from a typical year, routing stormwater through the user's model for each storm. Information needed for the model included soil type, soil volume voided per year, number of years to form gully, distance to receiving surface water, vegetation present and condition of the gully. The output data gives an estimate of how much sediment is being lost in that area.

A "base" model was created which estimated pollutant loading from selected sub-catchments in its present-day state. To accurately model the land uses in each catchment, we delineated each land use in each sub-catchment using ArcGIS, and assigned each a WinSLAMM standard land use file. A site specific land use file was created by adjusting total acreage and converting to "sand" soils to account for the sandy soils in the study area. This process resulted in a model that included estimates of the acreage of each type of source area (roof, road, lawn, etc.) in each sub-catchment. For certain source areas critical to our models we verified that model estimates were accurate by measuring actual acreages in ArcGIS and adjusting the model acreages if needed.

Once the "base" model was created, each proposed stormwater treatment practice was added to the model and pollutant reductions were generated. Because neither a detailed design of each practice nor in-depth site investigation was completed, a generalized design for each practice was used. Whenever possible, site-specific parameters were included. Design parameters were modified to obtain various levels of treatment. It is worth noting that we modeled each practice

individually, and the benefits of projects may not be additive, especially if serving the same area. Reported treatment levels are dependent upon optimal site selection and sizing.

Rural Catchments:

Rural catchment analyses were completed in a similar fashion to the urban catchment process. Following watershed delineation, the Chisago Soil and Water Conservation Service Rural Targeting Protocol was utilized to determine high priority locations within the watershed (Chisago SWCD – Rural Subwatershed Analysis Protocol Part 1 – Targeting). This process uses numerous factors included in the Revised Universal Soil Loss Equation (rainfall erosivity, soil types, landuse, topography) to determine which areas are more susceptible to soil loss. Catchments were delineated through the Natural Resource Conservation Service Engineering Tool. Spatial information was examined through ESRI's ArcGIS package, using the Targeting protocol as guidance. Nine priority zones were identified through this process. One zone (7) was quite expansive in size and separated by a major road. As a result, this zone was separated into two sub-zones (7a and 7b) for subsequent analysis.

The NRCS Engineering Tool was utilized to determine catchments within each of the nine priority zones. Additional information such as average slopes and concentrated flow paths were determined through the Tool as well. Following catchment determination, Chisago SWCD's Rural Priority Protocol (Part 2 – Prioritizing) was followed to determine potential rural BMP projects and to model potential pollutant reductions. Again, these projects would be located within the nine Priority Zones determined through the Targeting exercise as these areas hold the greatest potential for soil and nutrient export. A desktop analysis was completed using a variety of tools including aerial photography, topography, soils, etc. to determine potential BMP or management practice options within the nine zones. These potential BMPs were spatially located on maps and field verified where possible within the Blue Lake Watershed.

Similar to the urban catchment exercise, "base" conditions were determined through use of RUSLE2 software. All fields were assumed to utilize a corn / soybean rotation (RUSLE setting Corn FC Disk Fld Cult-Soybeans FC Disk Fld Cult) and contouring was assumed at a middle value for the absolute row grade. Field export estimates were input to the Board of Water and Soil Resources' (BWSR) Pollution Reduction Estimator spreadsheet to determine the level of phosphorus and sediment reduction on a given BMP practice. Table 3 displays the most common BMPs selected for Priority Zone catchments and the modeling procedures that were utilized for each one. Note that nutrient management is currently believed to be utilized by all agricultural operators in the watershed so this was not an option included in this study.

Table 3. Rural catchment BMPS and modeling programs for Blue Lake Subwatershed Assessment.

Parameter / BMP	*Model*
WASCOB / Grassed waterway	BWSR Spreadsheet - Gully
Filter Strip	BWSR Spreadsheet - Filter Strip; RUSLE2
Gully Stabilization	BWSR Spreadsheet - Gully
Permanent vegetation	BWSR Spreadsheet - Sheet and Rill, RUSLE2

Lakeshore Erosion and Runoff Pollutant Estimation

WinSLAMM modeling alone could not accurately estimate pollutants generated from eroding lakeshore, nor the pollutant reduction that may occur by installing a project. To estimate lakeshore pollutants, we used a two-step process that accounted for (1) overland flow from lakeshore backyards plus (2) the eroding lakeshore face.

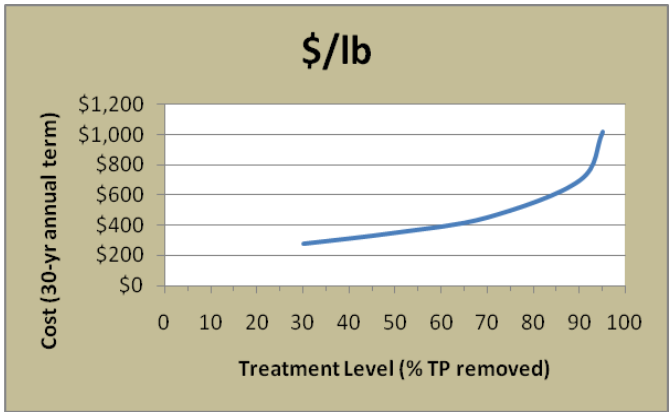
1. Overland Flow - We used WinSLAMM to estimate pollutant generation from the backyards of lakeshore homes. We created a custom WinSLAMM standard land use that replicated typical high priority Blue Lakeshore properties, including half of the home's roof, backyard and landscaping. In our base model the runoff from these surfaces flowed over sandy backyard soils to the lake. In our proposed project models the runoff was directed through a vegetated swale at the water's edge.
2. Eroding Lakeshore Face - We used a modified version of the Wisconsin NRCS streambank erosion method to calculate sediment loss from the lakeshore face, and then calculated phosphorus in that sediment using the MN Board of Water and Soil Resources (BWSR) water erosion pollutant calculator for streams and ditches. Assumptions for the NRCS bank erosion method included a 1 ft tall eroding face with a lateral recession rate of 0.1 feet/year (moderate erosion). The bulk density of the eroded material was assumed to be 100 lbs per cubic foot, the NRCS published value for sandy loam. This yielded an estimation of pounds of eroded material lost per year. The phosphorus content of that material was calculated based on a conversion factor of one pound of phosphorus per 1,481 pounds of soil, as derived from the BWSR erosion calculator.

We categorized candidate lakeshore restoration sites as either "low priority", "medium priority" or "high priority." Medium priority candidates were sites that lacked a vegetated buffer at least 5 feet deep from the lakeshore and had active instability/erosion. High priority sites additionally had overland flow concentrations converging at the site and would be especially well suited to a vegetated buffer to filter that water. Low priority sites consisted of existing buffer of non-native plants and potential for shoreline erosion based on the surrounding landscape. Paths of concentrated flow were determined using the NRCS Terrain Analysis Tools for GIS, with LiDAR data.

Cost Estimates

Urban Catchments:

Cost estimates were annualized costs that incorporated design, installation, installation oversight, and maintenance over a 30-year period. In cases where promotion to landowners is important, such as raingardens and lakeshore restorations, those costs were included as well. Design assistance from an engineer is assumed for practices in-line with the stormwater conveyance system, involving complex stormwater treatment interactions, or posing a risk for upstream flooding. It should be understood that no site-specific construction investigations were done as part of this stormwater assessment, and therefore cost estimates account for only general site considerations.



The costs associated with several different pollution reduction levels were calculated in certain cases. Generally, more or larger practices result in greater pollution removal. However the costs of obtaining the highest levels of treatment are often prohibitively expensive. By comparing costs of different treatment levels, the project partners can best choose the project sizing that meets their goals

Rural Catchments:

Cost estimates were annualized costs that incorporated installation costs, contracted annual maintenance, yearly operation and maintenance over a 10 year period, design costs and installation oversight. The cost of the project is largely dependent on the size and complexity, so these estimates were determined to be mid-range expectations for the associated project types. Like the urban practices, it should be understood that detailed site specific construction investigations were not done as part of this assessment and therefore cost estimates account for only general site consideration.

Table 4. Rural BMP practices and estimated costs.

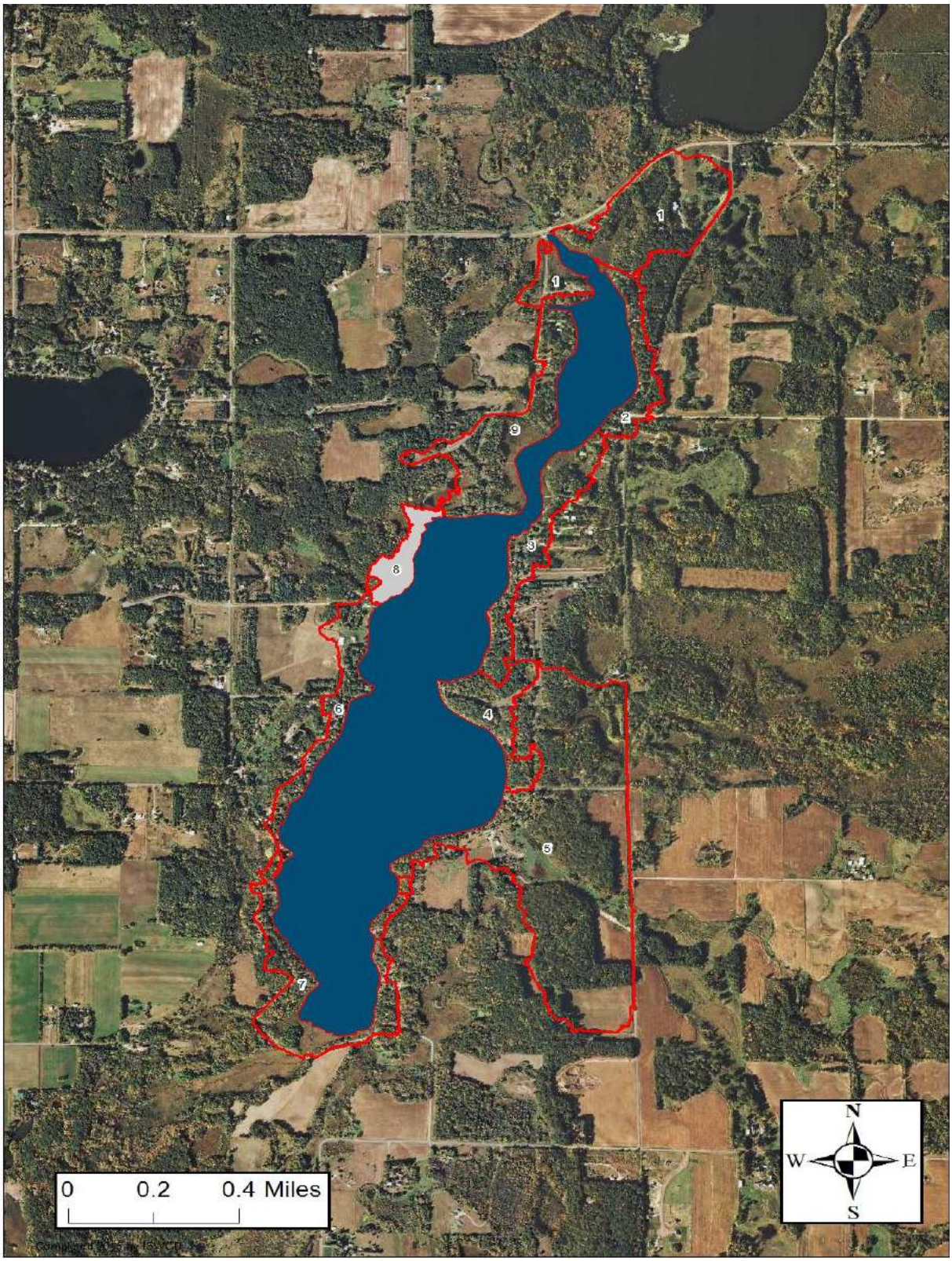
BMP	Initial Installation Cost ($/Unit)	Contracted annual maintenance cost ($/unit)	O & M Term (Years)	Design Cost ($70/hr)	Installation Oversight Cost ($70/hr)	Total Installation Cost (Including 1 year maintenance)
Grassed waterway (1,000 ft)	$4.00	$0.25	10	$1,120.00	$560.00	$5,930.00
WASCOB (0-10 acres drainage area)	$8,438.00	$100.00	10	$843.80	$421.90	$9,803.70
WASCOB (10-20 acres drainage area)	$11,250.00	$150.00	10	$1,125.00	$562.50	$13,087.50
WASCOB (20-40 acres drainage area)	$16,875.00	$200.00	10	$1,687.50	$843.75	$19,606.25
Filter strip (10 acres)	$500.00	$10.00	10	$1,120.00	$560.00	$6,780.00
Nutrient Mgmt (10 acres)	$11.00	$0.00	10	$560.00	$280.00	$950.00
Wetland Creation (10 acres)	$7,000.00	$45.00	10	$2,800.00	$1,400.00	$74,650.00
Wetland Restoration (10 acres)	$3,000.00	$45.00	10	$2,800.00	$1,400.00	$34,650.00
Permanent Vegetation (10 acre)	$400.00	$80.00	10	$1,120.00	$500.00	$6,110.00

**Cost estimates taken from Chisago SWCD report (Chisago Lakes Chain of Lakes Watershed SWA, North Center Lake Subwatershed report, 2014) except for Permanent Vegetation (Sherburne SWCD estimate).*

Evaluation and Ranking

The cost per pound of phosphorus treated was calculated for potential retrofit projects, and projects were ranked by this cost effectiveness measure. Only projects that seem realistic and feasible were considered. The recommended level was the level of treatment that would yield the greatest benefit per dollar spent while being considered feasible and not falling below a minimal amount needed to justify crew mobilization and outreach efforts. Local officials may wish to revise the recommended level based on water quality goals, finances or public opinion.

Catchment Profile – Urban Catchments



Urban Watershed and Catchments. Catchment 8 is not addressed in this report due to the lack of identified potential BMPs.

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Catchment 2

Existing Catchment Summary	
Acres	16.83
Dominant Land Cover	Low Density Residential

CATCHMENT DESCRIPTION

Catchment 2 consists of three different land use types (freeway, low density residential and open space). Three potential projects have been identified at the intersection of Tiger ST. NW and 285th Avenue.

EXISTING STORMWATER TREATMENT

Three storm drains are located at the intersection of Tiger ST. NW and 285th Avenue. Although the storm drains reduce overland flow, they provide zero treatment to the runoff being discharged into the lake. All three storm drains share the same outlet pipe located at shores edge.

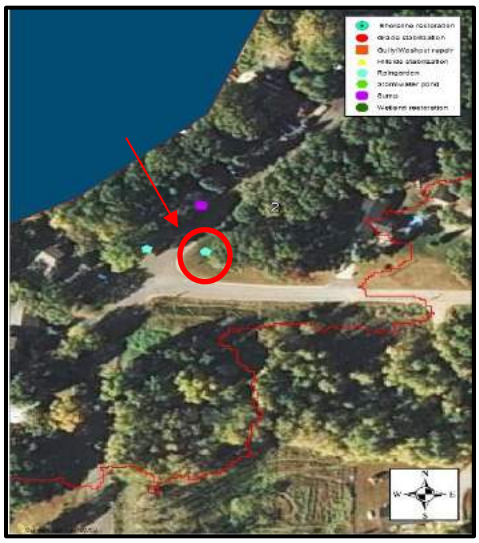
NEW STORMWATER TREATMENT IDENTIFIED

- Curb Cut Raingardens
- Sump

The maps and project summaries on the following pages describe the following potential new stormwater treatment projects.

Project ID: 2a –Curb-cut garden at 8771 285th Ave NW

Existing Sub-Catchment Summary	
Acres	1.07
Dominant Land Cover	residential
Volume (acre-feet/yr)	0.562
TP (lb/yr)	0.5364
TSS (lb/yr)	140



Location – 8771 285th Ave NW (See Map)

Property Ownership – Private. Landowner cooperation needed for project to proceed.

Description **-** This project ranked 9 for cost effectiveness at removing phosphorus among all projects identified in this assessment. The proposed project is a curb-cut raingarden installed in a residential yard. The raingarden would collect and infiltrates curbside stormwater from the township road and surrounding landscape. The garden is designed to hold water for no more than 48 hours after a storm, but the ponding time is often much shorter in areas with sandy soils. When the raingarden is full, water will flow into the retrofitted extension pipe on the beehive storm drain currently located at the site.

Current Site Conditions

We've analyzed scenarios where one of three raingardens is installed; small 250 sqft, medium 325 sqft and large 400 sqft. The results indicate that it would be most cost effective to install a 400 sqft raingarden, the one having the lowest cost per pound of phosphorus removed.

Cost Analysis -

Curb Cut and Raingarden

	Cost/Removal Analysis	New Treatment	% Reduction	New Treatment	% Reduction	New Treatment	% Reduction
Treatment	Number of BMPs	1		1		1	
	Total Size of BMPs	250 Sqft		325		400	
	TP (lb/yr)	0.36	67.1%	0.4	74.6%	0.5	93.2%
	TSS (lb/yr)	98	70.0%	110	78.6%	140	100.0%
	Volume (acre-feet/yr)	0.37	65.1%	0.416	74.0%	0.562	100.0%
Cost	Administration & Promotion Costs*		$4,784		$4,784		$4,784
	Design & Construction Costs**		$7,047		$8,922		$10,797
	Total Estimated Project Cost (2016)		**$11,831**		**$13,706**		**$15,581**
	Annual O&M***		$225		$225		$225
Efficiency	30-yr Cost/lb-TP		**$1,720**		**$1,705**		**$1,489**
	30-yr Cost/1,000lb-TSS		**$6,320**		**$6,199**		**$5,317**
	30-yr Cost/ac-ft Vol.		**$1,692**		**$1,639**		**$1,324**

*Indirect Cost: 60 hours at $66.44/hour base cost

**Direct Cost: $25.00/sq-ft for materials and labor + 12 hours/BMP at $66.44/hour for design

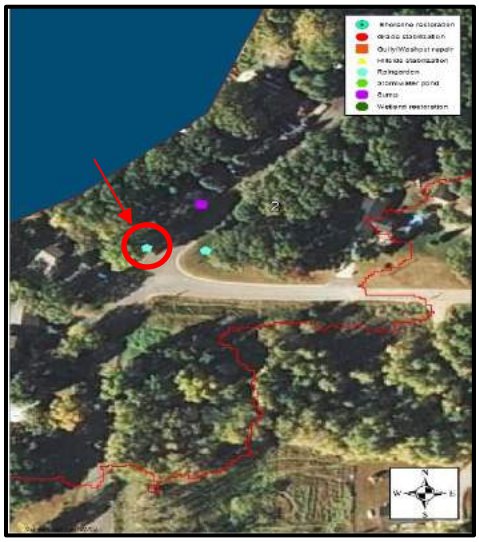
Current Site Conditions

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID: 2b – Raingarden at 28504 Tiger Street NW

Existing Sub-Catchment Summary	
Acres	1.9
Dominant Land Cover	Low Residential
Volume (acre-feet/yr)	0.9
TP (lb/yr)	0.7
TSS (lb/yr)	183



Location – 28504 Tiger Street NW (See Map).

Property Ownership – Private and township right of way. Landowner cooperation needed for project to proceed.

Project Description - This project ranked 8 for cost effectiveness at removing phosphorus among all projects identified in this assessment. The proposed project is a curb-cut raingarden installed in a residential yard. The raingardens collect and infiltrate curbside stormwater from the township road and surrounding landscape. The garden is designed to hold water for no more than 48 hours after a storm, but the ponding time is often much shorter in areas with sandy soils. When the raingarden is full, water will flow into the retrofitted extension pipe on the beehive storm drain.

We analyzed scenarios where one of three raingarden sizes are installed; extra small 200 sqft, medium 250 sqft and large 300 sqft. The results indicate that it would be most cost effective to install a 300 sqft raingarden, the one having the lowest cost per pound of phosphorus removed.

Current Site Conditions

Cost Analysis Table -

Curb-Cut Raingarden

	Cost/Removal Analysis	New Treatment	% Reduction	New Treatment	% Reduction	New Treatment	% Reduction
Treatment	Number of BMPs	1		1		1	
	Total Size of BMPs	200.0		250		300	
	TP (lb/yr)	0.30	42.9%	0.4	57.1%	0.7	100.0%
	TSS (lb/yr)	78	42.6%	91	49.7%	183	100.0%
	Volume (acre-feet/yr)	0.35	38.3%	0.404	44.9%	0.9	100.0%
Cost	Administration & Promotion Costs*	$3,986		$3,986		$3,986	
	Design & Construction Costs**	$5,797		$7,047		$8,297	
	Total Estimated Project Cost (2016)	**$9,784**		**$11,034**		**$12,284**	
	Annual O&M***	$225		$225		$225	
Efficiency	30-yr Cost/lb-TP	**$1,837**		**$1,482**		**$906**	
	30-yr Cost/1,000lb-TSS	**$7,066**		**$6,514**		**$3,467**	
	30-yr Cost/ac-ft Vol.	**$1,597**		**$1,467**		**$705**	

Current Site Conditions

*Indirect Cost: 60 hours at $66.44/hour base cost

**Direct Cost: $14.00/sq-ft for materials and labor + 12 hours/BMP at $66.44/hour for design

***Per BMP: $150/year for rehabilitations at years 10 + $75/year for routine maintenance

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID: 2c – Sump and Curb at Tiger Street

Existing Sub-Catchment Summary	
Acres	1.6
Dominant Land Cover	residential
Volume (acre-feet/yr)	0.517
TP (lb/yr)	0.79
TSS (lb/yr)	334.2

Location – See Map.

Property Ownership – Township.

Project Description – This project ranked 12th for cost effectiveness at removing phosphorus among all projects identified in this assessment. The purpose of this project is to divert stormwater from north into the current catch basin that will be retrofitted with a sump. A sump is a deep well below the catch basin which accumulates sediment and is periodically cleaned with a vacuum truck.

Currently, the runoff from Tiger Street north of the catch basin, flows off the road to the west through a private residence and into Blue Lake. By installing a 250ft curb on the west side of Tiger street, from the top of the hill to the purposed sump, we could eliminate overland flow draining to Blue Lake as well as reduce nutrient and sediment loading.

Current Site Conditions

Current Site Conditions

Sump and Curb			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Number of BMPs**	1	
	Total Size of BMPs	3 Feet Deep	
	TP (lb/yr)	0.30	38.0%
	TSS (lb/yr)	14	4.2%
	Volume (acre-feet/yr)	N.A.	N.A.
Cost	**Administration & Promotion Costs***		$3,986
	Design & Construction Costs**		$9,797
	Total Estimated Project Cost (2016)		**$13,784**
	Annual O&M***		$1,750
Efficiency	**30-yr Cost/lb-TP**	**$7,365**	
	30-yr Cost/1,000lb-TSS	**$157,818**	
	30-yr Cost/ac-ft Vol.	**N.A.**	

*Admin & Promo Cost: 60 hours at $66.44/hour base cost

**Direct Cost: $9000 for materials and labor + 12 hours/BMP at $66.44/hour for design

***O&M: $250/Monthly cleaning by vac truck* 7 months/year

Catchment 4

Existing Catchment Summary	
Acres	10
Dominant Land Cover	Low Density Residential

CATCHMENT DESCRIPTION

Catchment 4 consists of low density residential and park land uses. The North West section of the catchment has been plotted for future residential development and has a stormwater treatment pond currently in place.

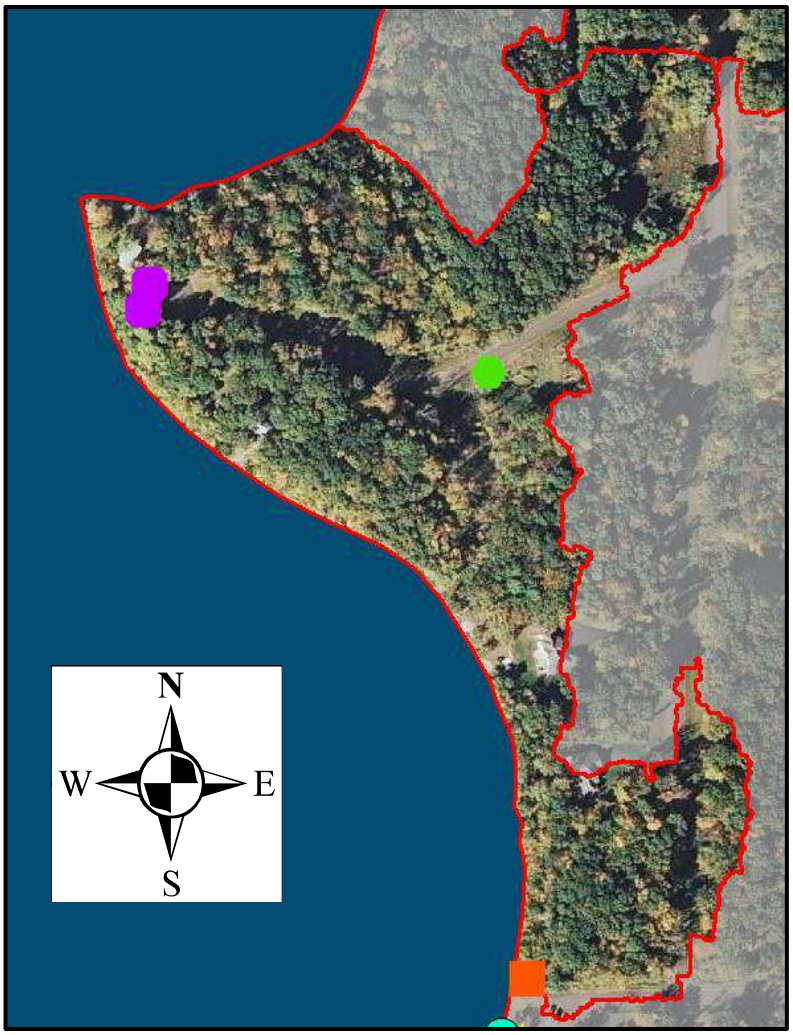
A total of three areas in the catchment have been identified to benefit from suggested BMPs.

EXISTING STORMWATER TREATMENT

Existing stormwater treatment within catchment 4 consists of a stormwater treatment pond on 279th avenue NW. The pond outlets into a lowland area on the south west side of the pond before entering Blue Lake.

NEW STORMWATER TREATMENT IDENTIFIED

The maps and project summaries on the following pages describe the new potential stormwater treatment projects.

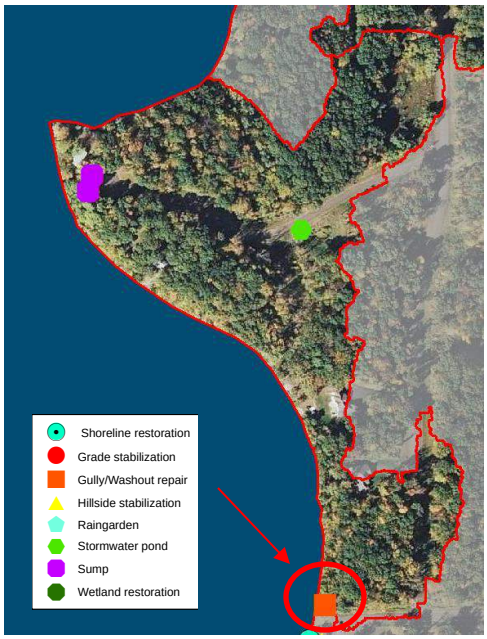


Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID: 4a – Grade Stabilization North of Stanford Township Boat Access

Drainage Area – 3.9 acres



Existing Sub-Catchment Summary	
Acres	3.9
Dominant Land Cover	LDR and Open
Volume (acre-feet/yr)	N.A.
TP (lb/yr)	0.91
TSS (lb/yr)	2140

Location – See map.

Property Ownership – Private and Township. Landowner and Township cooperation needed for project to proceed.

Description – This project ranked 2 for cost effectiveness at removing phosphorus among all projects identified in this assessment. The purpose of this project is to reduce upland erosion, sediment and nutrient loading into Blue Lake and allow runoff to infiltrate on shore.

In order to stabilize the hillside between the culvert and Blue Lake we propose to extend the culvert down the hill, repair the current washout zone by bringing in top soil, seeding the area with native deep rooted vegetation and establishing a buffer at the outlet of the extended culvert.

Current Site Conditions

Current Site Conditions

Gully/Washout Repair

	Cost/Removal Analysis	New Treatment	% Reduction
Treatment	Number of BMPs	1	
	Total Size of BMPs Cubic Feet	194.0	
	TP (lb/yr)	0.91	100.0%
	TSS (lb/yr)	2,140	100.0%
	Volume (acre-feet/yr)	N.A.	N.A.
Cost	Administration & Promotion Costs*		$3,986
	Design & Construction Costs**		$3,797
	Total Estimated Project Cost (2016)		**$7,784**
	Annual O&M***		$50
Efficiency	30-yr Cost/lb-TP	**$340**	
	30-yr Cost/1,000lb-TSS	**$145**	
	30-yr Cost/ac-ft Vol.	**N.A.**	

*Admin & Promo Cost: 60 hours at $66.44/hour base cost

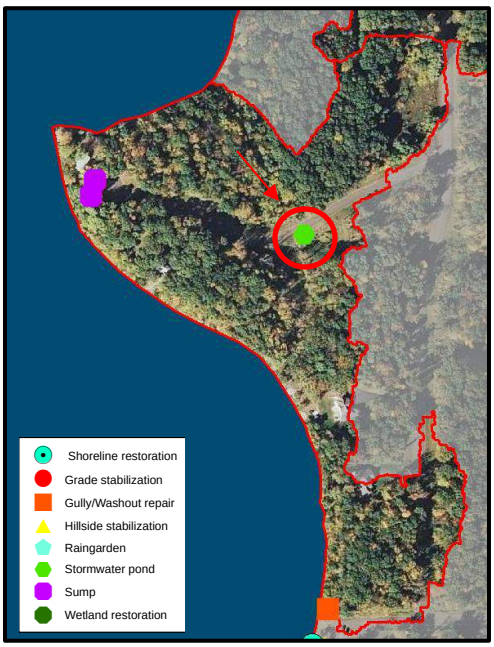
**Direct Cost: materials and labor + 12 hours/BMP at $66.44/hour for design

***O&M minimal inspection

Project ID: 4b – Stormwater Pond 279th Avenue NW

Drainage Area – 4.6 acres

Existing Sub Catchment	
Acres	4.6
Dominant Land Cover	residential
Volume (acre-feet/yr)	61494
TP (lb/yr)	1.783
TSS (lb/yr)	423.9



Location – 279th Avenue NW, Princeton MN - See Map

Property Ownership – Residential.

Description – This project ranked 10 for cost effectiveness at removing phosphorus among all projects identified in this assessment. The purpose of this project is to reduce sediment and nutrient loading into Blue Lake by collecting and storing stormwater. The pond allows sediment to separate and settle from the stormwater opposed to depositing into the lake.

Currently, a stormwater pond exists at this location. Our recommendation is to increase the holding capacity of the pond by increasing the size. The current pond reduces 181.8 lbs/yr of TSS and 1.783 lbs/yr of TP from Blue Lake. By increasing holding capacity of the pond, TSS reduction would increase by 40.2% and TP reduction would increase by 59.9%.

Current Site Conditions

Cost Analysis Table -

	Stormwater Pond		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Number of BMPs**	1	
	Total Size of BMP sq/ft	9,147.0	
	TP (lb/yr)	0.72	40.2%
	TSS (lb/yr)	254	59.9%
	Volume (acre-feet/yr)	3060.00	5.0%
Cost	**Administration & Promotion Costs***		$7,973
	Design & Construction Costs**		$105,191
	Total Estimated Project Cost (2016)		**$113,163**
	Annual O&M***		$1,000
Efficiency	**30-yr Cost/lb-TP**	**$6,656**	
	30-yr Cost/1,000lb-TSS	**$18,788**	
	30-yr Cost/ac-ft Vol.	**$2**	

*Admin & Promo Cost: 120 hours at $66.44/hour base cost

**Direct Cost: Based on City of Isanti Stormwater Pond $11.50/sq ft

***O&M $1000 per year for pond cleaning

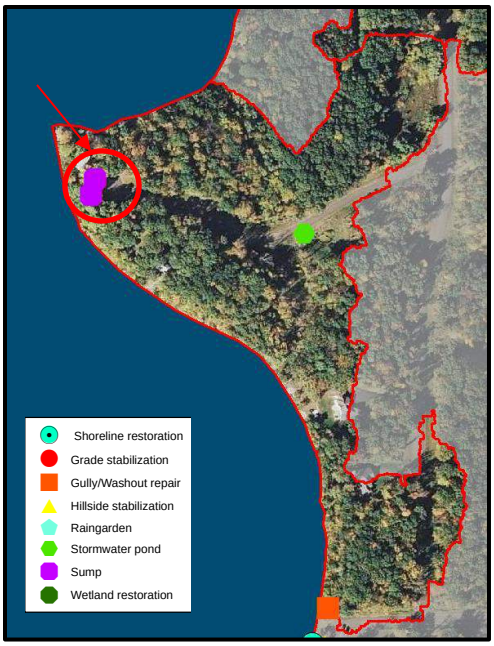
Current Site Conditions

Project ID: 4c – Sumps at cul-de-sac of 279th Ave NW

Drainage Area – 1.9 acres

Existing Sub-Catchment Summary	
Acres	1.9
Dominant Land Cover	residential
Volume (acre-feet/yr)	23371
TP (lb/yr)	0.79
TSS (lb/yr)	334.2

Location – Dead end of 279th Ave NW – See Map



Property Ownership – Spencer Brook Township.

Description – This project ranked 11 for cost effectiveness at removing phosphorus among all projects identified in this assessment. The purpose of the project is to capture sediment from runoff by installing sumps. Sumps are deep wells below the catch basin that accumulate sediment and are periodically cleaned with a vacuum truck.

279th Avenue NW ends in a cul-de-sac near the lakeshore. Two catch basins capture stormwater runoff from the roadway and residential property and pipe it to the lake. Due to topography and existing residences, little space exists for new stormwater features on the land surface.

Current Site Conditions

Cost Analysis Table -

	Sumps		
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Number of BMPs**	2	
	Total Size of BMPs	3 Feet Deep	
	TP (lb/yr)	0.10	12.7%
	TSS (lb/yr)	36	10.8%
	Volume (acre-feet/yr)	0.00	0.0%
Cost	**Administration & Promotion Costs***		$3,986
	Design & Construction Costs**		$8,797
	Total Estimated Project Cost (2016)		**$12,784**
	Annual O&M***		$1,750
Efficiency	**30-yr Cost/lb-TP**	**$21,761**	
	30-yr Cost/1,000lb-TSS	**$60,448**	
	30-yr Cost/ac-ft Vol.	**N.A.**	

*Admin & Promo Cost: 60 hours at $66.44/hour base cost

**Direct Cost: $4000/sump for materials and labor*two sumps + 12 hours/BMP at $66.44/hour for design

***O&M: $250/Monthly cleaning by vac truck* 7 months/year

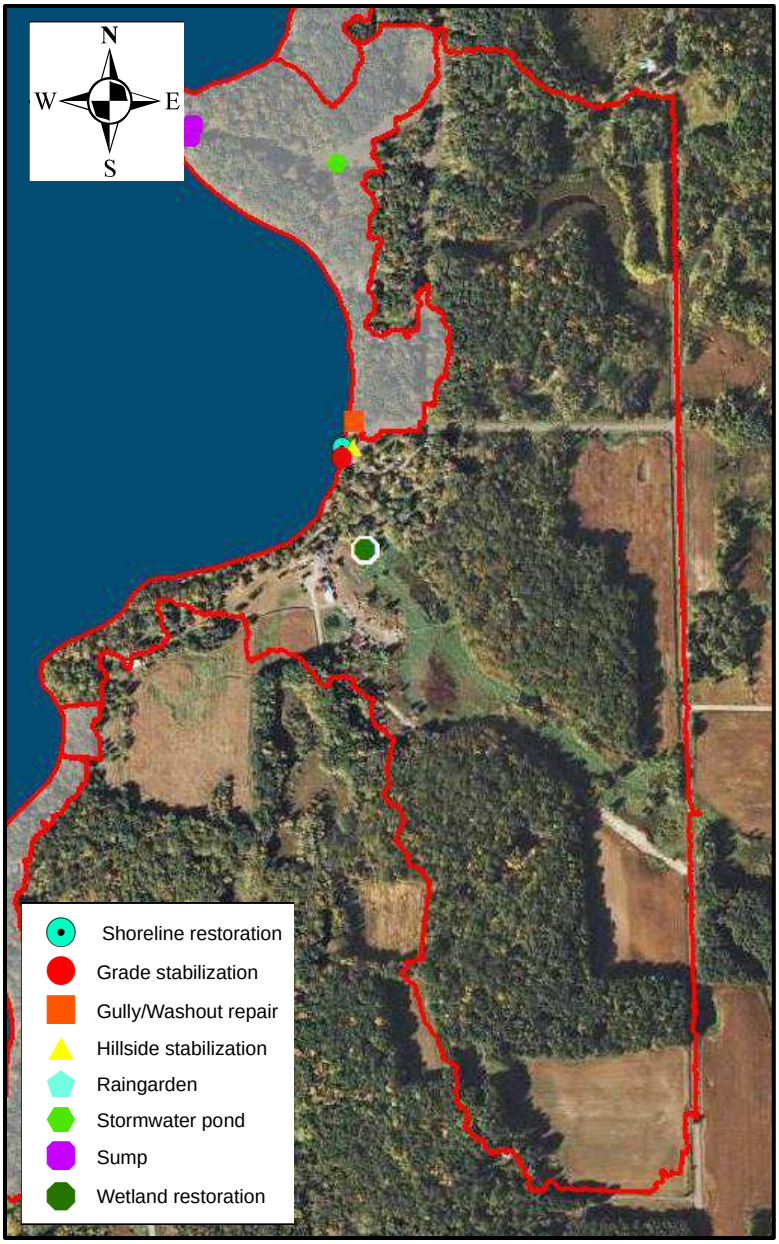
Current Site Conditions

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Catchment 5

Existing Catchment Summary	
Acres	164
Dominant Land Cover	Open



CATCHMENT DESCRIPTION

Catchment 5 is prominently open space land use. Most of the open space is undeveloped because it is lowland and or wetland. There is a small ditched tributary that runs through the middle of catchment. This inlet was monitored for total phosphorus and total suspended solids in 2015 and 2016. In 2016 ortho-phosphorus was added as a monitored parameter. This creek has been targeted as an area of concern for nutrient loading into Blue Lake.

There is a 60 acre campground located in the middle of the catchment. The campground houses around 70 permanent style, seasonal campers and has nearly 900 linear feet of lake frontage.

One of two public lake accesses is located in catchment 5. Owned by Stanford Township, the east side accesses offers parking spaces for 8 to 10 truck and trailers and 160 linear feet of shoreline for onshore fishing. The access has a lot of traffic during summer weekends. Parking often extends down the street.

NEW STORMWATER TREATMENT IDENTIFIED

There is currently no treatment of stormwater generated in this catchment. The maps and project summaries on the following pages describe the following potential new stormwater treatment projects.

Project ID: 5a – Boat Landing Project – Hillside/Gully/Shoreline Restoration and Repair

Drainage Area – .26 acres

Existing Sub-Catchment Summary	
Acres	0.26
Dominant Land Cover	Park
Volume (acre-feet/yr)	6912
TP (lb/yr)	6.242
TSS (lb/yr)	13296.64

Location – End of 277th Street Zimmerman MN (See Map)

Property Ownership Sanford Township.

Description- This project ranked 1 for cost effectiveness at removing phosphorus among all projects identified in this assessment. There are three areas of concern identified at this location in which three separate BMPs could be implemented. Being the areas of concern are in a centralized area (boat landing), the pollutant reductions portray results of all three proposed projects being implemented. The purpose of the project is stabilize the hillside, repair the existing gully and restore the shoreline to reduce sediment and nutrient loading into Blue Lake as well as to improve wildlife habitat and biodiversity.

Current Site Conditions

277th Avenue NW ends at the Stanford Township boat access. A 9,500 sq. feet mowed grass area sits between the parking area and the lakeshore. The bottom of the hill offers 150 linear feet of flat shoreline, a desirable area for onshore fishing. The combination of the hill's slope, short vegetation and excess foot traffic has resulted in moderate to severe hillside erosion and gully formation. Restoring the hillside and repairing the existing gully with designed landscaping and native vegetation plantings will eliminate soil loss and nutrient loading by stabilizing the hillside and filtering overland flow. Installing stairs from parking lot to the boat launch outlet will minimize impact caused by foot traffic.

Current Site Conditions

The 150 feet of linear shoreline was targeted during the shoreline boat survey as a high priority site as well as during the on shore assessment. The shoreline's eroding face is an average of 1ft high nearly void of vegetation and has some undercutting and vegetative overhang. A vegetated buffer with a minimum 15ft width along the entire length of shore line is proposed for this area. Intermediate open areas can offer access to those wishing to fish from the shore.

Cost Analysis Table -

Gully/Hill/Shoreline Restoration and Repair			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Number of BMPs**	3	
	Total Size of BMPs sqft	5,000.0	
	TP (lb/yr)	6.24	100.0%
	TSS (lb/yr)	13,297	100.0%
	Volume (acre-feet/yr)	119.40	1.7%
Cost	**Administration & Promotion Costs***		$3,986
	Design & Construction Costs**		$19,312
	Total Estimated Project Cost (2016)		**$23,298**
	Annual O&M***		$700
Efficiency	**30-yr Cost/lb-TP**	**$237**	
	30-yr Cost/1,000lb-TSS	**$111**	
	30-yr Cost/ac-ft Vol.	**N.A.**	

*Admin & Promo Cost: 60 hours at $66.44/hour base cost

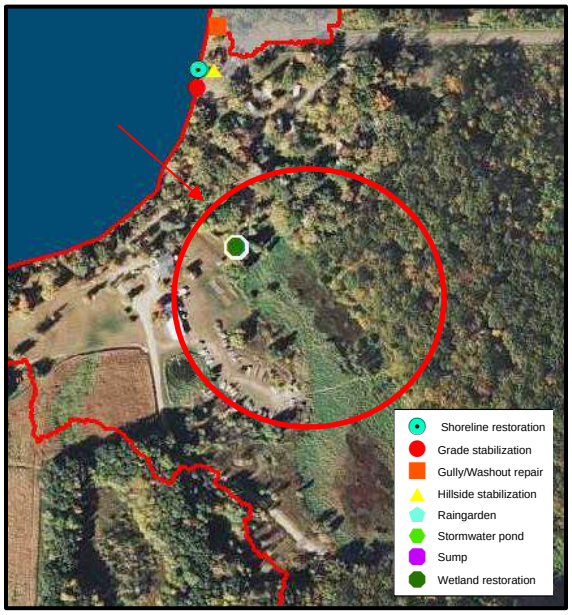
**Direct Cost: Materials and labor + 12 hours/BMP at $66.44/hour for design

***O&M: $100/Monthly inspection and repair* 7 months/year

Current Site Conditions

Project ID: 5b – Iron Enhanced Sand Filter and Sediment Pond

Existing Sub-Catchment Summary	
Acres	246
Dominant Land Cover	open
Volume (acre-feet/yr)	1356000
TP (lb/yr)	45.16
TSS (lb/yr)	11984



Drainage Area – 246 acres

Location – See map.

Property Ownership – Privately owned.

Description – This project ranked 7 for cost effectiveness at removing phosphorus among all projects identified in this assessment. The proposed project is to construct a 1.6 acre sediment pond incorporated with a 400 sq. feet iron enhanced sand filter.

The drainage area was determined using aerial photos and a GIS Watershed Delineation tool and is estimated to be 246 acres of open space. The sediment pond size was determined using the Pollution Control Agencies' recommended pond size needing to be .6% open space drainage area.

The pond will be constructed in the lowland area that includes a small, ditched, intermittent stream. The stream exits the lowland area and flows another 500ft until it reaches the lake. The treated stormwater will outlet into the stream.

Cost Analysis Table -

Pond With IESF			
	Cost/Removal Analysis	**New Treatment**	**% Reduction**
Treatment	**Number of BMPs**	2	
	Total Size of pond sqft	69696	
	Total Size of IESF sqft	400	
	TP (lb/yr)	24.11	53.4%
	TSS (lb/yr)	9,885	82.5%
	Volume (acre-feet/yr)	2.69	0.0%
Cost	**Administration & Promotion Costs***		$7,973
	Design & Construction Costs**		$818,099
	Total Estimated Project Cost (2016)		**$826,071**
Efficiency	**Annual O&M*****		$2,090
	30-yr Cost/lb-TP	**$1,229**	
	30-yr Cost/1,000lb-TSS	**$2,997**	
	30-yr Cost/ac-ft Vol.	**N.A.**	

*Admin & Promo Cost: 120 hours at $66.44/hour base cost

**Direct Cost: Based City of Isanti StormWater Pond $11.50/sq ft + IESF costs

***O&M: $10,000/acre of IESF+$2,000 per year of pond cleaning

Lakeshore Projects

DESCRIPTION

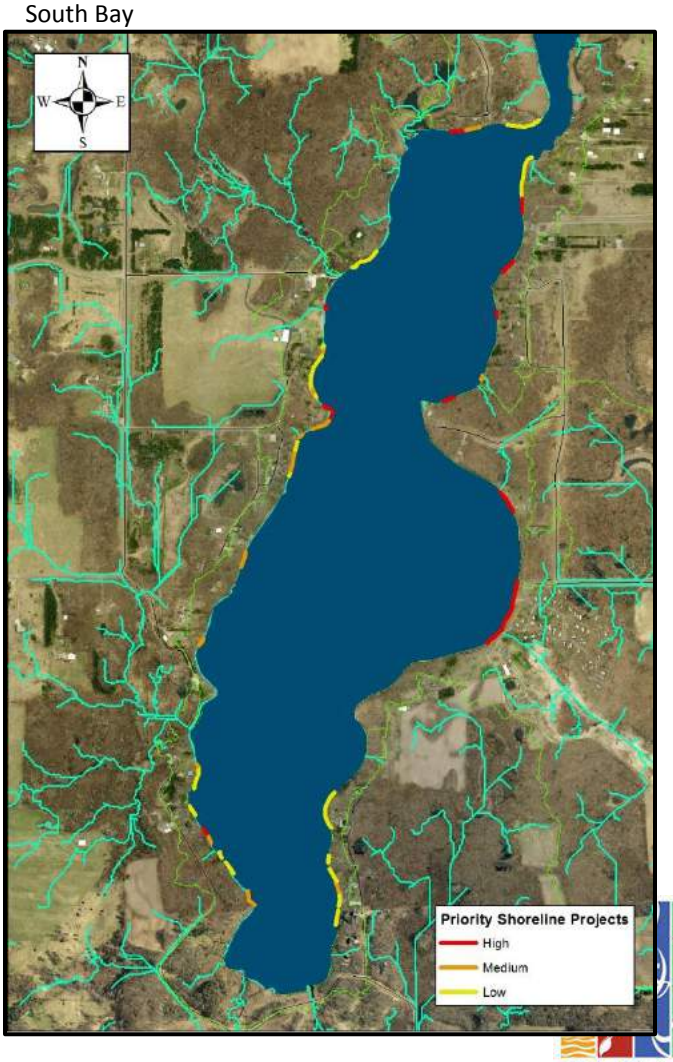
The lakefront is a problematic area, where residents attempt to balance recreational access, aesthetics, wave erosion, ice jacking and water quality.

On the whole, Blue Lakeshore is intensely managed by homeowners, especially in the North Bay. Mowing to the water's edge, sand beaches, beach raking and aquatic vegetation removal are commonplace. Some landowners have used rock rip rap and/or retaining walls.

Blue Lake's shoreline is approximately 31,224 linear feet. About 25% of the shoreline is undeveloped with 20% of the undeveloped space being wetland and the other 5% is privately owned woodland parcels. The remaining 75% (23,913 Feet) of the lake is developed and maintained to some severity. Out of the 23,913 feet of developed and maintained lakeshore, we determined 38% (9,197 feet) is candidate for lakeshore restoration, including correcting erosion and installing vegetated buffers.

North Bay

South Bay



Prioritized Potential Lakeshore Restoration Project Locations

Project ID: High Priority Lakeshore Location Restoration

Shoreline Summary	
Linear Feet	1272.0
Dominant Land Cover	LDR
Volume (acre-feet/yr)	22325.00
TP (lb/yr)	9.22
TSS (lb/yr)	10,629

Location – Dispersed around the lakeshore, see maps

Property Ownership – Private

Description – 9,197 feet of lakeshore was identified in the fall of 2015 to have some severity of erosion. Of that, 1,958 feet was targeted as high priority.

At each candidate lakeshore site we envision that 65% of the lakeshore (i.e. 65% of an average 100 ft frontage) will be stabilized to prevent future erosion and an unmowed vegetated buffer that is 15 feet wide (spanning 15 feet from the water's edge to manicured lawn). Using the aforementioned details, we were able to determine how much reduction can be accomplished when 65, 325, 650, 975 and 1,272 linear feet of shoreline is stabilized with an unmowed vegetated buffer and 15 ft width (i.e. spanning 15 ft from the water's edge to manicured lawn). Bioengineering techniques which utilize deep rooted native plants and biodegradable materials, such as coconut fiber logs and erosion blankets, are favored. Some site conditions may justify use of other techniques not including rock riprap with bioengineering techniques or a vegetated buffer. Hard structures, including rock alone or retaining walls, are not favored because they lack habitat attributes.

Shoreline Restorations

	Cost/Removal Analysis	New Treatment	% Reduction	New Treatment	% Reduction	New Treatment	% Reduction	New Treatment	% Reduction	New Treatment	% Reduction
Treatment	Number of BMPs ****	1 approx.		5 approx.		10 approx.		15 approx.		20 approx.	
	Total Size of BMPs	65 linear ft		325 linear ft		650 linear ft		975 linear ft		1,275 linear ft	
	TP (lb/yr)	0.44217	4.8%	2.21085	24.0%	4.42170	47.9%	6.63255	71.9%	8.40123	91.1%
	TSS (lb/yr)	552.54	5.2%	2762.72	26.0%	5525.44	52.0%	8288.16	78.0%	10498.34	98.8%
	Volume (acre-feet/yr)	0.00021	0.0%	0.00105	0.0%	0.00210	0.0%	0.00315	0.0%	0.00399	0.0%
Cost	Administration & Promotion Costs*		$1,453		$6,640		$10,790		$14,940		$19,090
	Design & Construction Costs**		$3,216		$16,080		$32,160		$48,240		$61,104
	Total Estimated Project Cost (2016)		**$4,669**		**$22,720**		**$42,950**		**$63,180**		**$80,194**
	Annual O&M***		$195		$195		$195		$195		$195
Efficiency	30-yr Average Cost/lb-TP	**$793**		**$431**		**$368**		**$347**		**$341**	
	30-yr Average Cost/1,000lb-TSS	**$635**		**$345**		**$294**		**$278**		**$273**	
	30-yr Average Cost/ac-ft Vol.	**N.A.**		**N.A.**		**N.A.**		**N.A.**		**N.A.**	

*Indirect Cost: 35 hours at $41.50/hour base cost per project up to 4 then 20hour for each subsequent project

**Direct Cost: $2.40/sq-ft for materials and labor + 12 hours/BMP at $73/hour for design

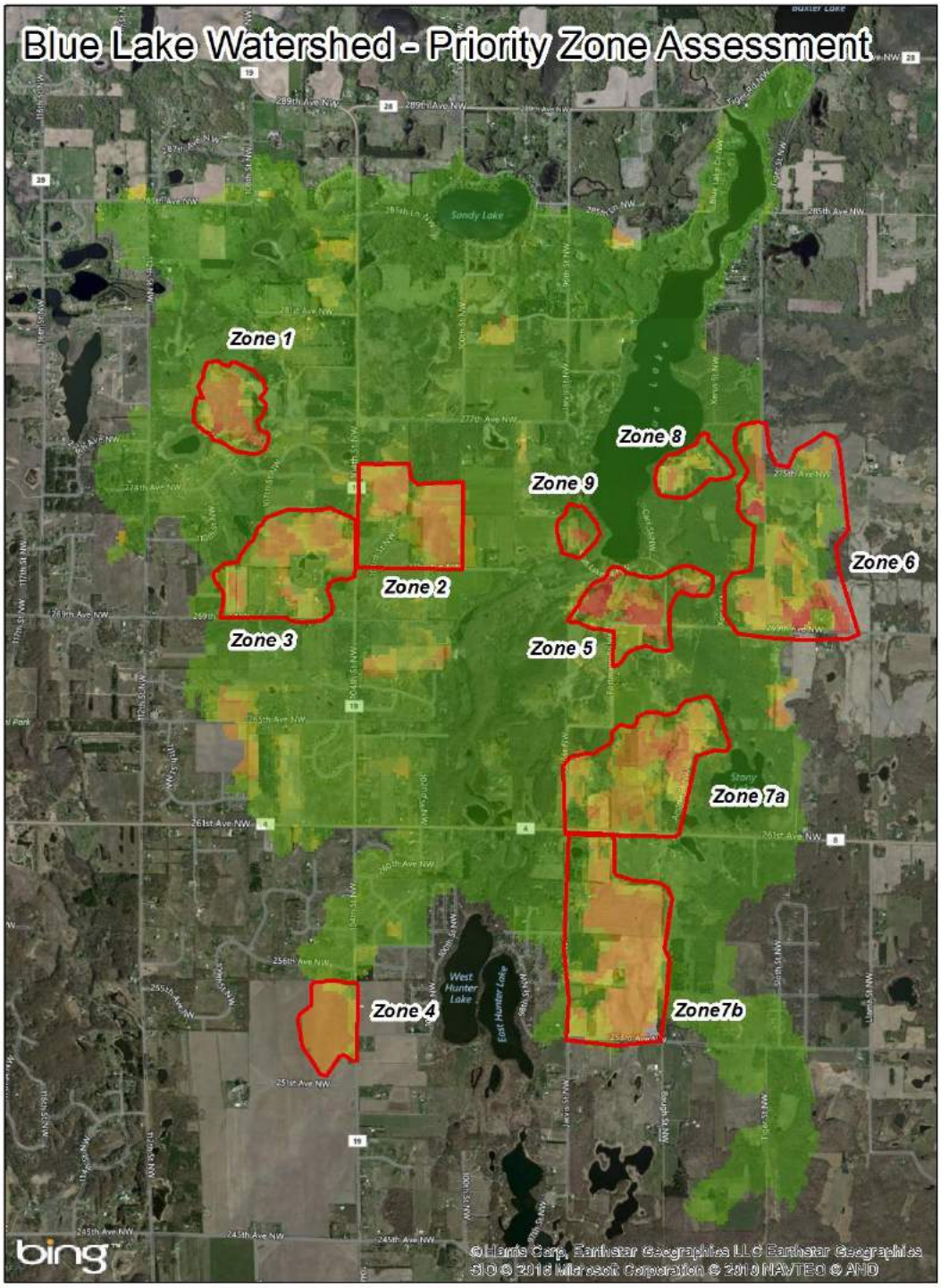
***Per BMP O&M: $0.20/sq-ft/year: excludes landowner weeding and watering

**** One BMP is assumed to be 65 ft. of a single owner lakeshore.

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

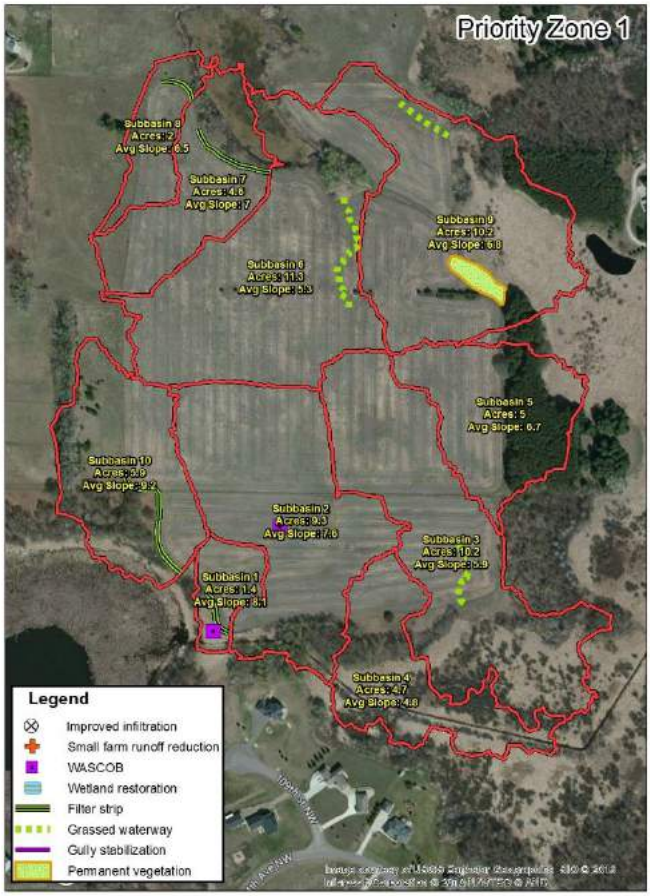
Catchment Profiles – Blue Lake Rural Catchments



Rural Watershed and Priority Zones. Zone 4 was not included in this report due to lack of identified potential BMP.

Priority Zone 1

Priority Zone 1 Summary	
Acres addressed	65.1
Dominant Land Cover	Agricultural
Total Sub-Basins	10
Potential BMPs	9
Potential TP reduction (lb/yr)	21.01
Potential TSS reduction (tons/yr)	22.89



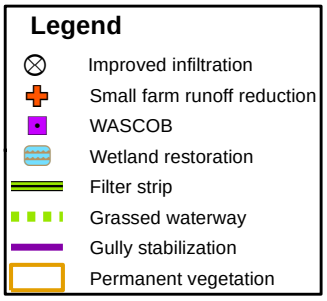
Priority Zone 1 is located along the western side of the Blue Lake Watershed, about 1.75 miles from the waterbody. The 76 acre area is directly connected to Blue Lake's western tributary. The area is primarily in agriculture land use. Slopes along the southern side of the priority zone are quite high (greater than 10%).

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 1
Sub-Basin 1

Drainage Area – 1.4 acres
Property Ownership – Private
Site Specific Information – An edge of field filter strip would benefit this area. Sub basin 1 is relatively small; however, it is in close proximity to a drainage ditch and has slopes >6%. Contour farming could also be taken into consideration. The majority of the basin is row cropped.

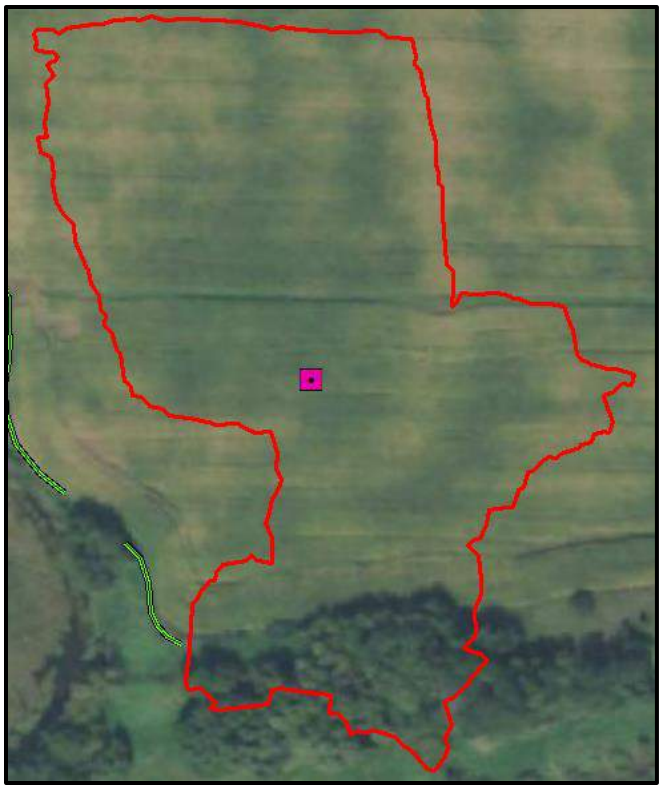
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
122.04	0.32	381.375



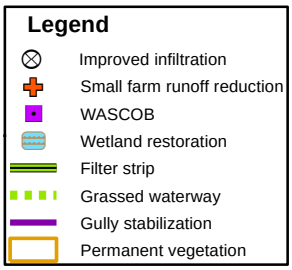
Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	Filter Strip	Sediment reduction (t/yr)	0.2
Acres	1.4	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.01
Soil	Mahtomedi loamy coarse sand, 1-6% slope	Length (ft)	158	Phosphorus reduction (lb/yr)	0.32
Average slope	8	Area (acres)	0.18		
		Contr. Area (acres)	1.4		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – WASCOB
Zone 1
Sub-Basin 2



Drainage Area – 9.3 acres
Property Ownership – Private
Site Specific Information – Sub-basin 2 has several concentrated paths that flow into natural depressions (small). A WASCOB would take care of erosion on the northern end of the field. Contour farming and increasing residue cover would be beneficial. This basin is 95% agricultural land use.



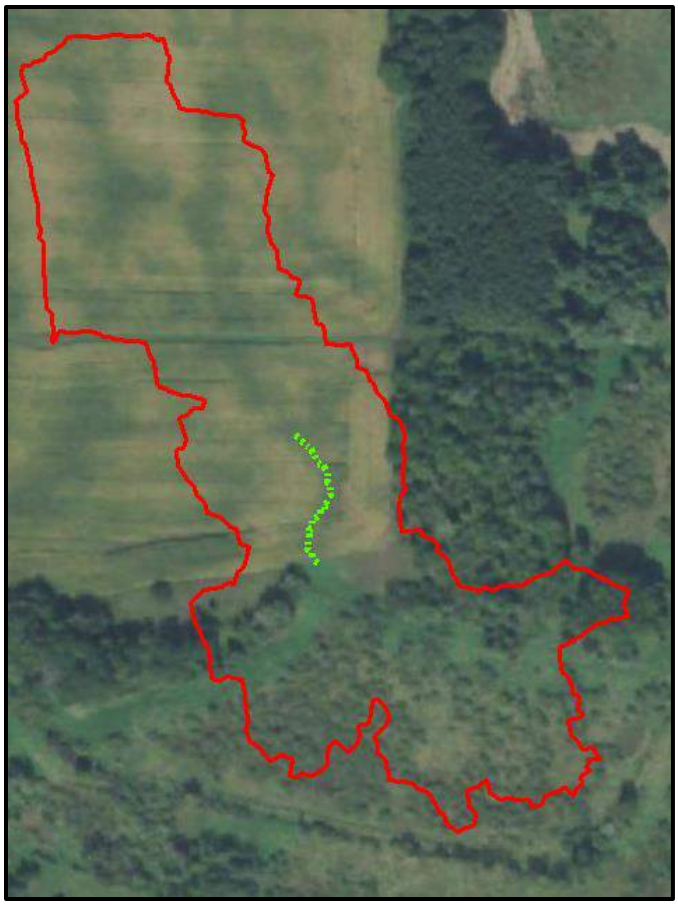
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	7.17	$1,367.32

Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	WASCOB	Sediment reduction (t/yr)	1.67
Acres	9.3	Contributing acres	4.9	Soil Loss reduction (t/yr)	6.16
Soil	Mahtomedi loamy coarse sand, 1-6% slope	Vol Voided (ft^3)	566	Phosphorus reduction (lb/yr)	1.42
Slope length (ft)	540	Length (ft)	566		
Average slope	7.6	Years	1		
		Distance to SW (ft)	550		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 1
Sub-Basin 3



Drainage Area – 10.2 acres
Property Ownership – Private
Site Specific Information – Sub-basin 3 is 70% agricultural land and 30% forested. It includes a northern section which has several natural depressions. The middle section (on the field) has a concentrated flow path that is best suited for a grassed waterway.

Legend
- Improved infiltration
- Small farm runoff reduction
- WASCOB
- Wetland restoration
- Filter strip
- Grassed waterway
- Gully stabilization
- Permanent vegetation

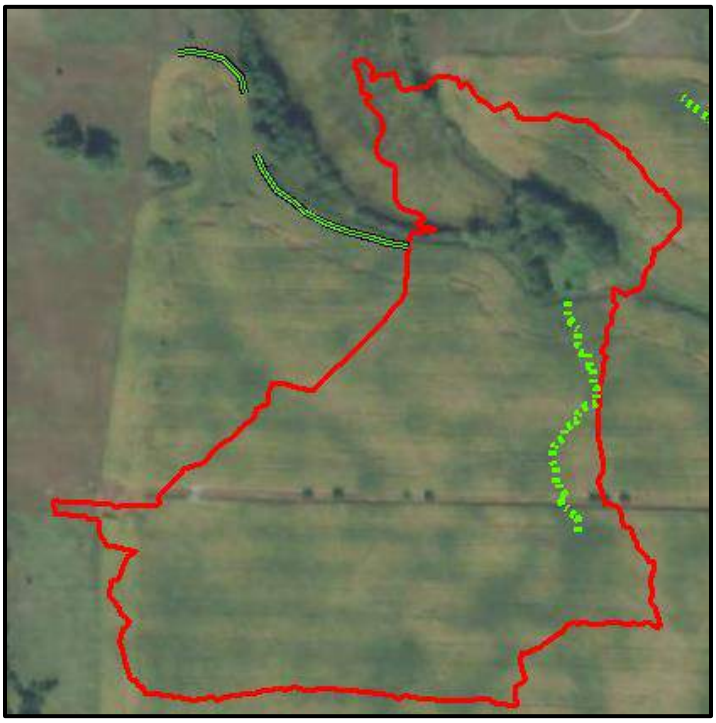
Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$1,482.50	2.26	$655.97

Current Conditions		Added Practice		Reduction	
Sub-Basin	3	**Type**	Grassed waterway	**Sediment reduction (t/yr)**	2.66
Acres	10.2	**Contributing acres**	3.7	**Soil Loss reduction (t/yr)**	11
Soil	Mahtomedi loamy coarse sand, 6-15% slope	**Vol Voided (ft^3)**	250	**Phosphorus reduction (lb/yr)**	2.26
Slope length (ft)	500	**Length (ft)**	250		
Average slope	5.9	**Area (acres)**	0.29		
		Years	1		
		Distance to SW (ft)	950		

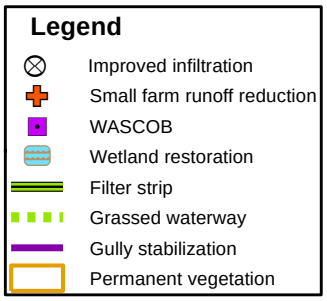
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grass Waterway
Zone 1
Sub-Basin 6



Drainage Area – 11.3 acres
Property Ownership – Private
Site Specific Information – Sub-basin 6 is almost all agricultural land. It is characterized by a large area of gently sloping land (5.3% avg. A grassed waterway could address erosion on the concentrated flow path. Aerial photos indicate possible ditch system running through the middle of the basin.



Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$2,621.06	4.95	$529.51

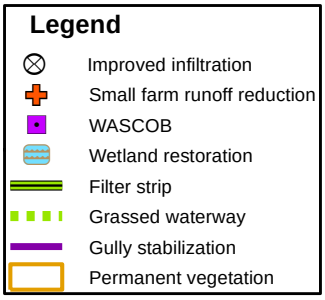
Current Conditions		Added Practice		Reduction	
Sub-Basin	6	**Type**	Grassed waterway	**Sediment reduction (t/yr)**	5.82
Acres	11.3	**Contributing acres**	8.1	**Soil Loss reduction (t/yr)**	24.31
Soil	Mahtomedi loamy coarse sand, 1-6% slope	**Vol Voided (ft^3)**	442	**Phosphorus reduction (lb/yr)**	4.95
Slope length (ft)	645	**Length (ft)**	442		
Average slope	5.3	**Area (acres)**	0.51		
		Years	1		
		Distance to SW (ft)	1000		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 1
Sub-Basin 7

Drainage Area – 4.6 acres
Property Ownership – Private
Site Specific Information – This sub-basin is 75% row cropped. It is quite steep at its lower half, leading to a ditch. A filter strip placed at the north field border would catch runoff from the field. Concentrated flow path is not strong enough to warrant a grassed waterway.



Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$223.74	0.76	$294.39

Current Conditions		Added Practice		Reduction	
Sub-Basin	7	**Type**	Filter strip	**Sediment reduction (t/yr)**	0.47
Acres	4.6	**Specs**	50 ft Cool season	**Soil Loss reduction (t/yr)**	0.04
Soil	Mahtomedi loamy coarse sand, 1-6% slope	**Length (ft)**	290	**Phosphorus reduction (lb/yr)**	0.76
Slope length (ft)	250	**Area (acres)**	0.33		
Average slope	7.0	**Contr. Area (acres)**	3.39		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 1
Sub-Basin 8

Drainage Area – 2.0 acres
Property Ownership – Private
Site Specific Information – Aerial photos indicate the basin is half row cropped and half lowland field. This basin is only 2 acres and constitutes the western edge of the field. A filter strip could catch runoff at the end of the field - too small for a WASCOB.

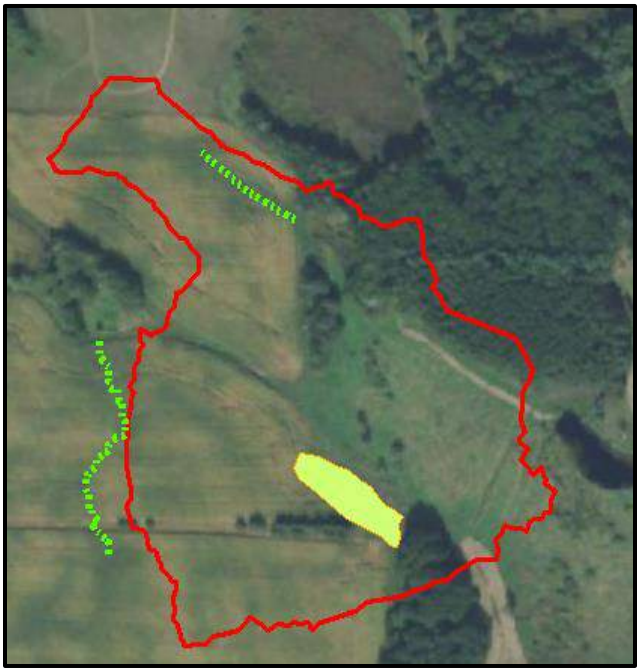
Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$101.70	0.36	$282.50

Current Conditions		Added Practice		Reduction	
Sub-Basin	8	**Type**	Filter strip	**Sediment reduction (t/yr)**	0.23
Acres	2	**Specs**	50 ft Cool season	**Soil Loss reduction (t/yr)**	0.02
Soil	Stonelake-Sanburn, 6-15% slope	**Length (ft)**	135	**Phosphorus reduction (lb/yr)**	0.36
Slope length (ft)	150	**Area (acres)**	0.15		
Average slope	6.5	**Contr. Area (acres)**	1.6		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Permanent Vegetation
Zone 1
Sub-Basin 9



Drainage Area – 10.2 acres.
Property Ownership – Private
Site Specific Information – Sub-basin 9 has one very steep section that could be taken out of production and placed into permanent vegetation. Aerial photos indicate this area of land is being farmed. With the steeps slopes this could be an area susceptible to soil erosion. Permanent veg would stabilize the soil and prevent erosion.

Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$176.28	0.81	$217.63

Current Conditions		Added Practice		Reduction	
Sub-Basin	9	**Type**	Permanent Vegetation	**Sediment reduction (t/yr)**	0.4
Acres	10.2	**Specs**	on hillslope	**Soil Loss reduction (t/yr)**	0.07
Soil	Mahtomedi loamy coarse sand, 6-15% slope	**Distance to water**	100	**Phosphorus reduction (lb/yr)**	0.81
Slope length (ft)	80	**Contr. Area (acres)**	4.00		
Average slope	6.8	**acres applied**	0.26		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 1
Sub-Basin 9

Drainage Area – 10.2 acres
Property Ownership – Private
Site Specific Information – This area has a concentrated flow path at the base of a steep slope, near a wetland. With this part of the basin being farmed, the vegetation would allow nutrient and soil to stay on the field.

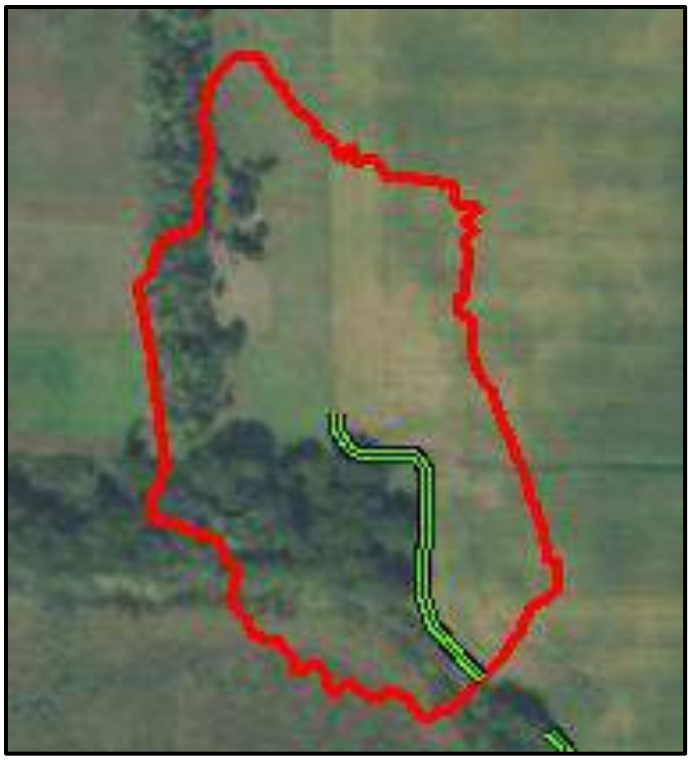
Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$1,126.70	3.43	$328.48

Current Conditions		Added Practice		Reduction	
Sub-Basin	9	**Type**	Grassed waterway	**Sediment reduction (t/yr)**	4.03
Acres	10.2	**Contributing acres**	1.4	**Soil Loss reduction (t/yr)**	10.45
Soil	Mahtomedi loamy coarse sand, 6-15% slope	**Vol Voided (ft^3)**	190	**Phosphorus reduction (lb/yr)**	3.43
Slope length (ft)	80	**Length (ft)**	190		
Average slope	6.8	**Area (acres)**	0.22		
		Years	1		
		Distance to SW (ft)	0		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 1
Sub-Basin 10



Drainage Area – 5.9 acres
Property Ownership – Private
Site Specific Information – This sub-basin holds a small percentage of agricultural land, however the slope is quite steep. A filter strip could be placed at the SW field edge to address erosion.

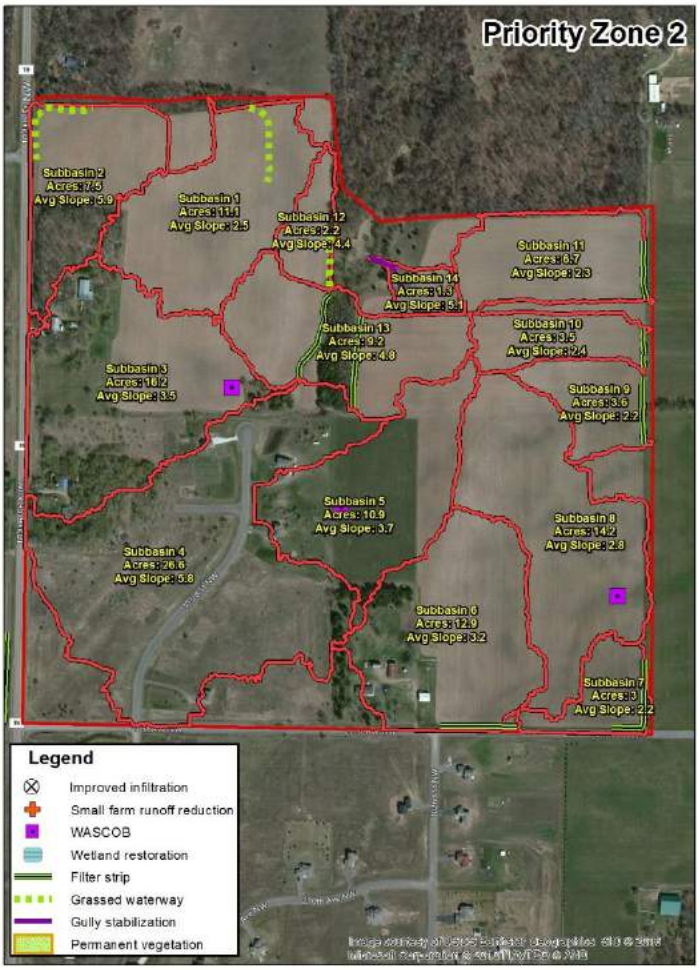
Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$332.22	0.95	$349.71

Current Conditions		Added Practice		Reduction	
Sub-Basin	10	**Type**	Filter strip	**Sediment reduction (t/yr)**	0.64
Acres	5.9	**Specs**	50 ft Cool season	**Soil Loss reduction (t/yr)**	0.07
Soil	Mahtomedi loamy coarse sand, 1-6% slope	**Length (ft)**	430	**Phosphorus reduction (lb/yr)**	0.95
Slope length (ft)	350	**Area (acres)**	0.49		
Average slope	9.2	**Contr. Area (acres)**	1.6		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Priority Zone 2

Priority Zone 2 Summary	
Acres addressed	111.5
Dominant Land Cover	Agricultural
Total Sub-Basins	14
Potential BMPs	14
Potential TP reduction (lb/yr)	56.64
Potential TSS reduction (tons/yr)	60.89



Priority Zone 2 is situated a little under a mile from Blue Lake and connects to the western tributary through intermittent ditches. The 147 acre zone consists of 38 acres of residential lots, 27 of which flow into a functioning stormwater retention basin. The remaining area consists of gently sloping (2%-6% average) row crop fields.

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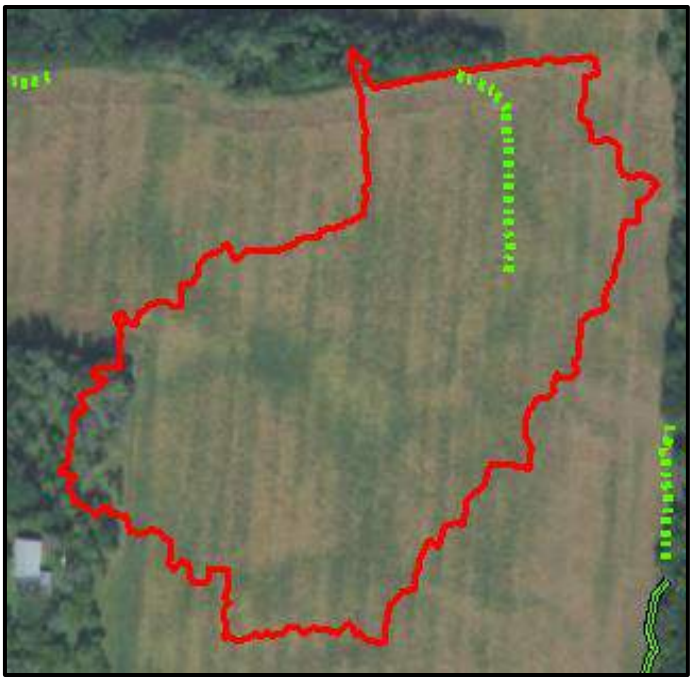
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 2
Sub-Basin 1



Drainage Area – 11.1 acres
Property Ownership – Private
Site Specific Information – Moderate slopes within field. Aerial photos indicate row cropping. Potential for gully formation at the north end of the basin. This is a good opportunity to implement a grass waterway to prevent erosion and nutrient loss.

Legend
- Improved infiltration
- Small farm runoff reduction
- WASCOB
- Wetland restoration
- Filter strip
- Grassed waterway
- Gully stabilization
- Permanent vegetation

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,134.80	3.42	$624.21

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	Grassed waterway	Sediment reduction (t/yr)	4.03
Acres	11.1	Contributing acres	10.3	Soil Loss reduction (t/yr)	19.8
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)	360	Phosphorus reduction (lb/yr)	3.42
Slope length (ft)	145	Length (ft)	360		
Average slope	2.5	Area (acres)	0.41		
		Years	1		
		Distance to SW (ft)	2200		

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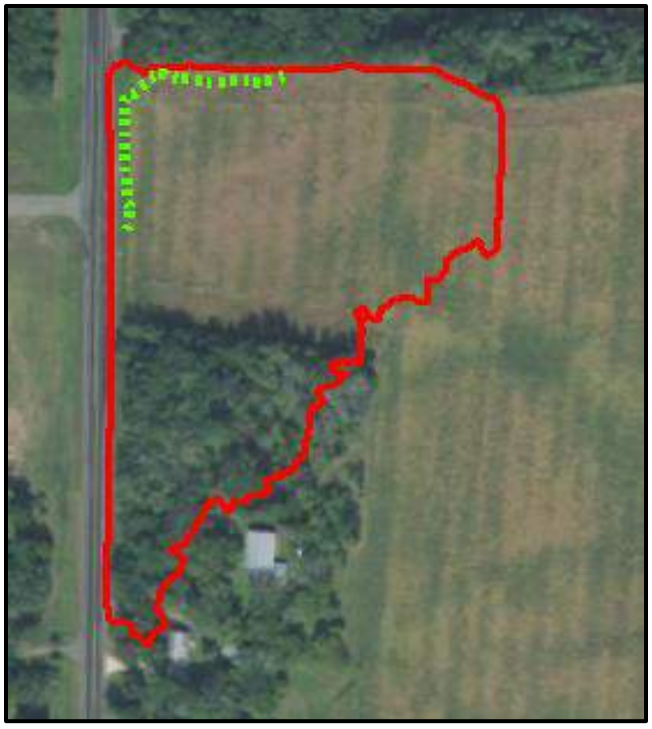
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grass Waterway
Zone 2
Sub-Basin 2

Drainage Area – 7.5 acres
Property Ownership – Private
Site Specific Information – Steep slopes were indicated running towards drainage ditches, good opportunity for grassed waterway at edge of field which will function as a filter strip. The southern part of the basin is wooded while the rest is row cropped.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,763.38	4.62	$598.13

Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	Grassed waterway	Sediment reduction (t/yr)	5.44
Acres	7.5	Contributing acres	7	Soil Loss reduction (t/yr)	25.63
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)	466	Phosphorus reduction (lb/yr)	4.62
Slope length (ft)	330	Length (ft)	466		
Average slope	5.9	Area (acres)	0.53		
		Years	1		
		Distance to SW (ft)	1800		

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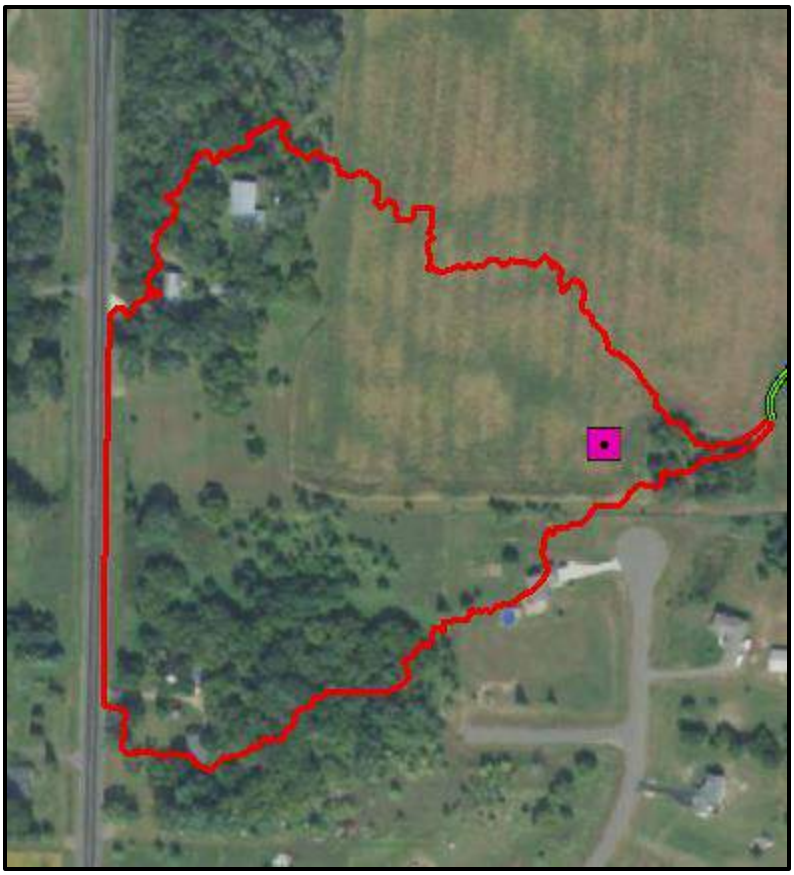
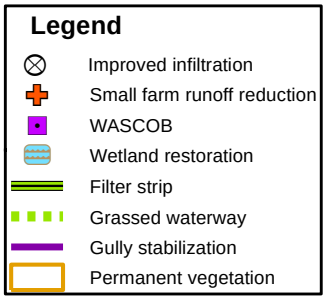
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 2
Sub-Basin 3



Drainage Area – 16.2 acres
Property Ownership – Private
Site Specific Information –The northeast section of the basin is row cropped while the southern wooded area boarders a new residential development. Moderate slopping in the area 2-6%. A WASCOB implemented on the east side of the basin would allow for water infiltration and reduce the chance of gully formation.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$13,087.50	8.96	$1,460.66

Current Conditions		Added Practice		Reduction	
Sub-Basin	3	Type	WASCOB	Sediment reduction (t/yr)	10.54
Acres	16.2	Contributing acres	15	Soil Loss reduction (t/yr)	44
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)	800	Phosphorus reduction (lb/yr)	8.96
Slope length (ft)	650	Length (ft)	800		
Average slope	3.5	Years	1		
		Distance to SW (ft)	1000		

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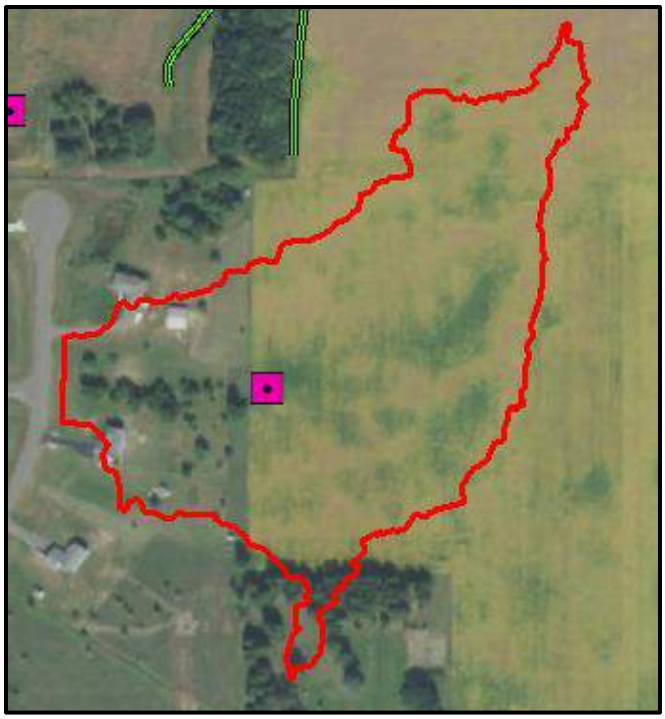
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 2
Sub-Basin 5



Drainage Area – 10.9 acres
Property Ownership – Private
Site Specific Information – 25% of the basin is residential area but the majority is row cropped. Address field runoff before it reaches residential areas by implementing a WASCOB. The WASCOB will allow water to infiltrate in the field, reducing sediment and nutrient loss.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	8.46	$1,158.83

Current Conditions		Added Practice		Reduction	
Sub-Basin	5	Type	WASCOB	Sediment reduction (t/yr)	9.96
Acres	10.9	Contributing acres	7	Soil Loss reduction (t/yr)	37.4
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)	680	Phosphorus reduction (lb/yr)	8.46
Slope length (ft)	730	Length (ft)	680		
Average slope	3.7	Years	1		
		Distance to SW (ft)	600		

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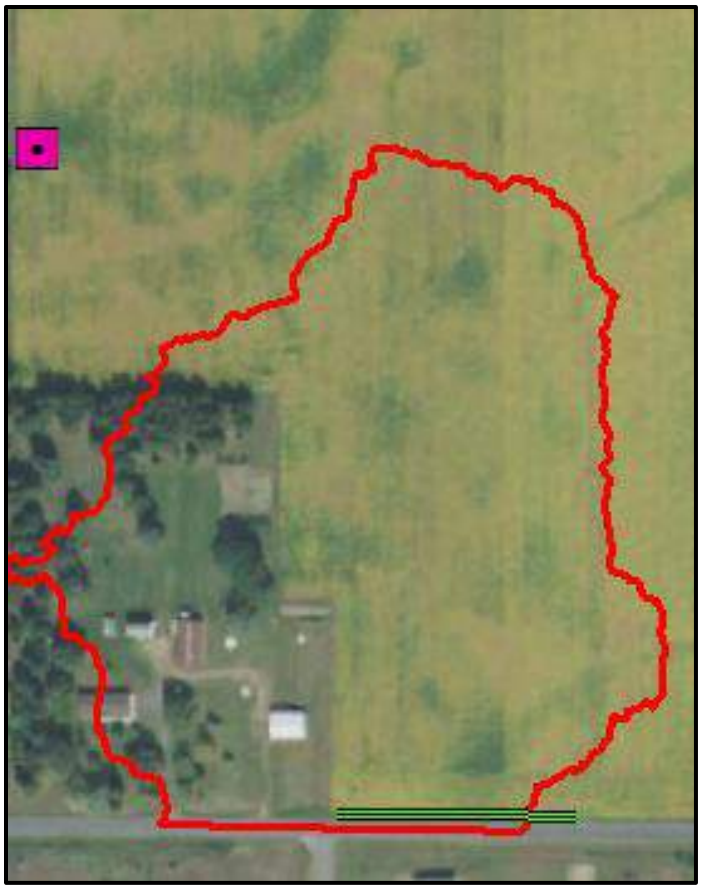
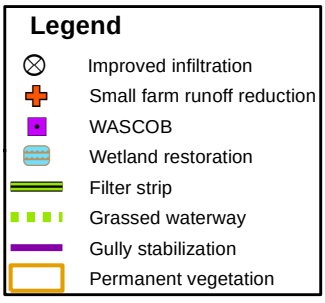
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 2
Sub-Basin 6



Drainage Area – 12.9 acres
Property Ownership – Private
Site Specific Information –
Moderate slopes running to ditch make an edge of field filter strip a good option. Assuming the area is row cropped (based on aerial photos) the filter strip would catch any sediment and nutrients prior to reaching the ditch. A quater of the basin is a wooded residential area.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$257.64	3.83	$67.27

Current Conditions		Added Practice		Reduction	
Sub-Basin	6	Type	Filter Strip	Sediment reduction (t/yr)	2.73
Acres	12.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.07
Soil	Stonelake-Sanburn complex, 1-6% slope	Length (ft)	330	Phosphorus reduction (lb/yr)	3.83
Slope length (ft)	650	Area (acres)	0.38		
Average slope	3.2	Contr. Area (acres)	10		

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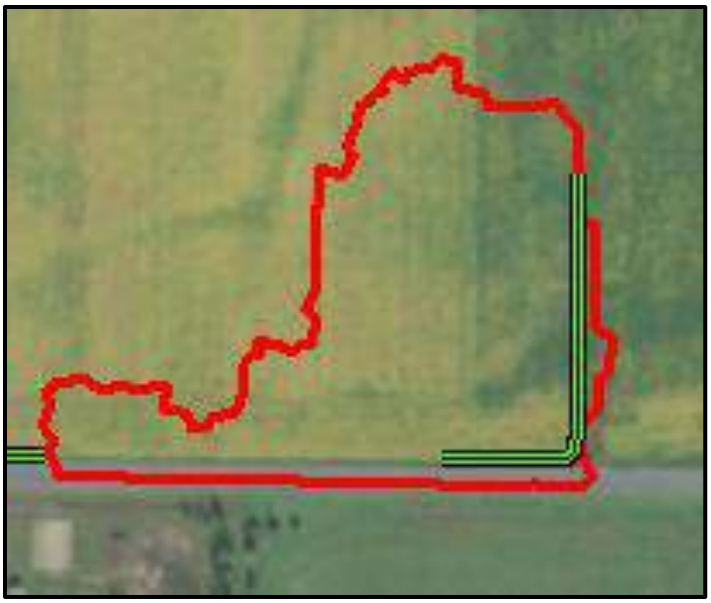
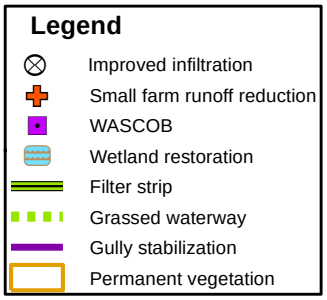
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 2
Sub-Basin 7



Drainage Area – 3 acres
Property Ownership – Private
Site Specific Information –
Moderate slopes make an edge of field filter strip a good option. Assuming the area is row cropped (based on aerial photos) the filter strip would catch any sediment and nutrients prior to reaching the ditch. Possible ditch along the roadside.



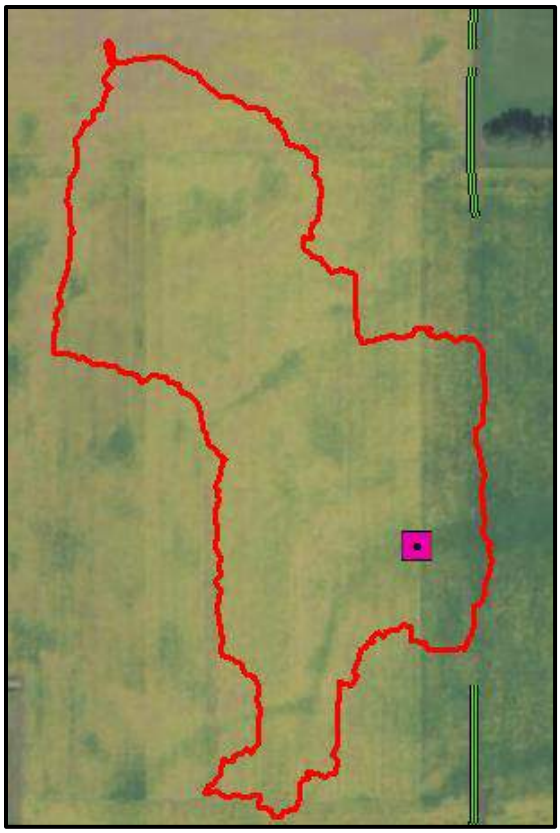
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$325.44	0.88	$369.82

Current Conditions		Added Practice		Reduction	
Sub-Basin	7	Type	Filter Strip	Sediment reduction (t/yr)	0.57
Acres	3	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.3
Soil	Sanburn fine sandy loam, 0-2% slopes	Length (ft)	415	Phosphorus reduction (lb/yr)	0.88
Slope length (ft)	65	Area (acres)	0.48		
Average slope	2.0	Contr. Area (acres)	2.2		

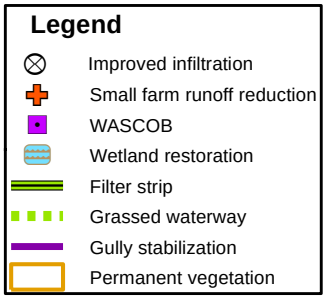
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 2
Sub-Basin 8



Drainage Area – 14.2 acres
Property Ownership – Private
Site Specific Information – Good opportunity implement a WASCOB at point in which flow concentrates near edge of field. Flow concentration indicates the possibility for gully formation. With moderate slopes and row cropping as the land use, a WASCOB is an ideal option. The entire basin is row cropped.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	11.33	$865.29

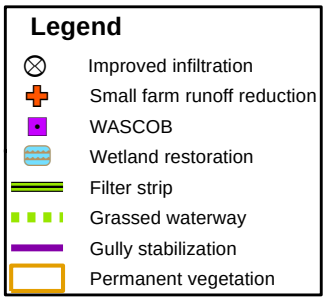
Current Conditions		Added Practice		Reduction	
Sub-Basin	8	Type	WASCOB	Sediment reduction (t/yr)	13.32
Acres	14.2	Contributing acres	7	Soil Loss reduction (t/yr)	60.5
Soil	Stonelake-Sanburn complex, 1-6% slope	Vol Voided (ft^3)	1100	Phosphorus reduction (lb/yr)	11.33
Slope length (ft)	600	Length (ft)	1100		
Average Steepness (%)	2.8	Years	1		
		Distance to SW (ft)	1500		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 2
Sub-Basin 9

Drainage Area – 3.6 acres
Property Ownership – Private
Site Specific Information – With moderate slopes and row cropping as the land use, an edge of field filter strip would reduce sediment and nutrient loading. The entire basin is row cropped.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$223.74	1.12	$199.77

Current Conditions		Added Practice		Reduction	
Sub-Basin	9	Type	Filter Strip	Sediment reduction (t/yr)	0.76
Acres	3.6	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.04
Soil	Stonelake-Sanburn complex, 1-6% slope	Length (ft)	290	Phosphorus reduction (lb/yr)	1.12
Slope length (ft)	575	Area (acres)	0.33		
Average slope	2.2	Contr. Area (acres)	3.6		

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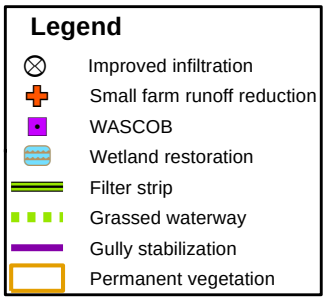
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 2
Sub-Basin 10



Drainage Area – 3.5 acres
Property Ownership – Private
Site Specific Information – With moderate slopes and row cropping as the land use, an edge of field filter strip would reduce sediment and nutrient loading. Connecting to the filter strip in sub-basin 9 (to the south) would increase the benefits of the practice.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$128.82	1.06	$121.53

Current Conditions		Added Practice		Reduction	
Sub-Basin	10	Type	Filter strip	Sediment reduction (t/yr)	0.72
Acres	3.5	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.01
Soil	Stonelake-Sanburn complex, 1-6% slope	Length (ft)	166	Phosphorus reduction (lb/yr)	1.06
Slope length (ft)	550	Area (acres)	0.19		
Average slope	2.4	Contr. Area (acres)	3.5		

Project ID – Filter Strip
Zone 2
Sub-Basin 11

Drainage Area – 6.7 acres
Property Ownership – Private
Site Specific Information – With moderate slopes and row cropping as the land use, an edge of field filter strip would reduce sediment and nutrient loading as well increase the biodiversity in the area. To the east of the basin is another row cropped field and to the north is wooded area.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$189.84	1.92	$98.88

Current Conditions		Added Practice		Reduction	
Sub-Basin	11	Type	Filter Strip	Sediment reduction (t/yr)	1.31
Acres	6.7	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.01
Soil	Stonelake-Sanburn complex, 1-6% slope	Length (ft)	243	Phosphorus reduction (lb/yr)	1.92
Slope length (ft)	800	Area (acres)	0.28		
Average slope	2.3	Contr. Area (acres)	6		

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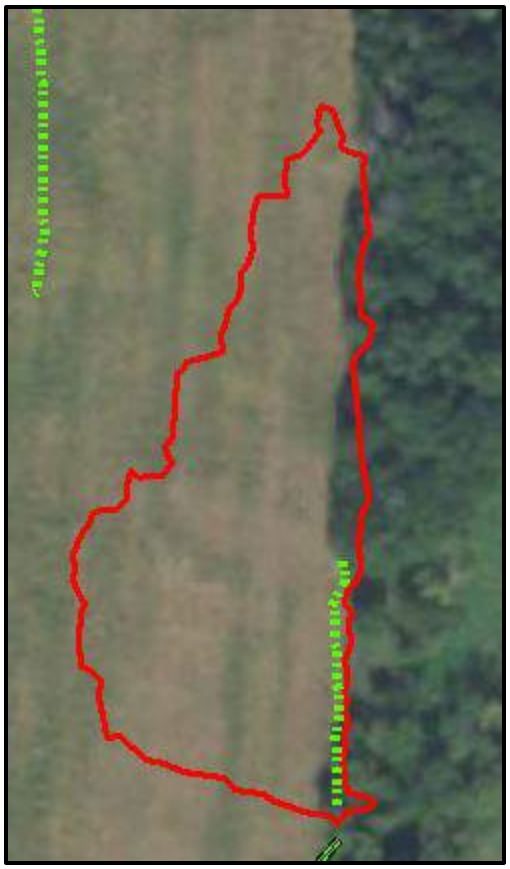
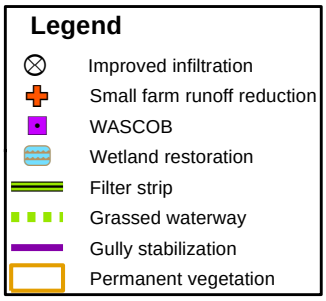
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 2
Sub-Basin 12



Drainage Area – 2.2 acres
Property Ownership – Private
Site Specific Information – Steep slopes (6-15%) and row cropping as the land use, implementing a grassed waterway would reduce the potential of gully formation and nutrient loss. The area to the east of the basin is wooded.

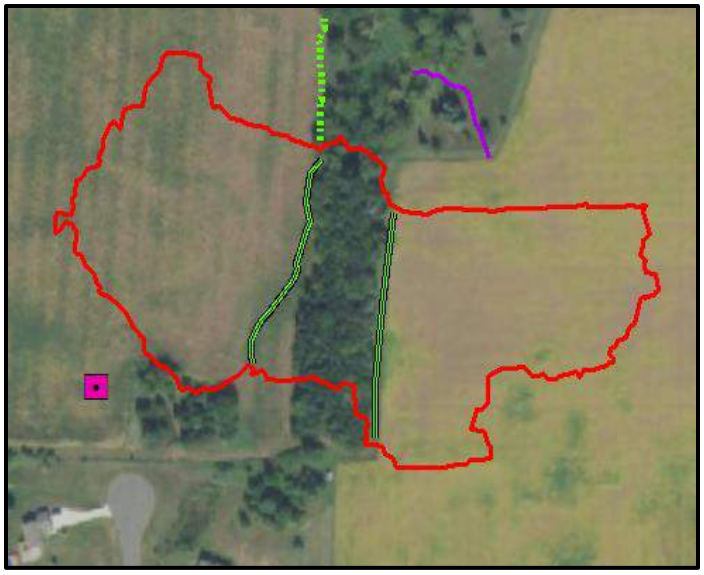
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,304.60	3.44	$379.24



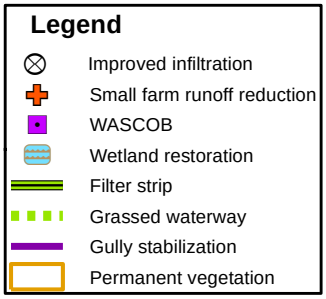
Current Conditions		Added Practice		Reduction	
Sub-Basin	12	Type	Grassed waterway	Sediment reduction (t/yr)	4.04
Acres	2.2	Contributing acres	4.4	Soil Loss reduction (t/yr)	12.1
Soil	Stonelake-Sanburn complex, 6-15% slope	Vol Voided (ft^3)	220	Phosphorus reduction (lb/yr)	3.44
Slope length (ft)	500	Length (ft)	220		
Average slope	4.4	Area (acres)	0.25		
		Years	1		
		Distance to SW (ft)	200		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 2
Sub-Basin 13



Drainage Area – 9.2 acres
Property Ownership – Private
Site Specific Information – Located on the east side of the sub-catchment, steep slopes 6-15% leading to wooded flow path. No concentrated flow within field, address runoff via filter strips. This basin is located directly north of a new subdivision development.



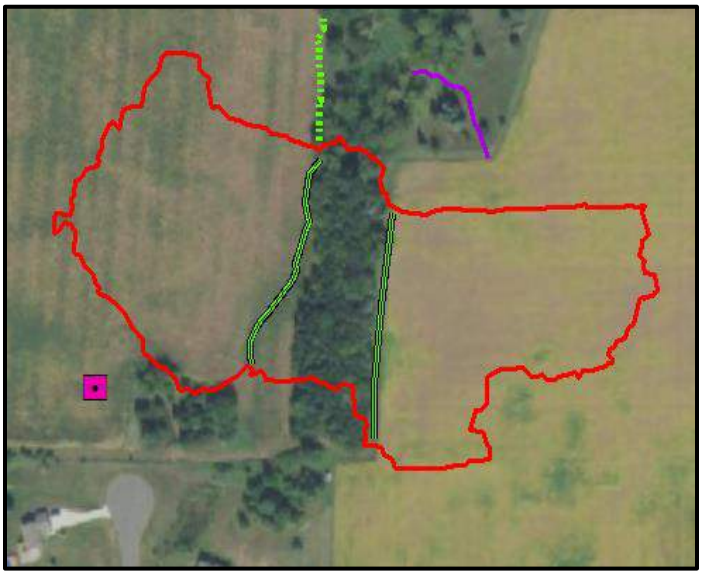
Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$298.32	1.77	$168.54

Current Conditions		Added Practice		Reduction	
Sub-Basin	13	Type	Filter Strip	Sediment reduction (t/yr)	1.33
Acres	9.2	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.09
Soil	Stonelake-Sanburn complex, 6-15% slope	Length (ft)	393	Phosphorus reduction (lb/yr)	1.77
Slope length (ft)	600	Area (acres)	0.45		
Average Steepness (%)	4.8	Contr. Area (acres)	3.7		

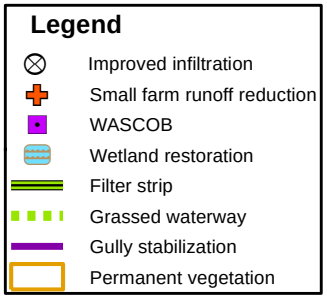
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 2
Sub-Basin 13



Drainage Area – 9.2 acres
Property Ownership – Private
Site Specific Information – An edge of field filter strip would benefit west field. With 6-15% slopes and indications of row cropping as a land use, the filter strip would catch sediment and nutrient loss from the field. The west side of the basin is wooded land.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$305.10	1.68	$181.61

Current Conditions		Added Practice		Reduction	
Sub-Basin	13	Type	Filter Strip	Sediment reduction (t/yr)	1.26
Acres	9.2	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.09
Soil	Stonelake-Sanburn complex, 6-15% slope	Length (ft)	387	Phosphorus reduction (lb/yr)	1.68
Slope length (ft)	600	Area (acres)	0.44		
Average slope	4.8	Contr. Area (acres)	3.5		

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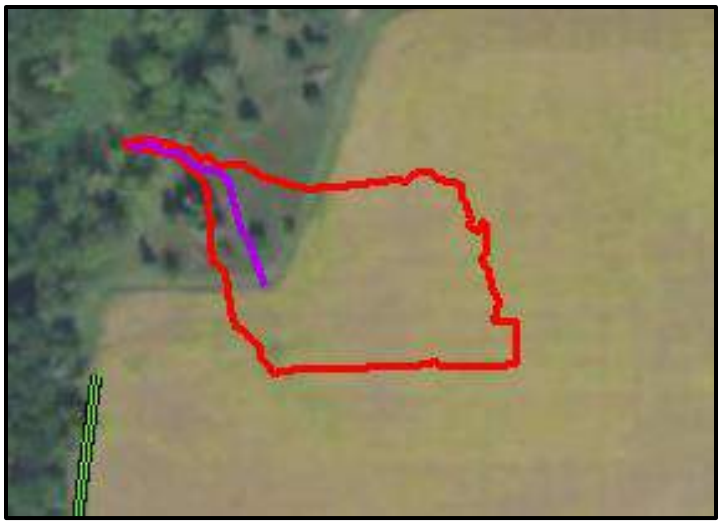
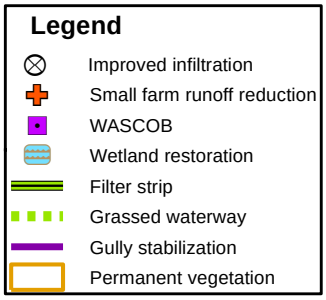
Project ID – Filter Strip
Zone 2
Sub-Basin 14



Drainage Area – 1.3 acres
Property Ownership – Private
Site Specific Information – Visible gully formed just off of the field at NW portion of basin. Address with perennial grassed waterway to stabilize the current gully. The topography indicates flow coming off the field into the wooded area. The basin in mostly row cropped with a small section of woods to the northwest.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,363.90	4.15	$328.65

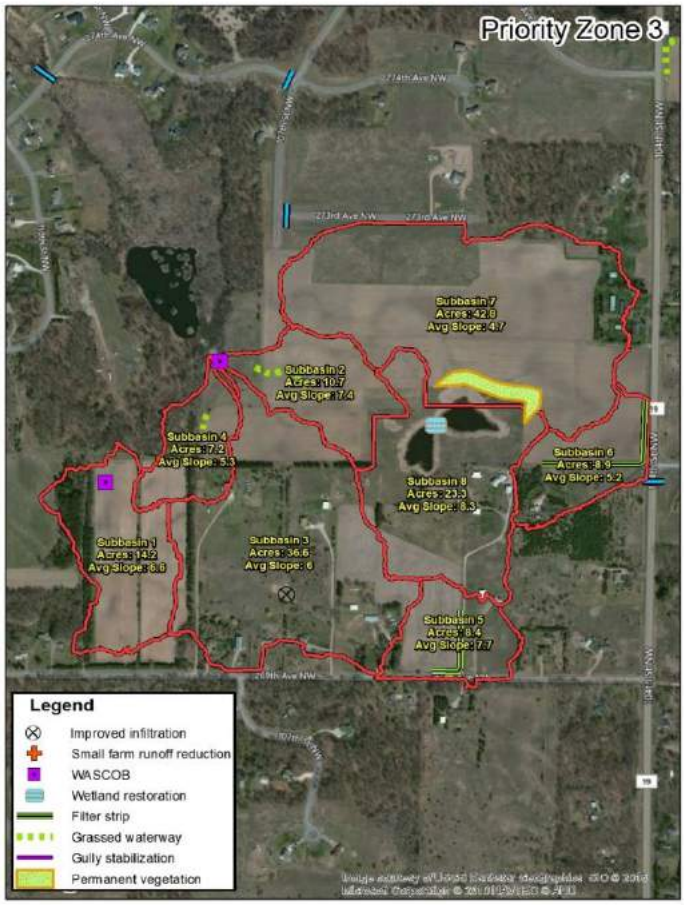
Current Conditions		Added Practice		Reduction	
Sub-Basin	14	Type	Gully stabilization	Sediment reduction (t/yr)	4.88
Acres	1.3	Contributing acres	3	Soil Loss reduction (t/yr)	12.65
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)	230	Phosphorus reduction (lb/yr)	4.15
Slope length (ft)	435	Length (ft)	230		
Average slope	5.1	Area (acres)	0.26		
		Years	1		
		Distance to SW (ft)	100		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

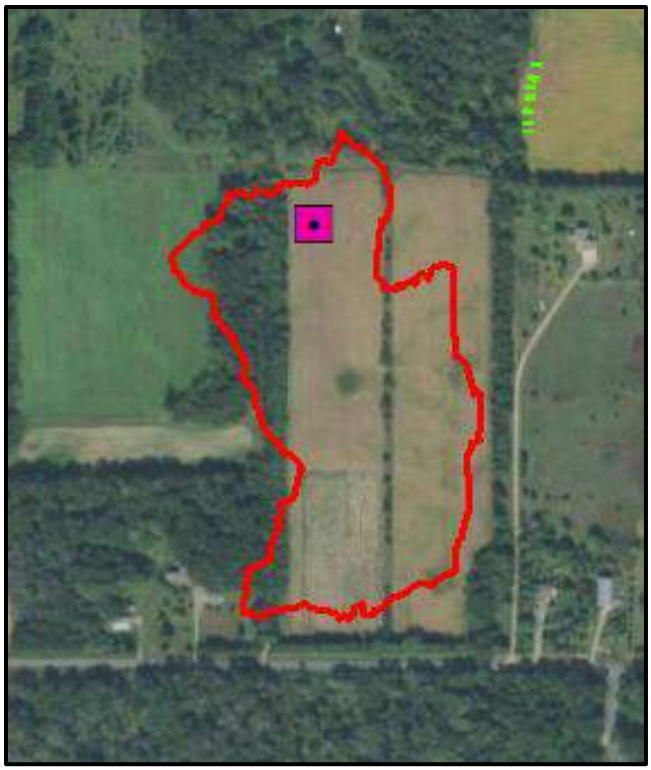
Priority Zone 3

Priority Zone 3 Summary	
Acres addressed	152.1
Dominant Land Cover	Agricultural
Total Sub-Basins	8
Potential BMPs	8
Potential TP reduction (lb/yr)	46.04
Potential TSS reduction (tons/yr)	39.17

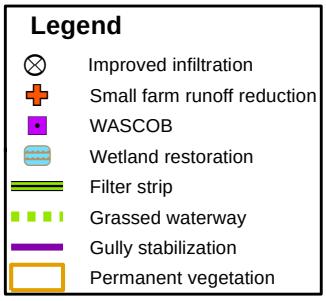


Priority Zone 3 is roughly 175 acres in size, located west of Priority Zone 2. Some residential land exists within several of the delineated sub-basins, however a vast majority of the northern half of this zone is in row crop agriculture land with moderate to steep slopes (4%-8%). Two wetland restorations practices were identified but were not modeled. Further engineering investigation is needed to model the wetland restoration projects.

Project ID – WASCOB
Zone 3
Sub-Basin 1



Drainage Area – 14.2 acres
Property Ownership – Private
Site Specific Information – The majority of the area is row crop land use. Basin 1 drains a large field with some moderate to steep slopes. A WASCOB to be placed at culmination point of flow paths. Aerial photos indicate a possible ditch running through the middle of the basin.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	6.04	$1,623.13

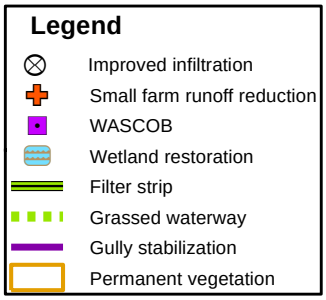
Current Conditions		Added Practice			Reduction
Sub-Basin	1	Type	WASCOB	Sediment reduction (t/yr)	7.1
Acres	14.2	Contributing acres	13	Soil Loss reduction (t/yr)	30.25
Soil	Stonelake-Sanburn complex, 6-15% slope	Vol Voided (ft^3)	550	Phosphorus reduction (lb/yr)	6.04
Slope length (ft)	375	Length (ft)	550		
Average slope	6.6	Years	1		
		Distance to SW (ft)	1100		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 3
Sub-Basin 2

Drainage Area – 10.7 acres
Property Ownership – Private
Site Specific Information – Aerial imagery indicates agricultural land use. Steepest part of sub-basin is in perennial grass. Construct grassed waterway leading to this region to filter water.



Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$2,152.59	6.63	$324.67

Current Conditions		Added Practice			Reduction
Sub-Basin	2	Type	Grassed waterway	Sediment reduction (t/yr)	7.81
Acres	10.7	Contributing acres	9.2	Soil Loss reduction (t/yr)	27.5
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)	363	Phosphorus reduction (lb/yr)	6.63
Slope length (ft)	200	Length (ft)	363		
Average slope	7.4	Area (acres)	0.42		
		Years	1		
		Distance to SW (ft)	440		

Project ID – Wetland Restoration
Zone 3
Sub-Basin 3

Drainage Area – 36.6 acres
Property Ownership – Private
Site Specific Information – This basin contains 6.5 cropped acres of 36.6 total, 3 in the north section and 3.5 in the east section. The northern section drains to permanent vegetation currently. Improved infiltration of a Type 2 wetland would allow for drainage and infiltration of the eastern cropped land. More information and in-depth engineering modeling is needed to calculate reduction possibilities.

Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
NA	NA	NA

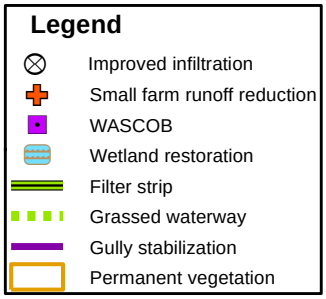
Current Conditions		Added Practice			Reduction
Sub-Basin	3	Type	Wetland Restoration	Sediment reduction (t/yr)	
Acres	36.6	Contributing acres		Soil Loss reduction (t/yr)	
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)		Phosphorus reduction (lb/yr)	
Slope length (ft)	450	Length (ft)			
Average slope	6	Years			
		Distance to SW (ft)			

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 3
Sub-Basin 4

Drainage Area – 7.2 acres
Property Ownership – Private
Site Specific Information – Concentrated flow was identified along the field edge in a row cropped land use area. Implementing a grass waterway at the wester field edge would reduce sediment and nutrient loss. Areas to the west of the grassed waterway is wooded and areas to the east is row cropped.

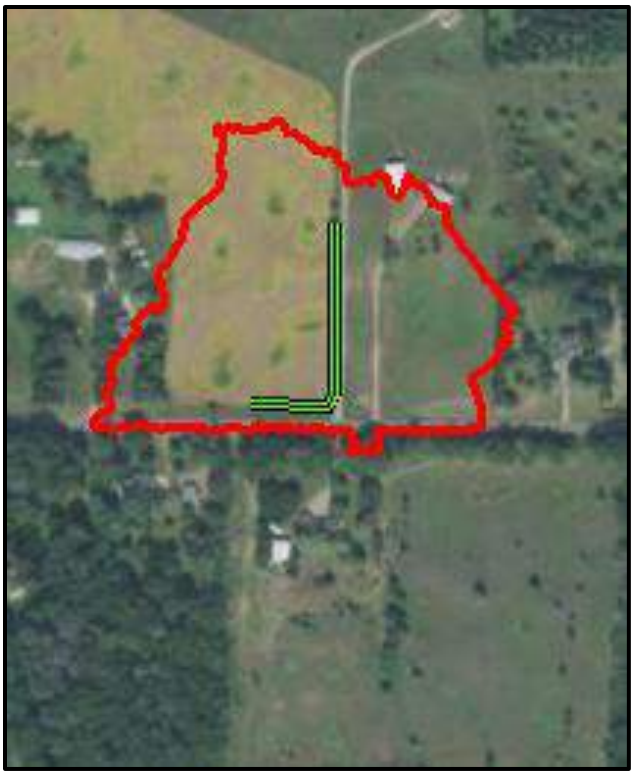


Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$1,245.30	3.07	$405.64

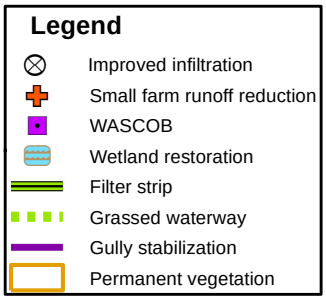
Current Conditions		Added Practice			Reduction
Sub-Basin	4	Type	Grassed waterway	Sediment reduction (t/yr)	3.61
Acres	7.2	Contributing acres	4.6	Soil Loss reduction (t/yr)	11.55
Soil	Sanburn fine sandy loam, 2-6% slopes	Vol Voided (ft^3)	210	Phosphorus reduction (lb/yr)	3.07
Slope length (ft)	350	Length (ft)	210		
Average slope	5.3	Area (acres)	0.24		
		Years	1		
		Distance to SW (ft)	275		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 3
Sub-Basin 5



Drainage Area – 8.4 acres
Property Ownership – Private
Site Specific Information – The area is 50% row cropped and drains to a roadside ditch. Implementing a grassed waterway along the ditch would reduce sediment and nutrient loading into the roadside ditch.



Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$413.58	3.41	$121.28

Current Conditions		Added Practice			Reduction
Sub-Basin	5	Type	Filter Strip	Sediment reduction (t/yr)	2.85
Acres	8.4	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.49
Soil	Sanburn fine sandy loam, 2-6% slopes	Length (ft)	535	Phosphorus reduction (lb/yr)	3.41
Slope length (ft)	420	Area (acres)	0.61		
Average slope	7.7	Contr. Area (acres)	4.5		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 3
Sub-Basin 6

Drainage Area – 8.9 acres
Property Ownership – Private
Site Specific Information – The area is 50% row cropped and drains to a roadside ditch. Soil data indicated moderate slopping. Implementing a grassed waterway along the ditch would reduce sediment and nutrient loading into the roadside ditch.

Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$745.80	2.93	$254.54

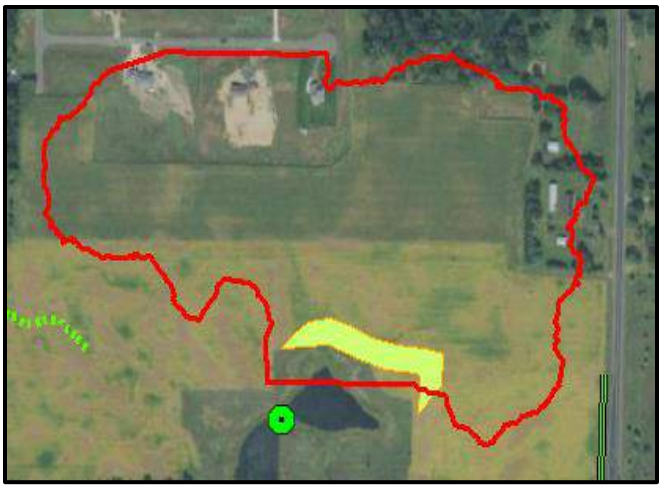
Current Conditions		Added Practice			Reduction
Sub-Basin	6	Type	Filter Strip	Sediment reduction (t/yr)	2.43
Acres	8.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.55
Soil	Sanburn fine sandy loam, 2-6% slopes	Length (ft)	960	Phosphorus reduction (lb/yr)	2.93
Slope length (ft)	440	Area (acres)	1.10		
Average slope	5.2	Contr. Area (acres)	3.9		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Permanent Vegetation
Zone 3
Sub-Basin 7

Drainage Area – 42.8 acres
Property Ownership – Private
Site Specific Information – Sub-basin 7 is a large field. The field drains to a wetland in Sub-basin 8, but could benefit from filtering before reaching the wetland through perennial vegetation planting.



Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$745.80	2.93	$254.54

Current Conditions		Added Practice			Reduction
Sub-Basin	7	Type	Permanent Vegetation	Sediment reduction (t/yr)	15.37
Acres	42.8	Specs	before wetland	Soil Loss reduction (t/yr)	1.63
Soil	Sanburn fine sandy loam, 2-6% slopes	Distance to water	300	Phosphorus reduction (lb/yr)	23.96
Slope length (ft)	160	Contr. Area (acres)	40.00		
Average slope	4.7	acres applied	1.3		

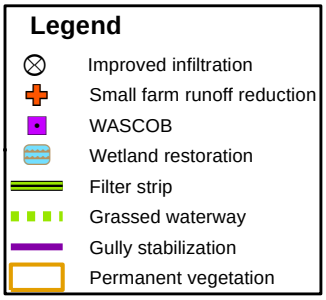
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 3
Sub-Basin 8

Drainage Area – 23.3 acres
Property Ownership – Private
Site Specific Information – This area drains to a wetland, which is likely landlocked. Could benefit from wetland restoration. A good portion of basin 7 likely drains to this wetland as well. More site investigation is needed to calculate pollution reduction.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
NA	NA	NA

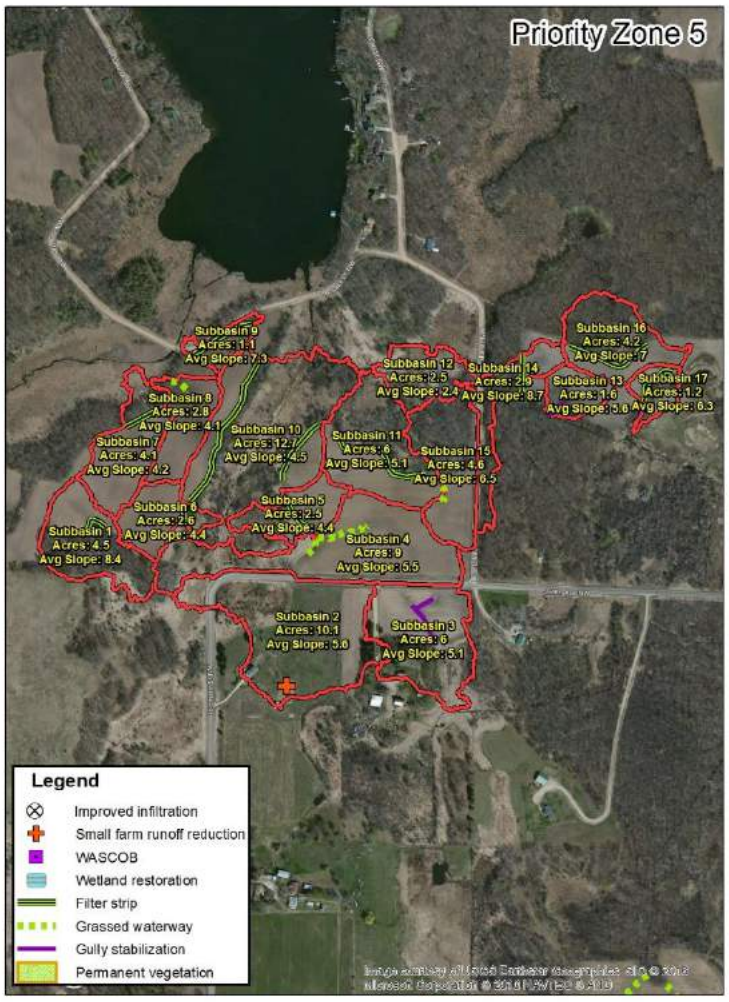


Current Conditions		Added Practice			Reduction
Sub-Basin	8	Type	Wetland Restoration	Sediment reduction (t/yr)	
Acres	23.3	Specs		Soil Loss reduction (t/yr)	
Soil	Stonelake-Sanburn complex, 6-15% slopes	Length (ft)		Phosphorus reduction (lb/yr)	
Slope length (ft)		Area (acres)			
Average slope	8.3	Contr. Area (acres)			

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Priority Zone 5

Priority Zone 5 Summary	
Acres addressed	75.9
Dominant Land Cover	Agricultural
Total Sub-Basins	17
Potential BMPs	16
Potential TP reduction (lb/yr)	35.50
Potential TSS reduction (tons/yr)	36.93

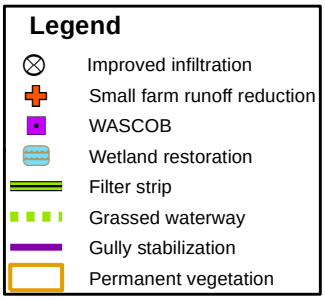


Priority Zone 5 is located only 250 feet south of Blue Lake. The lake's two southern tributaries run through this region, which consists of a mix of some wetland, forest and row crops. The fields in this 106 acre area have a moderate to steep slope. Both tributaries are monitored for suspended solids and total phosphorus. The tributary to the east is at the threshold of exceeding TP and TSS measurements for this ecoregion. The tributary to the west exceeds the concentration average by 23.25 µg/L. Because of the monitoring data and the proximity to the lake, Zone 5 should be near at the top of the priority list when project selection begins.

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 5
Sub-Basin 1

Drainage Area – 4.5 acres
Property Ownership – Private
Site Specific Information – An edge of field filter strip would benefit this area. The area is relatively small, however it is in close proximity to a drainage ditch and has slopes >6%. Contour farming could also be taken into consideration. 75% of the basin is wooded.



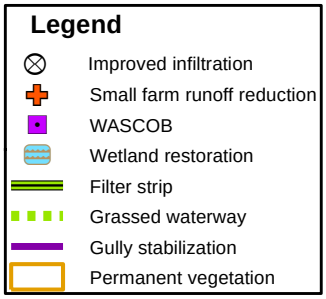
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$13,087.50	6.04	$2,166.80

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	WASCOB	Sediment reduction (t/yr)	7.1
Acres	4.5	Contributing acres	13	Soil Loss reduction (t/yr)	30.25
Soil	Braham loamy fine sand, 2-7% slopes	Vol Voided (ft^3)	550	Phosphorus reduction (lb/yr)	6.04
Slope length (ft)	150	Length (ft)	550		
Average slope	8.4	Years	1		
		Distance to SW (ft)	1100		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Manure Management
Zone 5
Sub-Basin 2

Drainage Area – 10.1 acres
Property Ownership – Private
Site Specific Information – This property has a small hobby farm with what appears to be horses. Manure and runoff management is recommended for this area. More information and engineering data is need to calculate pollution reduction results



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
NA	NA	NA

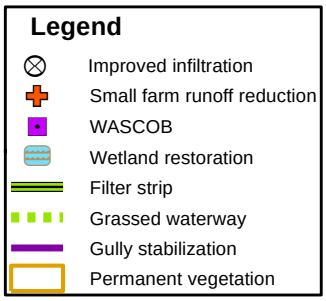
Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	Manure mgmt	Sediment reduction (t/yr)	
Acres	10.1	Contributing acres		Soil Loss reduction (t/yr)	
Soil	Chetek loamy sand, 2-7% slopes	Vol Voided (ft^3)		Phosphorus reduction (lb/yr)	
Slope length (ft)	500	Length (ft)			
Average slope	5.6	Area (acres)			
		Years			
		Distance to SW (ft)			

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Gully Stabilization
Zone 5
Sub-Basin 3

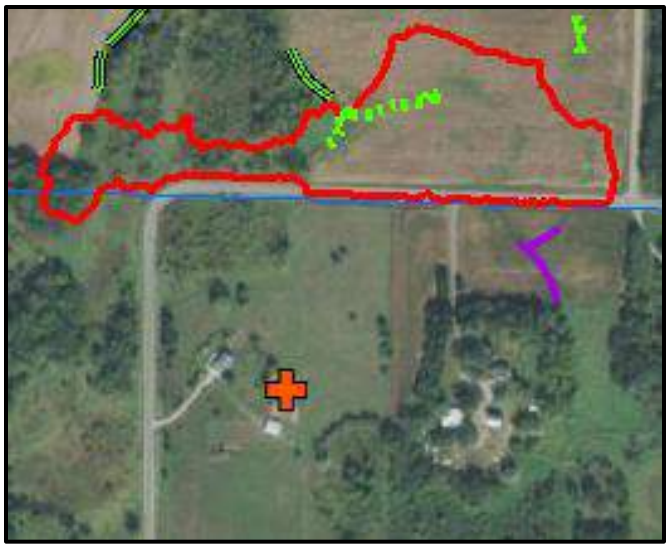
Drainage Area – 6.0 acres
Property Ownership – Private
Site Specific Information – Visible gully has formed on the property within agricultural field. GIS tools indicate steep slopes (7-12%) Address by implementing a grassed waterway to stabilize the current gully as well and trap sediment and nutrients.

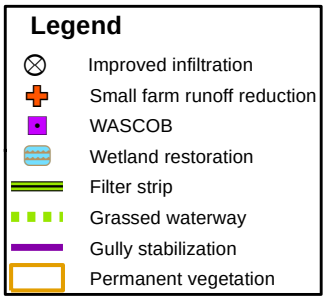


Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,779.00	4.11	$432.85

Current Conditions		Added Practice		Reduction	
Sub-Basin	3	Type	Gully stabilization	Sediment reduction (t/yr)	4.84
Acres	6	Contributing acres	2.75	Soil Loss reduction (t/yr)	16.5
Soil	Sanburn fine sandy loam, 7-12% slopes	Vol Voided (ft^3)	300	Phosphorus reduction (lb/yr)	4.11
Slope length (ft)	125	Length (ft)	300		
Average slope	5.1	Area (acres)	0.34		
		Years	1		
		Distance to SW (ft)	375		

Project ID – Grassed Waterway
Zone 5
Sub-Basin 4





Drainage Area – 9.0 acres
Property Ownership – Private
Site Specific Information – The agricultural field has steep slopes. The field is row cropped with corn and soybeans. Address runoff at concentrated flow path to prevent soil and nutrient loss. The west side of the basin has forested cover.

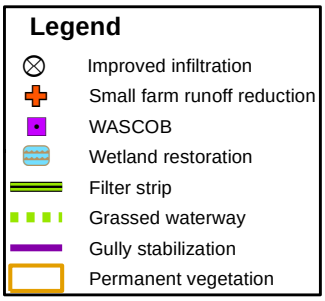
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,549.90	5.82	$438.13

Current Conditions		Added Practice		Reduction	
Sub-Basin	4	Type	Grassed waterway	Sediment reduction (t/yr)	6.85
Acres	9	Contributing acres	4.1	Soil Loss reduction (t/yr)	23.65
Soil	Sanburn fine sandy loam, 7-12% slopes	Vol Voided (ft^3)	430	Phosphorus reduction (lb/yr)	5.82
Slope length (ft)	400	Length (ft)	430		
Average slope	5.5	Area (acres)	0.49		
		Years	1		
		Distance to SW (ft)	400		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 5
Sub-Basin 5



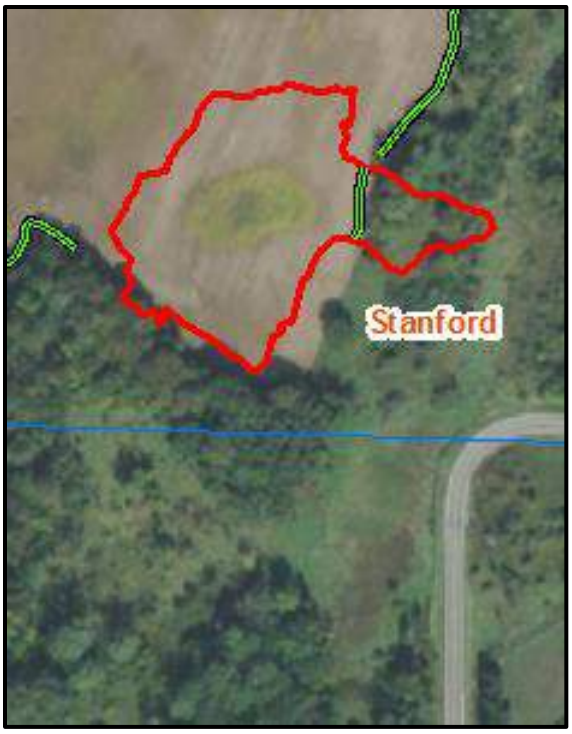
Drainage Area – 2.5 acres
Property Ownership – Private
Site Specific Information – The area has steep slopes and loamy fine sand soils. Aerial imagery indicates row cropping as the land use. The field edge is adjacent lowland area with a tributary running through it. Implementing a filter strip along the field edge would prevent nutrients and soil from entering the wetland and tributary.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$108.48	1.51	$71.84

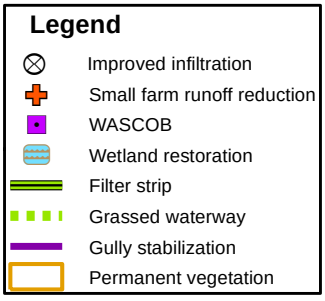
Current Conditions		Added Practice		Reduction	
Sub-Basin	5	Type	Filter Strip	Sediment reduction (t/yr)	1.19
Acres	2.5	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.11
Soil	Braham loamy fine sand, 7-12% slopes	Length (ft)	140	Phosphorus reduction (lb/yr)	1.51
Slope length (ft)	150	Area (acres)	0.16		
Average slope	4.4	Contr. Area (acres)	2.6		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 5
Sub-Basin 6



Drainage Area – 2.6 acres
Property Ownership – Private
Site Specific Information – The area has steep slopes and loamy fine sand soils. Aerial imagery indicates row cropping as the land use. The field edge is adjacent lowland area with a tributary running through it. Implementing a filter strip along the field edge would prevent nutrients and soil from entering the wetland and tributary.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$74.58	0.48	$155.38

Current Conditions		Added Practice		Reduction	
Sub-Basin	6	Type	Filter Strip	Sediment reduction (t/yr)	0.33
Acres	2.6	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.04
Soil	Sanburn fine sandy loam, 7-18% slopes	Length (ft)	100	Phosphorus reduction (lb/yr)	0.48
Slope length (ft)	225	Area (acres)	0.11		
Average slope	4.0	Contr. Area (acres)	1.5		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 5
Sub-Basin 7

Drainage Area – 4.1 acres
Property Ownership – Private
Site Specific Information – The area has moderate to steep slopes and loamy fine sand soils. Aerial imagery indicates row cropping as the land use. The field edge is adjacent lowland area with a tributary running through it. Implementing a filter strip along the field edge would prevent nutrients and soil from entering the wetland and tributary.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$74.58	1.79	$41.66

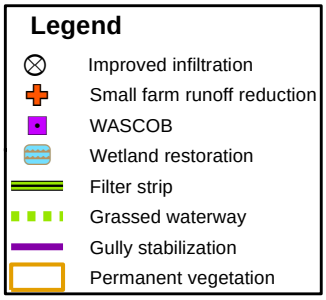
Current Conditions		Added Practice		Reduction	
Sub-Basin	7	Type	Filter Strip	Sediment reduction (t/yr)	1.42
Acres	4.1	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.06
Soil	Braham loamy fine sand, 2-7% slopes	Length (ft)	100	Phosphorus reduction (lb/yr)	1.79
Slope length (ft)	230	Area (acres)	0.11		
Average slope	4.2	Contr. Area (acres)	3		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 5
Sub-Basin 8

Drainage Area – 2.8 acres
Property Ownership – Private
Site Specific Information With moderate to steep slopes and the land use being row cropped, a grassed waterway at the northwest section of the basin would be an ideal practice to prevent erosion. The majority of this basin is row cropped.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$741.25	1.91	$388.09

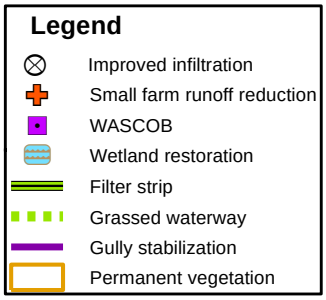
Current Conditions		Added Practice		Reduction	
Sub-Basin	8	Type	Grassed waterway	Sediment reduction (t/yr)	2.25
Acres	2.8	Contributing acres	2	Soil Loss reduction (t/yr)	6.88
Soil	Braham loamy fine sand, 2-7% slopes	Vol Voided (ft^3)	125	Phosphorus reduction (lb/yr)	1.91
Slope length (ft)	375	Length (ft)	125		
Average slope	4.1	Area (acres)	0.14		
		Years	1		
		Distance to SW (ft)	220		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 5
Sub-Basin 9

Drainage Area – 1.1 acres
Property Ownership – Private
Site Specific Information – This basin has steep slopes that drain to the roadside ditch. Implementing a filter strip along the field edge and the ditch would help prevent soil and nutrients from entering the nearby tributaries. The majority of the basin is row cropped.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$264.42	0.96	$275.44

Current Conditions		Added Practice		Reduction	
Sub-Basin	9	Type	Filter Strip	Sediment reduction (t/yr)	0.8
Acres	1.1	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.62
Soil	Braham loamy fine sand, 7-12% slopes	Length (ft)	340	Phosphorus reduction (lb/yr)	0.96
Slope length (ft)	125	Area (acres)	0.39		
Average slope	7.3	Contr. Area (acres)	0.8		

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Project ID – Filter Strip
Zone 5
Sub-Basin 10

Drainage Area – 12.7 acres
Property Ownership – Private
Site Specific Information – Most of this basin is lowland area. However, a smaller section is row cropped and has steep slopes adjacent to a nearby tributary. A filter strip would be beneficial in along the field edge to capture nutrients and sediment prior to reaching the lowland.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$915.30	3.11	$294.31

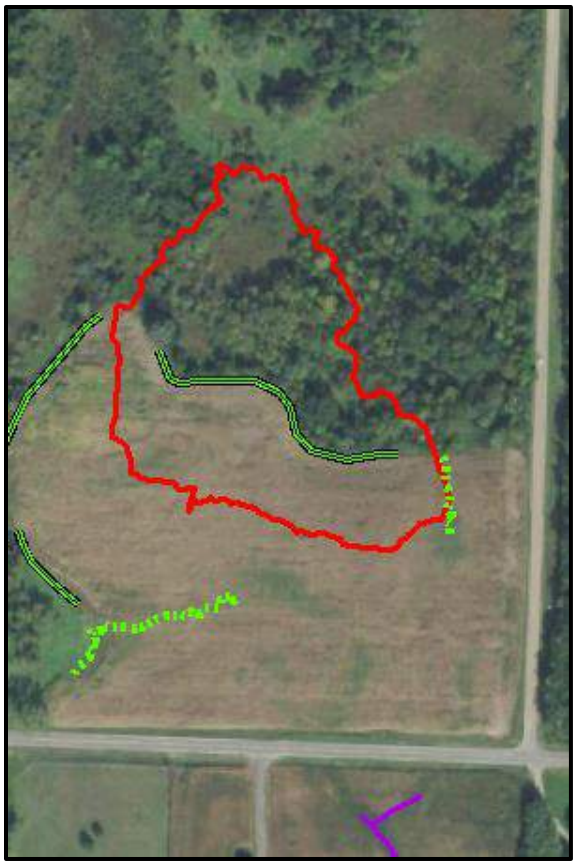
Current Conditions		Added Practice		Reduction	
Sub-Basin	10	Type	Filter Strip	Sediment reduction (t/yr)	2.47
Acres	12.7	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	1.94
Soil	Braham loamy fine sand, 7-12% slopes	Length (ft)	1174	Phosphorus reduction (lb/yr)	3.11
Slope length (ft)	100	Area (acres)	1.35		
Average slope	4.5	Contr. Area (acres)	3		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 5
Sub-Basin 11

Drainage Area – 6 acres
Property Ownership – Private
Site Specific Information – The area has moderate to steep slopes and loamy fine sand soils. Aerial imagery indicates row cropping as the land use. The field edge is adjacent lowland area with a tributary running through it. Implementing a filter strip along the field edge would prevent nutrients and soil from entering the wetland and tributary.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$427.14	1.70	$251.26

Current Conditions		Added Practice		Reduction	
Sub-Basin	11	Type	Filter Strip	Sediment reduction (t/yr)	1.33
Acres	6	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.53
Soil	Sanburn fine sandy loam, 7-18% slopes	Length (ft)	550	Phosphorus reduction (lb/yr)	1.7
Slope length (ft)	170	Area (acres)	0.63		
Average slope	5.1	Contr. Area (acres)	2.6		

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Project ID – Filter Strip
Zone 5
Sub-Basin 13

Drainage Area – 1.6 acres.
Property Ownership – Private
Site Specific Information – Visible gully has formed on property within row cropped field. GIS tools has indicated a nearby stream that would potentially receive sediment and nutrients do to the gully. Address through grassed waterway to stabilize the gully and filter stormwater.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$622.65	2.19	$284.32

Current Conditions		Added Practice		Reduction	
Sub-Basin	13	Type	Gully stabilization	Sediment reduction (t/yr)	2.57
Acres	1.6	Contributing acres	1.4	Soil Loss reduction (t/yr)	5.78
Soil	Hayden fine sandy loam, 7-12% slopes	Vol Voided (ft^3)	105	Phosphorus reduction (lb/yr)	2.19
Slope length (ft)	155	Length (ft)	105		
Average slope	5.6	Area (acres)	0.12		
		Years	1		
		Distance to SW (ft)	50		

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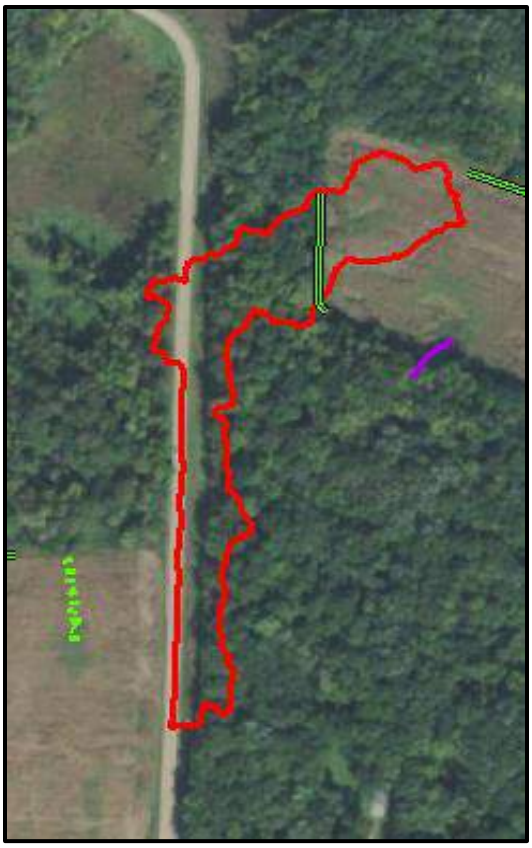
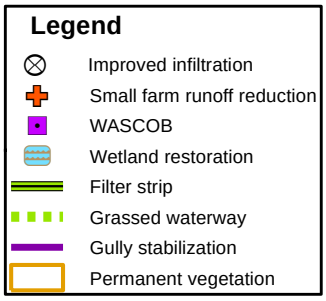
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 5
Sub-Basin 14



Drainage Area – 2.9 acres
Property Ownership – Private
Site Specific Information – Most of steep basin was in forested land cover. Implement a filter strip along the field boarder. The field is addressed as row cropped. Aerial imagery indicates a possible gully perpendicular to proposed filter strip location. The filter strip would trap and filter stormwater coming off of the agricultural field.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$162.72	1.11	$146.59

Current Conditions		Added Practice		Reduction	
Sub-Basin	14	Type	Filter Strip	Sediment reduction (t/yr)	1.01
Acres	2.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.53
Soil	Hayden fine sandy loam, 7-12% slopes	Length (ft)	205	Phosphorus reduction (lb/yr)	1.11
Slope length (ft)	250	Area (acres)	0.24		
Average slope	6.7	Contr. Area (acres)	0.8		

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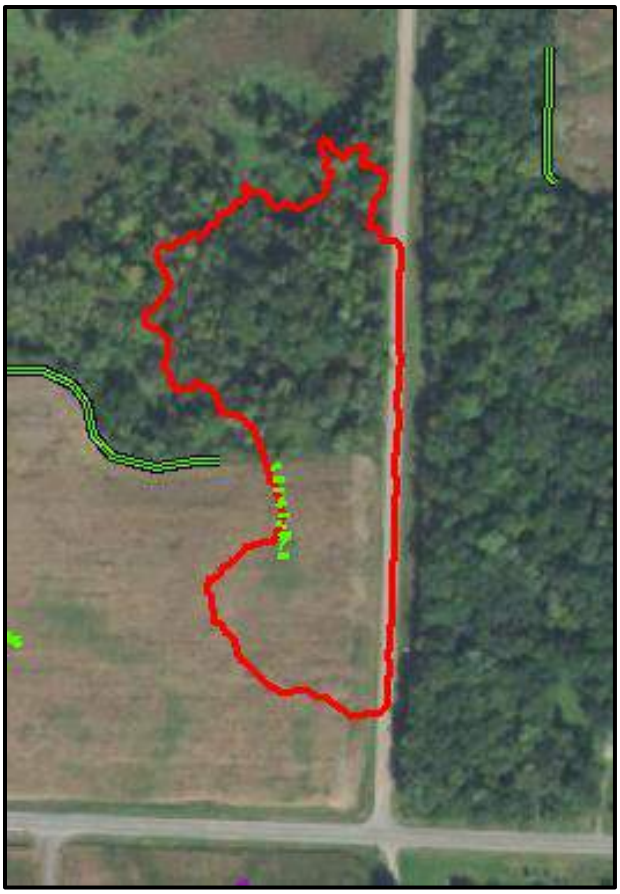
Project ID – Grassed Waterway
Zone 5
Sub-Basin 15



Drainage Area – 4.6 acres
Property Ownership – Private
Site Specific Information – Steep slopes identified in this area. The basin is 50% row cropped land use and has forest bordering the field to the north. A grassed waterway along the west boarder of the basin would benefit water quality.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,008.10	2.30	$438.30

Current Conditions		Added Practice		Reduction	
Sub-Basin	15	Type	Grassed waterway	Sediment reduction (t/yr)	2.71
Acres	4.6	Contributing acres	1.6	Soil Loss reduction (t/yr)	9.35
Soil	Sanburn fine sandy loam, 7-18% slopes	Vol Voided (ft^3)	170	Phosphorus reduction (lb/yr)	2.3
Slope length (ft)	210	Length (ft)	170		
Average slope	6.5	Area (acres)	0.20		
		Years	1		
		Distance to SW (ft)	400		

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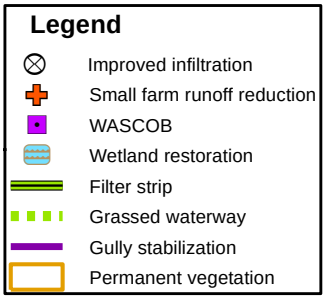
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 5
Sub-Basin 16

Drainage Area – 4.2 acres
Property Ownership – Private
Site Specific Information – Steep slopes identified in this area. The basin is 50% row cropped land use and has forest bordering the field to the north. A filter strip along the field boarder would benefit water quality by filtering any stormwater runoff.

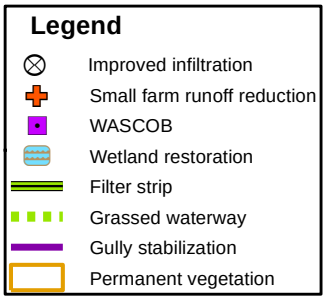


Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$359.34	2.00	$179.67

Current Conditions		Added Practice		Reduction	
Sub-Basin	16	Type	Filter Strip	Sediment reduction (t/yr)	1.71
Acres	4.2	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	1.28
Soil	Hayden fine sandy loam, 7-12% slopes	Length (ft)	460	Phosphorus reduction (lb/yr)	2
Slope length (ft)	80	Area (acres)	0.53		
Average slope	7	Contr. Area (acres)	1.4		

Project ID – Filter Strip
Zone 5
Sub-Basin 17

Drainage Area – 1.2 acres
Property Ownership – Private
Site Specific Information – Steep slopes identified in this area. The basin is 50% row cropped land use and has forest/lowland bordering the field to the south. A filter strip along the field boarder would benefit water quality.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$196.62	0.47	$418.34

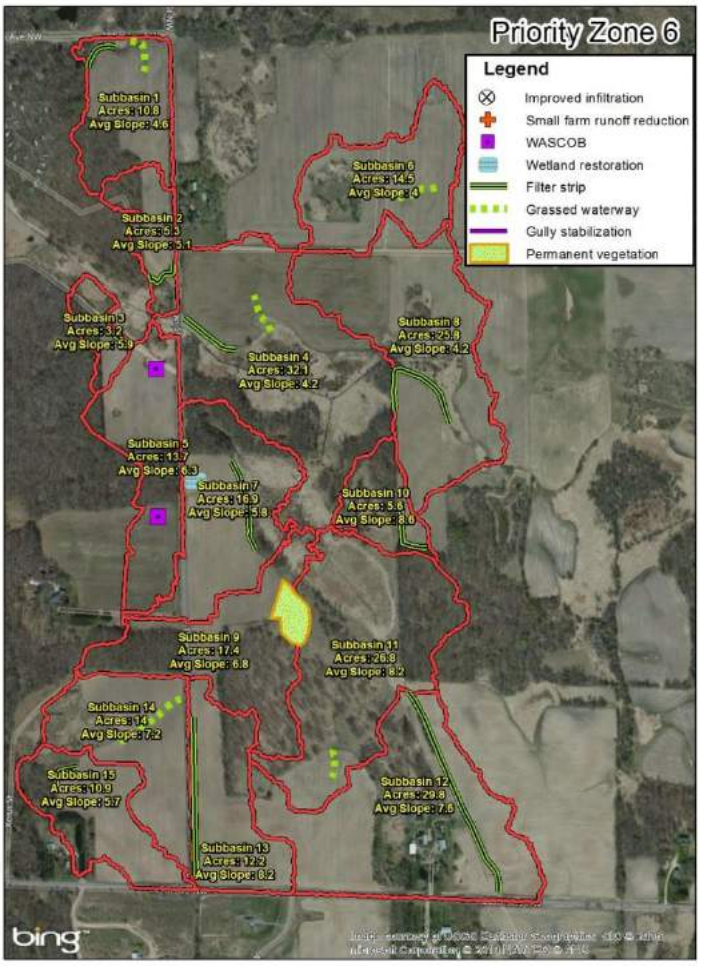
Current Conditions		Added Practice		Reduction	
Sub-Basin	17	Type	Filter Strip	Sediment reduction (t/yr)	0.35
Acres	1.2	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.36
Soil	Sanburn fine sandy loam, 7-18% slopes	Length (ft)	250	Phosphorus reduction (lb/yr)	0.47
Slope length (ft)	70	Area (acres)	0.29		
Average slope	6.3	Contr. Area (acres)	0.43		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Priority Zone 6

Priority Zone 6 Summary	
Acres addressed	295.6
Dominant Land Cover	Agricultural
Total Sub-Basins	15
Potential BMPs	18
Potential TP reduction (lb/yr)	48.23
Potential TSS reduction (tons/yr)	47.52



Priority Zone 6 is situated only 1,500 feet from the south-eastern side and the lakes lone eastern tributary runs directly through this location. Monitoring information has indicated that this tributary is contributing the highest pollutant load to the lake; as such, implementing practices in this zone should be a high priority. The area contains row crops; slope steepness is moderate to high with field averages ranging from 4% to 14%.

The tributary running through this zone is monitored by the SWCD and has been targeted as high priority based on the high nutrient concentrations identified when taking water samples. The average total phosphorus level for 2016 was 224.63 µg/L which is 50% higher than the typical range in this ecoregion. Suspended solids averaged nearly 70% higher than what is typical for this region. The wetland restoration project identified in this assessment was not modeled.

Project ID – Grass Waterway
Zone 6
Sub-Basin 1

Drainage Area – 10.8 acres
Property Ownership – Private
Site Specific Information – An edge of field filter strip would benefit the northwest field boarder. This area is relatively small, however it is in close proximity to a drainage ditch and has slopes >6%. Contour farming could also be taken into consideration.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,601.10	3.62	$442.29

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	waterway	Sediment reduction (t/yr)	4.26
Acres	10.8	Contributing acres	5.1	Soil Loss reduction (t/yr)	14.85
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	270	Phosphorus reduction (lb/yr)	3.62
Slope length (ft)	500	Length (ft)	270		
Average slope	4.6	Area (acres)	0.31		
		Years	1		
		Distance to SW (ft)	420		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 1

Drainage Area – 10.8 acres
Property Ownership – Private
Site Specific Information – A small concentrated flow path was indicated at the North West corner of the basin. Because I is a smaller flow path, a filter strip is recommended at the border of the field and the forested area. The filter strip would run perpendicular to the flow path.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$196.62	0.85	$231.32

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	Filter Strip	Sediment reduction (t/yr)	0.69
Acres	10.8	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.15
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	250	Phosphorus reduction (lb/yr)	0.85
Slope length (ft)		Area (acres)	0.29		
Average slope		Contr. Area (acres)	1.25		

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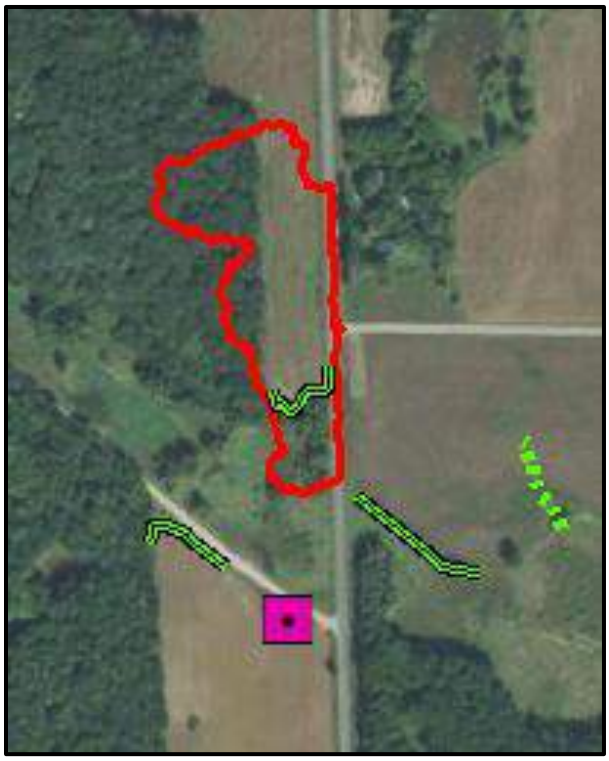
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 2

Drainage Area – 5.3 acres
Property Ownership – Private
Site Specific Information – This basin is about 75% row cropped. A flow path runs to the south through the middle of the basin. The flow path connects to the tributary that runs into the lake. A filter strip is proposed at the south end of the basin where the slopes are the highest and in the closest proximity to the inlet.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$196.62	1.49	$131.96

Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	Filter Strip	Sediment reduction (t/yr)	1.17
Acres	5.3	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.2
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	250	Phosphorus reduction (lb/yr)	1.49
Slope length (ft)	230	Area (acres)	0.29		
Average slope	5.1	Contr. Area (acres)	2.45		

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CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 3

Drainage Area – 3.2 acres.
Property Ownership – Private
Site Specific Information – This basin is 50% row cropped on the southeast end. There are steep slopes in this area. A filter strip is proposed at the field's edge to the northeast along the road. Field investigations indicate runoff characteristics from the field and across the road.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$203.40	0.53	$383.77

Current Conditions		Added Practice		Reduction	
Sub-Basin	3	Type	Filter Strip	Sediment reduction (t/yr)	0.4
Acres	3.2	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.14
Soil	Chetek loamy sand, 2-7% slopes	Length (ft)	260	Phosphorus reduction (lb/yr)	0.53
Slope length (ft)	295	Area (acres)	0.30		
Average slope	5.9	Contr. Area (acres)	0.95		

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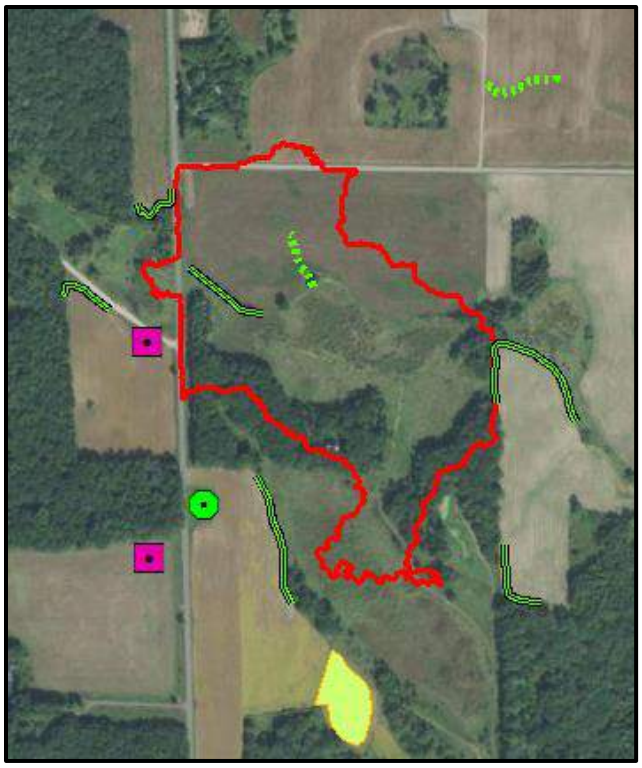
Project ID – Grass Waterway
Zone 6
Sub-Basin 4

Drainage Area – 32.1 acres
Property Ownership – Private
Site Specific Information – Large area that contains marsh/forest to south and agricultural land to north. A concentrated flow path travels over the row cropped field to the south where it merges with the lake's inlet. A Grassed waterway is proposed along the flow path where the slopes are the greatest.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,452.85	3.52	$412.74

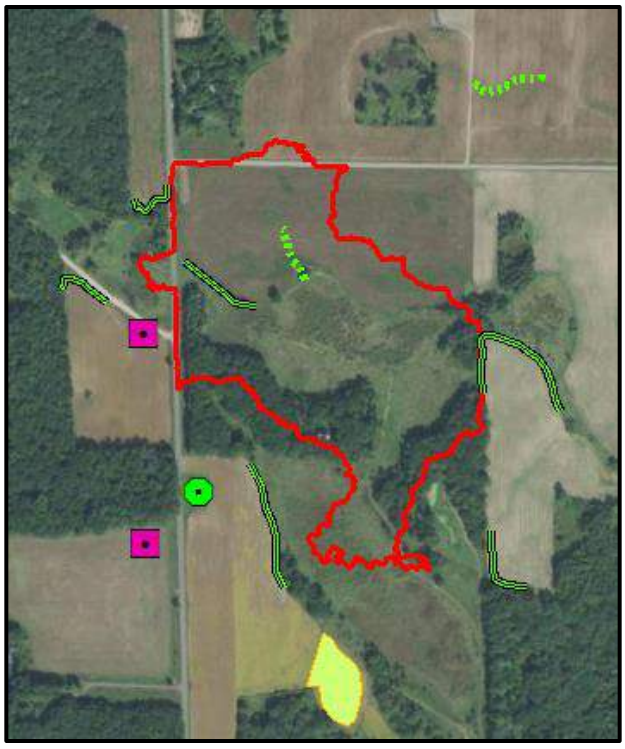
Current Conditions		Added Practice		Reduction	
Sub-Basin	4	Type	Grassed waterway	Sediment reduction (t/yr)	4.14
Acres	32.1	Contributing acres	5.3	Soil Loss reduction (t/yr)	13.48
Soil	Chetek loamy sand, 2-7% slopes	Vol Voided (ft^3)	245	Phosphorus reduction (lb/yr)	3.52
Slope length (ft)	100	Length (ft)	245		
Average slope	4.2	Area (acres)	0.28		
		Years	1		
		Distance to SW (ft)	300		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 4

Drainage Area – 32.1 acres
Property Ownership – Private
Site Specific Information – A filter strip along the field edge of the row cropped field where the slopes ate the greatest would address the areas water quality concerns. The field edge is in close proximity to an inlet to the lake.

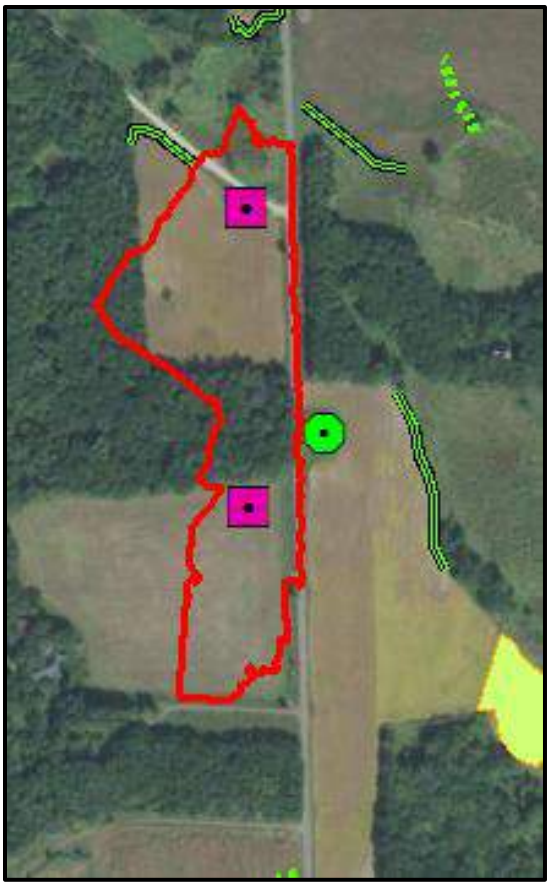


Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$291.54	0.91	$320.37

Current Conditions		Added Practice		Reduction	
Sub-Basin	4	Type	Filter Strip	Sediment reduction (t/yr)	0.62
Acres	32.1	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.28
Soil	Chetek loamy sand, 2-7% slopes	Length (ft)	375	Phosphorus reduction (lb/yr)	0.91
Slope length (ft)		Area (acres)	0.43		
Average slope		Contr. Area (acres)	2.1		

Project ID – WASCOB
Zone 6
Sub-Basin 5

Drainage Area – 13.7 acres
Property Ownership – Private
Site Specific Information – This basin has areas of steep slopes and is primarily row cropped. Two large concentrated flow paths were identified using GIS Tools. A proposed WASCOB would allow water to infiltrate and reduce the loss of sediment and nutrients.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	4.20	$2,334.21

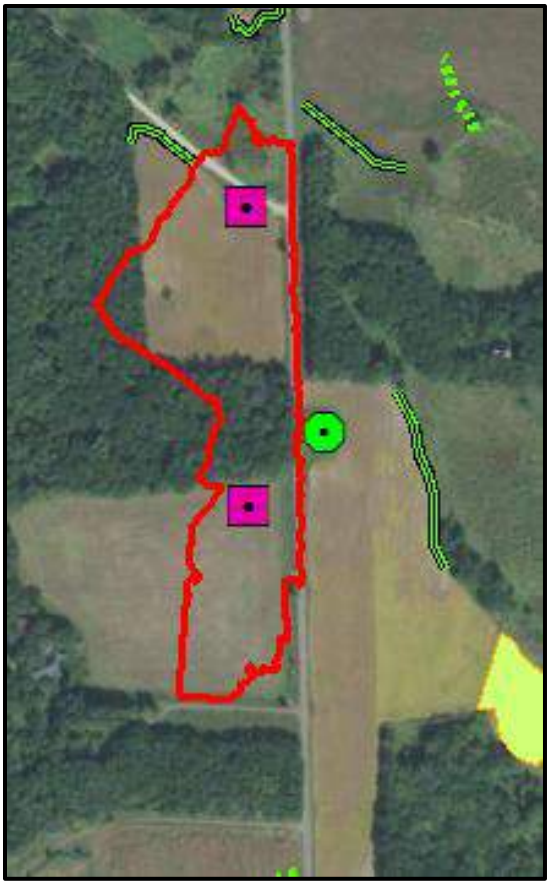
Current Conditions		Added Practice		Reduction	
Sub-Basin	5	Type	WASCOB	Sediment reduction (t/yr)	4.94
Acres	13.7	Contributing acres	2.9	Soil Loss reduction (t/yr)	16.5
Soil	Chetek loamy sand, 2-7% slopes	Vol Voided (ft^3)	340	Phosphorus reduction (lb/yr)	4.2
Slope length (ft)	290	Length (ft)	340		
Average slope	6.3	Years	1		
		Distance to SW (ft)	400		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 6
Sub-Basin 5

Drainage Area – 13.7 acres
Property Ownership – Private
Site Specific Information – This basin has areas of steep slopes and is primarily row cropped. Two large concentrated flow paths were identified using GIS Tools. A proposed WASCOB would allow water from the flow paths to infiltrate and reduce the loss of sediment and nutrients.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	3.13	$3,132.17

Current Conditions		Added Practice		Reduction	
Sub-Basin	5	Type	WASCOB	Sediment reduction (t/yr)	3.69
Acres		Contributing acres	3.75	Soil Loss reduction (t/yr)	16.5
Soil	Chetek loamy sand, 2-7% slopes	Vol Voided (ft^3)	600	Phosphorus reduction (lb/yr)	3.13
Slope length (ft)		Length (ft)	600		
Average slope		Years	1		
		Distance to SW (ft)	1400		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Grass Waterway
Zone 6
Sub-Basin 6

Drainage Area – 14.5 acres
Property Ownership – Private
Site Specific Information – With only a small area of the basin being lowland area the majority of it is row cropped. Slopes in the area are moderate and a concentrated flow path was identified. Implementing a grassed waterway along the flow path is proposed.

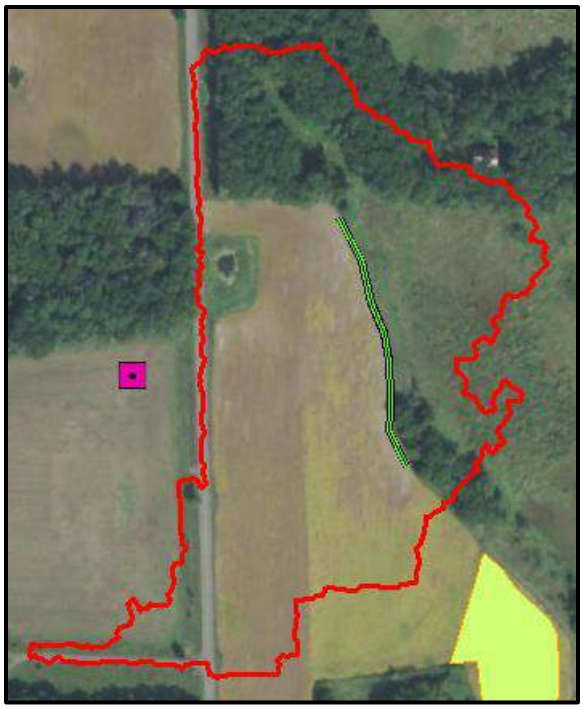
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,016.20	3.55	$567.94

Current Conditions		Added Practice		Reduction	
Sub-Basin	6	Type	Grassed waterway	Sediment reduction (t/yr)	4.18
Acres	14.5	Contributing acres	6.7	Soil Loss reduction (t/yr)	18.7
Soil	Chetek loamy sand, 2-7% slopes	Vol Voided (ft^3)	340	Phosphorus reduction (lb/yr)	3.55
Slope length (ft)	150	Length (ft)	340		
Average slope	4.0	Area (acres)	0.39		
		Years	1		
		Distance to SW (ft)	1400		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

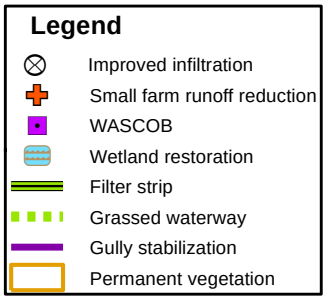
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 7



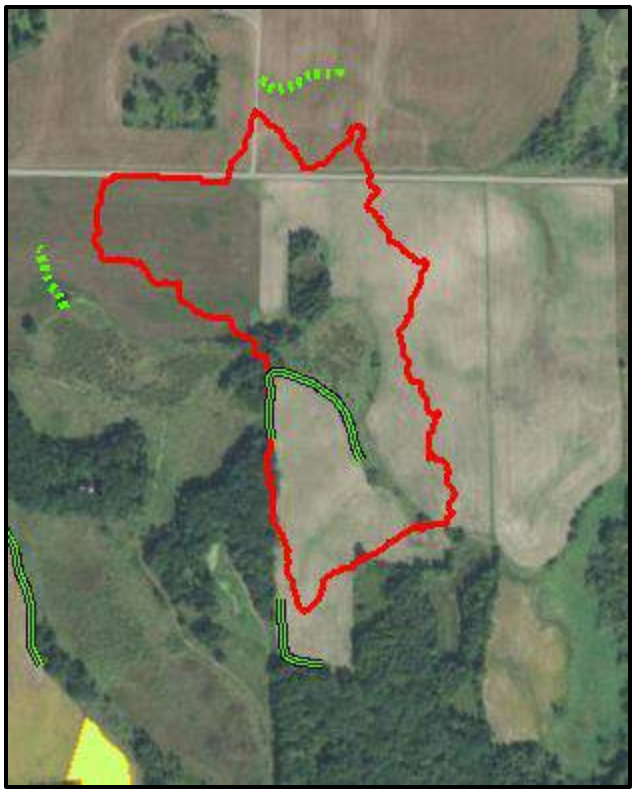
Drainage Area – 16.9 acres
Property Ownership – Private
Site Specific Information – The majority of this basin is row cropped. It bumps up to a lowland area with a ditch flowing through it. At one area of the field the ditch come within close proximity. Implementing a filter strip along the field border would benefit the water quality.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$176.28	1.11	$158.81

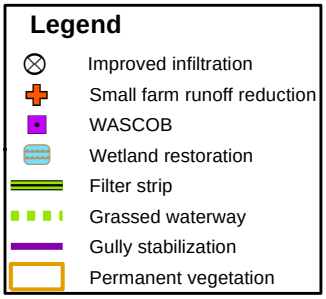


Current Conditions		Added Practice		Reduction	
Sub-Basin	7	Type	Filter Strip	Sediment reduction (t/yr)	0.8
Acres	16.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.1
Soil	Chetek loamy sand, 2-7% slopes	Length (ft)	230	Phosphorus reduction (lb/yr)	1.1
Slope length (ft)	230	Area (acres)	0.26		
Average slope	5.8	Contr. Area (acres)	2.35		

Project ID – Filter Strip
Zone 6
Sub-Basin 8



Drainage Area – 25.8 acres
Property Ownership – Private
Site Specific Information – The majority of field in this basin is buffered; the southern portion could use a filter strip to catch sheer runoff. Aerial imagery indicates predominant row cropped land use with a possible lowland area in the middle



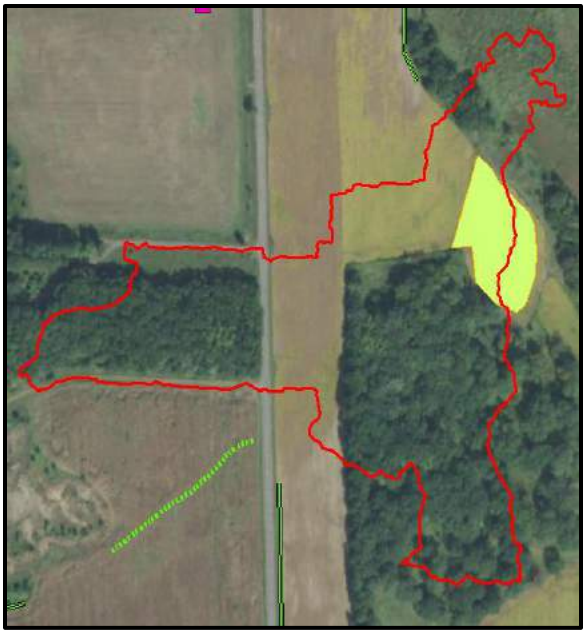
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$596.64	3.00	$198.88

Current Conditions		Added Practice		Reduction	
Sub-Basin	8	Type	Filter Strip	Sediment reduction (t/yr)	2.9
Acres	25.8	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.9
Soil	Hayden fine sandy loam, 12-19% slopes	Length (ft)	770	Phosphorus reduction (lb/yr)	3.0
Slope length (ft)	490	Area (acres)	0.88		
Average slope	4.2	Contr. Area (acres)	2.1		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

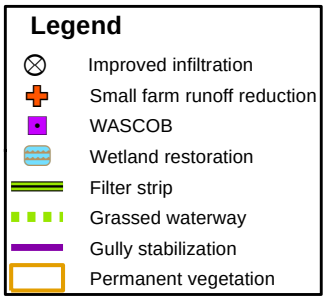
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Permanent Vegetation
Zone 6
Sub-Basin 9



Drainage Area – 17.4 acres
Property Ownership – Private
Site Specific Information – Very steep sloped small section of field could be put into permanent vegetation. The area where the permanent vegetation is being proposed is agricultural land. This may be a good area to plant a food plot. Vegetated area spans basin 9 and 10.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$264.42	0.96	$275.44



Current Conditions		Added Practice		Reduction	
Sub-Basin	9	Type	Permanent Vegetation	Sediment reduction (t/yr)	1.55
Acres	17.4	Specs	on hillslope	Soil Loss reduction (t/yr)	1.61
Soil	Chetek loamy sand, 2-7% slopes	Length (ft)	180	Phosphorus reduction (lb/yr)	2.42
Slope length (ft)	180	Contr. Area (acres)	1.28		
Average slope	6.8	acres applied	1.28		

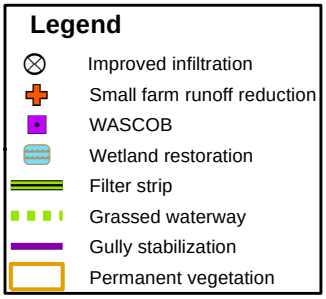
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 10

Drainage Area – 5.6 acres
Property Ownership – Private
Site Specific Information – The majority of this basin is wooded and lowland. The south east corner is row cropped and implementing a filter strip along the field edge is proposed.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$277.98	1.41	$197.15



Current Conditions		Added Practice		Reduction	
Sub-Basin	10	Type	Filter Strip	Sediment reduction (t/yr)	1.34
Acres	5.6	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	1.11
Soil	Hayden fine sandy loam, 7-12% slopes	Length (ft)	360	Phosphorus reduction (lb/yr)	1.41
Slope length (ft)	140	Area (acres)	0.41		
Average slope	8.6	Contr. Area (acres)	0.7		

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CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grass Waterway
Zone 6
Sub-Basin 11

Drainage Area – 26.8 acres
Property Ownership – Private
Site Specific Information – Very steep sloped small section of field could be put into permanent vegetation. Vegetated area spans basin 9 and 11. Grassed waterway to be included in southern field along concentrated flow path.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,008.10	1.85	$544.92

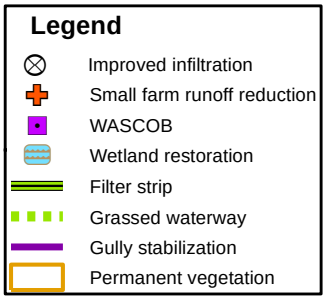
Current Conditions		Added Practice		Reduction	
Sub-Basin	11	Type	Grassed waterway	Sediment reduction (t/yr)	2.18
Acres	26.8	Contributing acres	2.7	Soil Loss reduction (t/yr)	9.35
Soil	Sanburn fine sandy loam, 12-25% slopes	Vol Voided (ft^3)	170	Phosphorus reduction (lb/yr)	1.85
Slope length (ft)	65	Length (ft)	170		
Average slope	8.2	Area (acres)	0.20		
		Years	1		
		Distance to SW (ft)	1150		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 6
Sub-Basin 12

Drainage Area – 29.8 acres
Property Ownership – Private
Site Specific Information – A sliver of the basin on the east side is row cropped with what appears to be a drainage ditch running through it. The slopes on both side of the ditch are steep. Implementing a filter strip along the east side of the ditch is recommended.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,050.90	4.24	$247.85



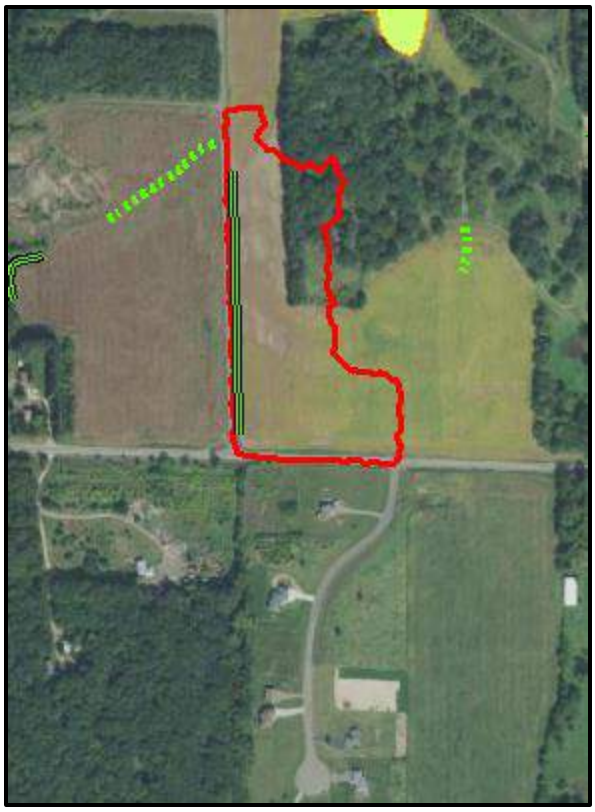
Current Conditions		Added Practice		Reduction	
Sub-Basin	12	Type	Filter Strip	Sediment reduction (t/yr)	3.1
Acres	29.8	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	1.81
Soil	Hayden fine sandy loam, 7-12% slopes	Length (ft)	1350	Phosphorus reduction (lb/yr)	4.24
Slope length (ft)	110	Area (acres)	1.55		
Average slope	7.6	Contr. Area (acres)	6.25		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 13

Drainage Area – 12.2 acres
Property Ownership – Private
Site Specific Information – The majority of the basin is row cropped except for a small portion to the northeast. The entire field slopes towards a drainage ditch on east side of road, making a filter strip a very efficient choice here.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$759.36	4.56	$166.53

Current Conditions		Added Practice		Reduction	
Sub-Basin	13	Type	Filter Strip	Sediment reduction (t/yr)	3.48
Acres	12.2	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.99
Soil	Chetek loamy sand, 2-7% slopes	Length (ft)	975	Phosphorus reduction (lb/yr)	4.56
Slope length (ft)	150	Area (acres)	1.12		
Average slope	8.2	Contr. Area (acres)	7.9		

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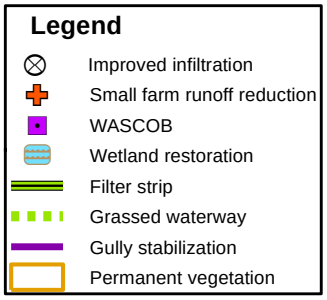
Project ID – Grass Waterway
Zone 6
Sub-Basin 14

Drainage Area – 14.0 acres
Property Ownership – Private
Site Specific Information – The majority of this basin is row cropped. There is a concentrated flow path running down the middle of the basin. GIS tools suggest a gully could form under these conditions. A grassed waterway is proposed for this area.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,905.70	5.51	$527.35

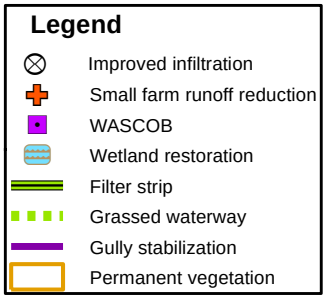
Current Conditions		Added Practice		Reduction	
Sub-Basin	14	Type	Grassed waterway	Sediment reduction (t/yr)	6.5
Acres	14	Contributing acres	9.7	Soil Loss reduction (t/yr)	27.0
Soil	Chetek loamy sand, 2-7% slopes	Vol Voided (ft^3)	490	Phosphorus reduction (lb/yr)	5.5
Slope length (ft)	100	Length (ft)	490		
Average slope	7.2	Area (acres)	0.56		
		Years	1		
		Distance to SW (ft)	980		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 6
Sub-Basin 15

Drainage Area – 10.9 acres
Property Ownership – Private
Site Specific Information – Basin 15 is about 60% row cropped and the rest forested. A concentrated flow path was identified on the north end of the field running perpendicular to the field's edge. A filter strip is recommended at the edge of the field where the flow path runs.



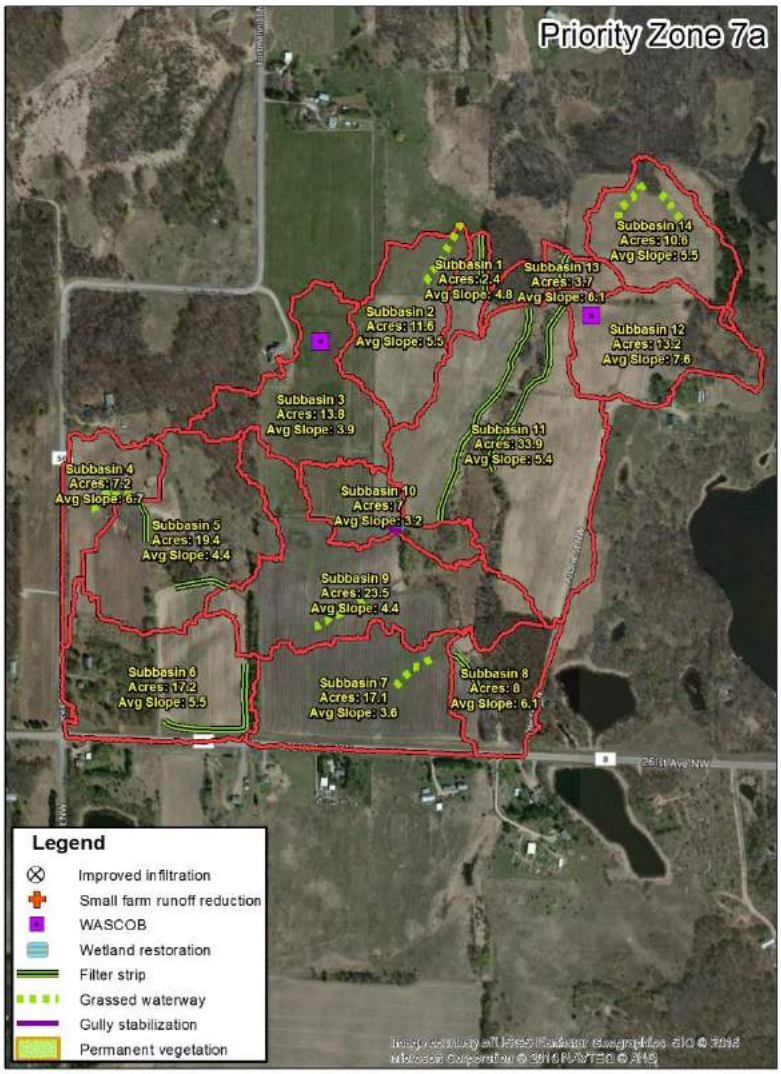
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$196.62	2.33	$84.39

Current Conditions		Added Practice		Reduction	
Sub-Basin	15	Type	Filter Strip	Sediment reduction (t/yr)	1.60
Acres	10.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.2
Soil	Chetek loamy sand, 2-7% slopes	Length (ft)	255	Phosphorus reduction (lb/yr)	2.3
Slope length (ft)	100	Area (acres)	0.29		
Average slope	5.7	Contr. Area (acres)	6.5		

Priority Zone 7a

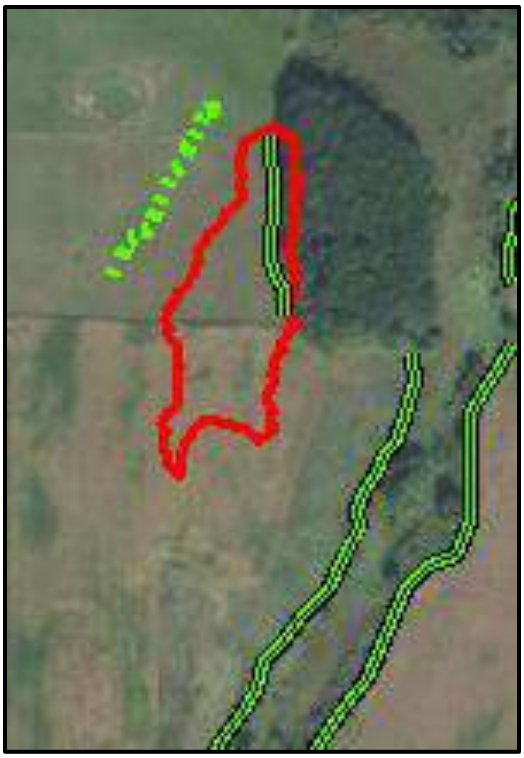
Priority Zone 7a Summary	
Acres addressed	218.6
Dominant Land Cover	Agricultural
Total Sub-Basins	14
Potential BMPs	16
Potential TP reduction (lb/yr)	58.77
Potential TSS reduction (tons/yr)	62.12

The results of the Targeting and Mapping study indicated that the region surrounding Priority Zone 7 was quite large. Therefore, it was decided to split this into two smaller and more manageable priority zones, Priority Zone 7a and 7b. Zone 7a is roughly 218 acres in size and is primarily agricultural land. GIS tools indicate areas of steep slopes and concentrated flow paths that could benefit from BMPs to improve the areas water quality.



Project ID – Filter Strip
Zone 7a
Sub-Basin 1

Drainage Area – 2.4 acres
Property Ownership – Private
Site Specific Information – This area is all agricultural land use with several identified concentrated flow paths makes this location ideal for implementing a filter strip along the field boarder to the northeast to catch sediment and nutrients.



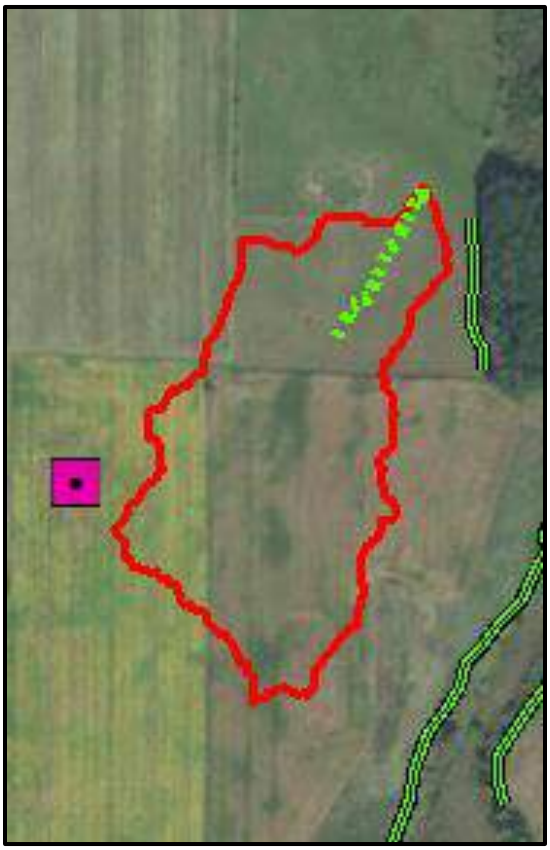
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$277.98	2.25	$123.55

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	Filter Strip	Sediment reduction (t/yr)	1.65
Acres	2.4	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.42
Soil	Sanburn fine sandy loam, 7-12% slopes	Length (ft)	360	Phosphorus reduction (lb/yr)	2.25
Slope length (ft)	80	Area (acres)	0.41		
Average slope	4.8	Contr. Area (acres)	4.5		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Grassed Waterway
Zone 7a
Sub-Basin 2

Drainage Area – 11.6 acres
Property Ownership – Private
Site Specific Information – This basin is assumed to be entirely row crop field. A flow path as well as moderate slope was identified using GIS tools. A grassed waterway is recommended in the northeast corner of the basin.



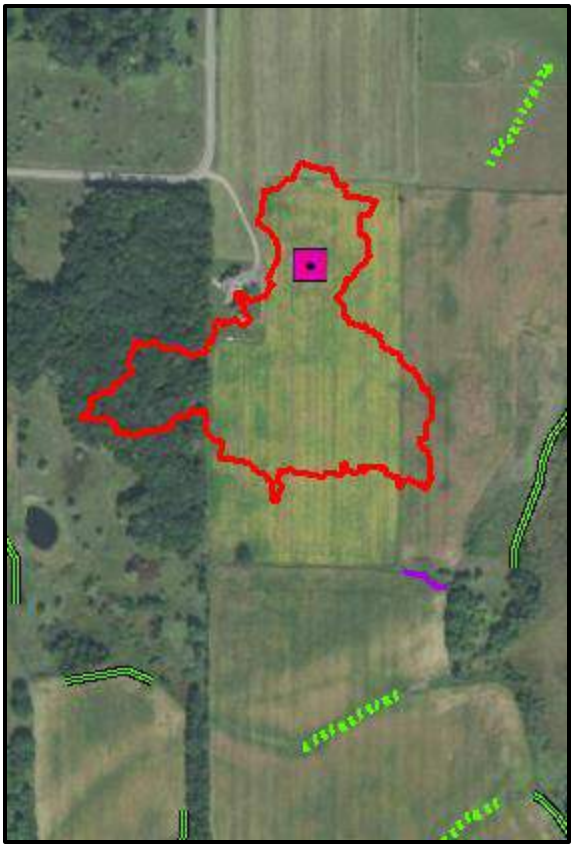
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,490.60	6.19	$402.36

Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	Grassed waterway	Sediment reduction (t/yr)	7.28
Acres	11.6	Contributing acres	11	Soil Loss reduction (t/yr)	23.1
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	420	Phosphorus reduction (lb/yr)	6.19
Slope length (ft)	200	Length (ft)	420		
Average slope	5.5	Area (acres)	0.48		
		Years	1		
		Distance to SW (ft)	265		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 7a
Sub-Basin 3



Drainage Area – 13.8 acres
Property Ownership – Private
Site Specific Information – This row cropped field has moderate slopes and has a flow path draining to the north. A WASCOB is recommended for this area to allow for water to infiltrate the soil and reduce erosion potential.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$13,087.50	5.04	$2,596.73

Current Conditions		Added Practice		Reduction	
Sub-Basin	3	Type	WASCOB	Sediment reduction (t/yr)	5.93
Acres	13.8	Contributing acres	11.5	Soil Loss reduction (t/yr)	28.6
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	520	Phosphorus reduction (lb/yr)	5.04
Slope length (ft)	140	Length (ft)	520		
Average slope	3.9	Years	1		
		Distance to SW (ft)	2000		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Grassed Waterway
Zone 7a
Sub-Basin 4

Drainage Area – 7.2 acres
Property Ownership – Private
Site Specific Information – Steep slopes and an identified concentrated flow path across the row cropped field makes this location ideal for a grassed waterway to be implemented. The majority of the basin is row cropped.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$3,528.35	5.89	$599.04

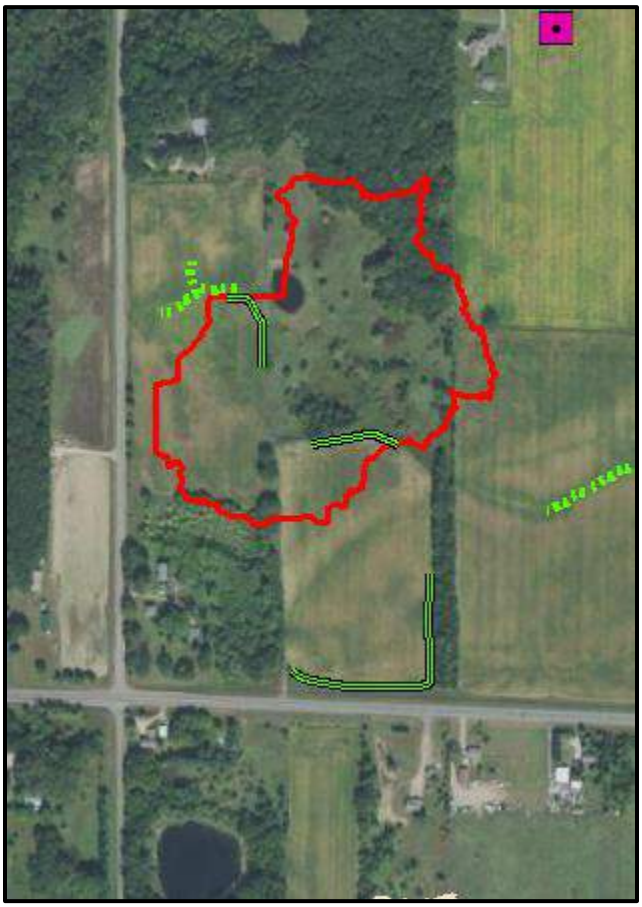
Current Conditions		Added Practice		Reduction	
Sub-Basin	4	Type	Grassed waterway	Sediment reduction (t/yr)	6.93
Acres	7.2	Contributing acres	7	Soil Loss reduction (t/yr)	22.6
Soil	Sanburn fine sandy loam, 7-12% slopes	Vol Voided (ft^3)	410	Phosphorus reduction (lb/yr)	5.89
Slope length (ft)	100	Length (ft)	595		
Average slope	6.7	Area (acres)	0.68		
		Years	1		
		Distance to SW (ft)	300		

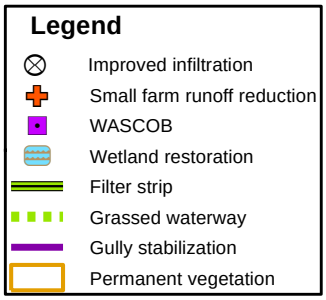
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7a
Sub-Basin 5

Drainage Area – 19.4 acres.
Property Ownership – Private
Site Specific Information – This basin is 50% row cropped and 50% forested land. The moderate slopes from the field to the forested land has potential for soil and nutrient erosion. A filter strip along the field edge would trap any nutrients and sediment eroding from the adjacent slope.





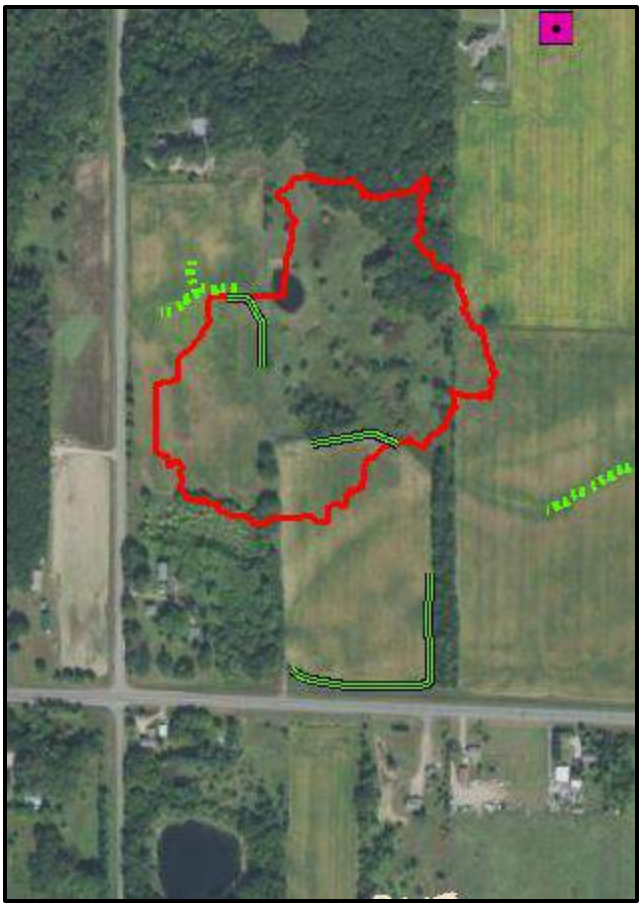
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$250.86	2.47	$101.56

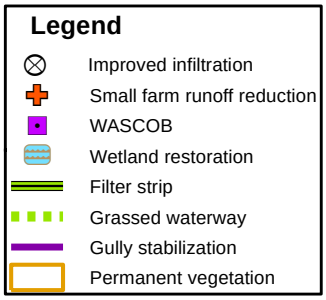
Current Conditions		Added Practice		Reduction	
Sub-Basin	5	Type	Filter Strip	Sediment reduction (t/yr)	1.85
Acres	19.4	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.29
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	320	Phosphorus reduction (lb/yr)	2.47
Slope length (ft)	150	Area (acres)	0.37		
Average slope	4.4	Contr. Area (acres)	4.9		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 7a
Sub-Basin 5

Drainage Area – 19.4 acres
Property Ownership – Private
Site Specific Information – This basin is 50% row cropped and 50% forested land. The moderate slopes from the field to the forested land has potential for soil and nutrient erosion. A filter strip along the field edge would trap any nutrients and sediment eroding from the adjacent slope.





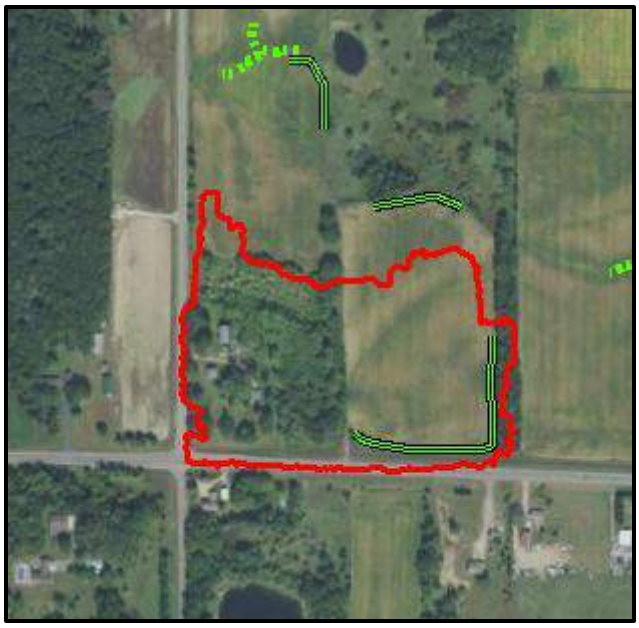
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$244.08	0.89	$274.25

Current Conditions		Added Practice		Reduction	
Sub-Basin	5	Type	Filter Strip	Sediment reduction (t/yr)	1.85
Acres	19.4	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.29
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	320	Phosphorus reduction (lb/yr)	2.47
Slope length (ft)	150	Area (acres)	0.37		
Average slope	4.4	Contr. Area (acres)	4.9		

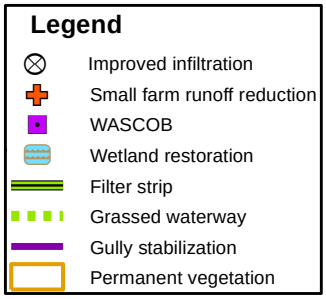
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7a
Sub-Basin 6



Drainage Area – 17.2 acres.
Property Ownership – Private
Site Specific Information – Basin 6 is half forested land half row crop land use. Not much slope however a concentrated flow path was identified at the southeast side of the field. A filter strip along the field border would catch and runoff from the field.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$664.44	4.01	$165.70

Current Conditions		Added Practice		Reduction	
Sub-Basin	6	Type	Filter Strip	Sediment reduction (t/yr)	2.97
Acres	17.2	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	1.11
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	855	Phosphorus reduction (lb/yr)	4.01
Slope length (ft)	75	Area (acres)	0.98		
Average slope	5.5	Contr. Area (acres)	6.9		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Grassed Waterway
Zone 7a
Sub-Basin 7

Drainage Area – 17.1 acres
Property Ownership – Private
Site Specific Information – Basin 7 is 100% row cropped. There is moderate slope with a concentrated flow path on the eastside of the basin. A grassed waterway is recommended along the path of the concentrated flow to slow water and allow it to infiltrate into the soil.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,779.00	4.69	$379.32

Current Conditions		Added Practice		Reduction	
Sub-Basin	7	Type	Grassed waterway	Sediment reduction (t/yr)	5.51
Acres	17.1	Contributing acres	16.2	Soil Loss reduction (t/yr)	16.5
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	300	Phosphorus reduction (lb/yr)	4.69
Slope length (ft)	50	Length (ft)	300		
Average slope	3.6	Area (acres)	0.34		
		Years	1		
		Distance to SW (ft)	200		

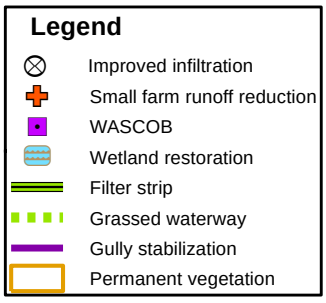
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7a
Sub-Basin 8

Drainage Area – 8 acres
Property Ownership – Private
Site Specific Information – The majority of basin 8 is forested land. The area to the west of the forest is row cropped and has moderate slope. A filter strip is recommended in the row cropped area where the slope is greatest.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$216.96	0.83	$261.40



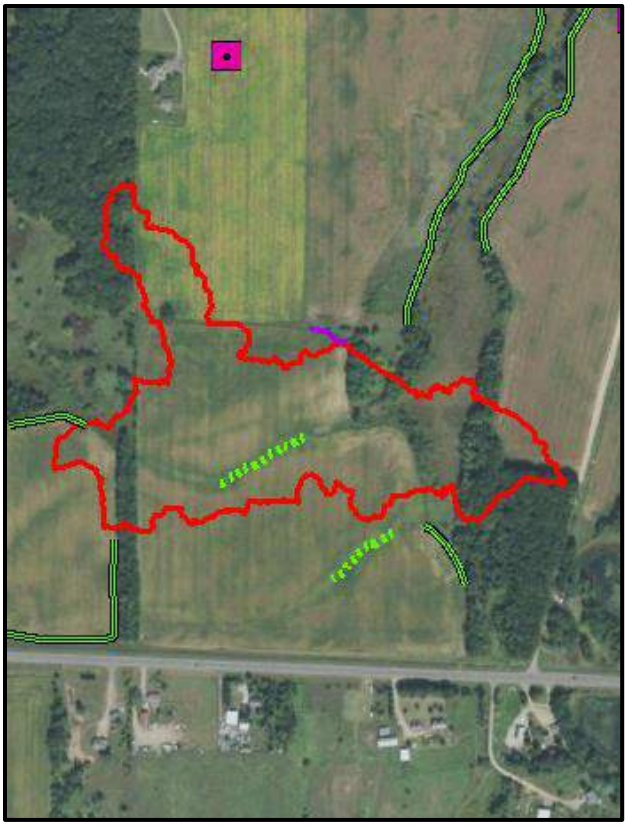
Current Conditions		Added Practice		Reduction	
Sub-Basin	8	Type	Filter Strip	Sediment reduction (t/yr)	0.61
Acres	8	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.37
Soil	Emmert loamy fine sand, 12-25% slopes	Length (ft)	280	Phosphorus reduction (lb/yr)	0.83
Slope length (ft)	65	Area (acres)	0.32		
Average slope	6.1	Contr. Area (acres)	1.2		

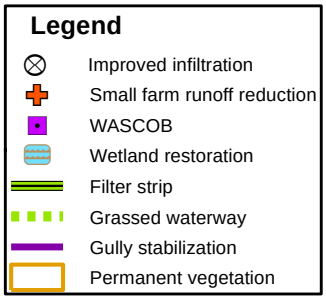
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 7a
Sub-Basin 9

Drainage Area – 23.5 acres
Property Ownership – Private
Site Specific Information – Basin 9 is almost 100% row cropped. The middle of the basin has some steep slopes with a concentrated flow path running through the middle. Implementing a grassed waterway in this area would reduce sediment and nutrient loss.





Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,401.65	5.35	$448.91

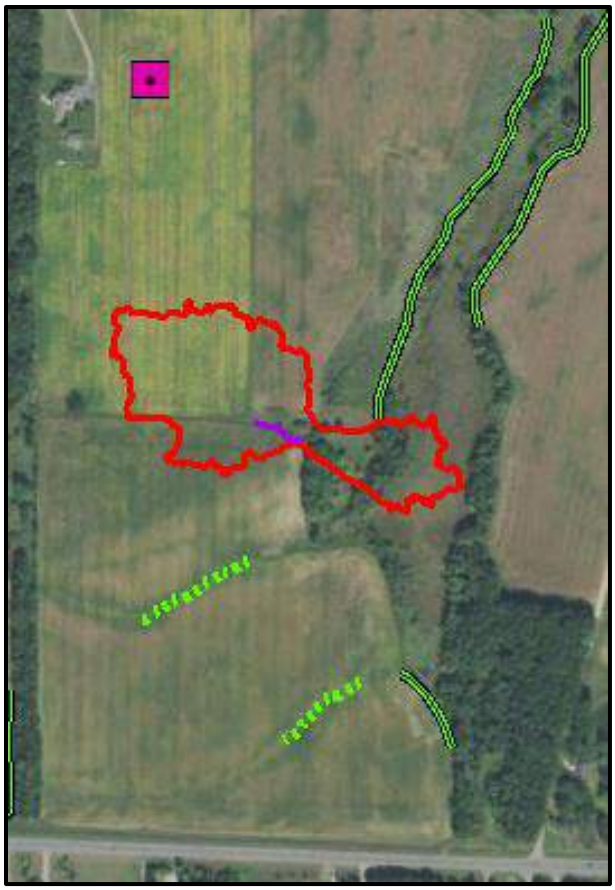
Current Conditions		Added Practice		Reduction	
Sub-Basin	9	Type	Grassed waterway	Sediment reduction (t/yr)	6.29
Acres	23.5	Contributing acres	12.5	Soil Loss reduction (t/yr)	22.3
Soil	Sanburn fine sandy loam, 7-12% slopes	Vol Voided (ft^3)	405	Phosphorus reduction (lb/yr)	5.35
Slope length (ft)	235	Length (ft)	405		
Average slope	4.4	Area (acres)	0.46		
		Years	1		
		Distance to SW (ft)	450		

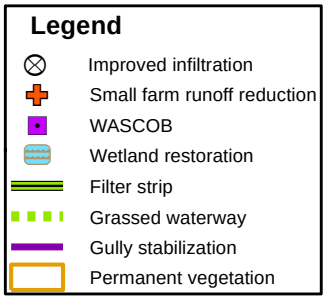
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7a
Sub-Basin 10

Drainage Area – 7 acres
Property Ownership – Private
Site Specific Information – Basin 10 is predominantly row cropped. In the middle of the basin a concentrated flow path was identified and it looks like a gully has formed. Stabilizing the gully would benefit the water quality in this area.





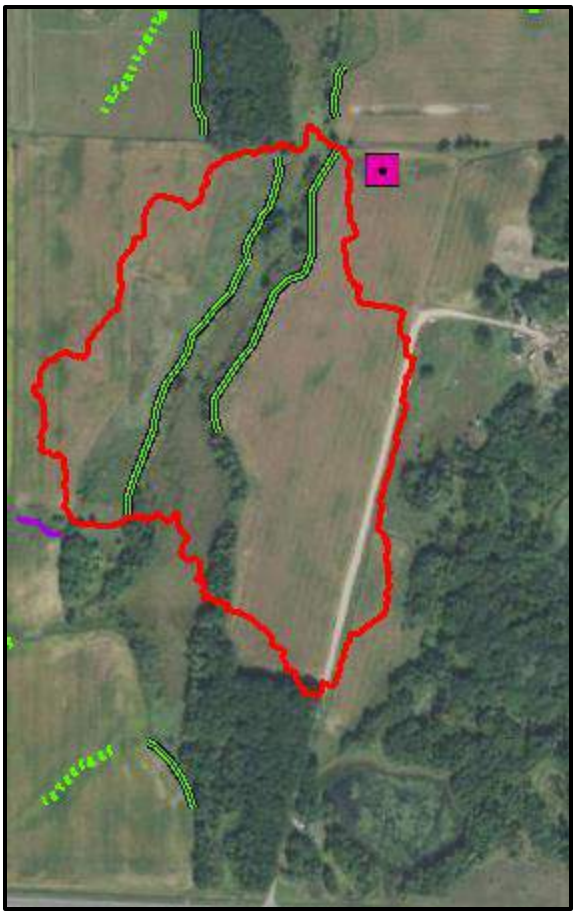
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$978.45	2.12	$461.53

Current Conditions		Added Practice		Reduction	
Sub-Basin	10	Type	Gully stabilization	Sediment reduction (t/yr)	2.49
Acres	7	Contributing acres	5.1	Soil Loss reduction (t/yr)	9.08
Soil	Sanburn fine sandy loam, 7-12% slopes	Vol Voided (ft^3)	165	Phosphorus reduction (lb/yr)	2.12
Slope length (ft)	20	Length (ft)	165		
Average slope	3.2	Area (acres)	0.19		
		Years	1		
		Distance to SW (ft)	520		

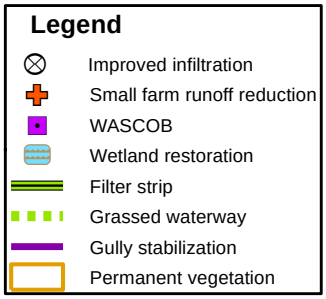
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7a
Sub-Basin 11



Drainage Area – 33.9 acres
Property Ownership – Private
Site Specific Information – This is a large basin. The BMP identified on the western half of the basin is a filter strip. The strip would be implemented along the row cropped field boarder. The basin is predominantly row cropped with a forested/lowland strip running through the middle.



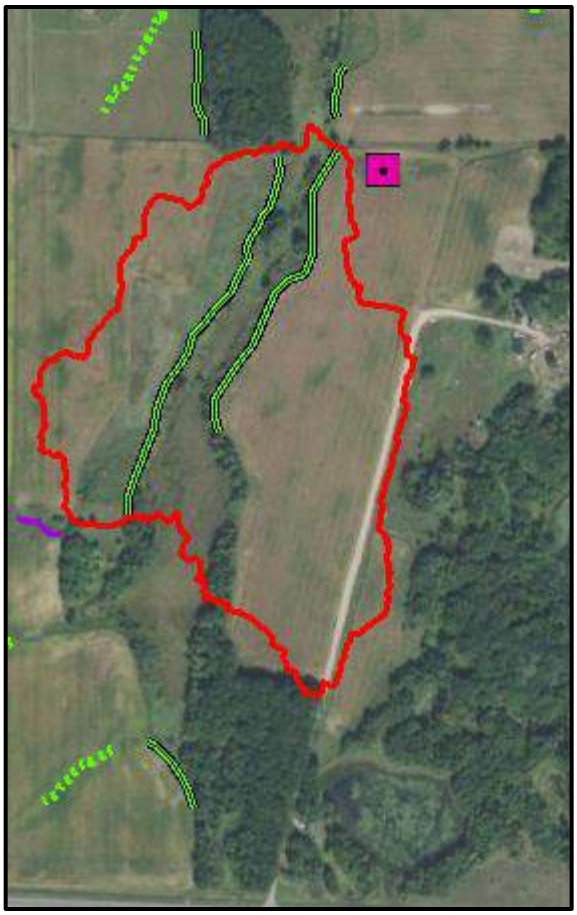
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,064.46	5.13	$207.50

Current Conditions		Added Practice		Reduction	
Sub-Basin	11	Type	Filter Strip	Sediment reduction (t/yr)	3.8
Acres	33.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.9
Soil	Chetek loamy sand, 7-12% slopes	Length (ft)	1370	Phosphorus reduction (lb/yr)	5.1
Slope length (ft)	175	Area (acres)	1.57		
Average slope	5.4	Contr. Area (acres)	9.7		

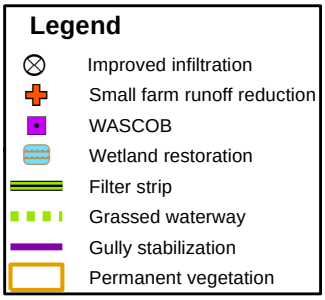
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7a
Sub-Basin 11



Drainage Area – 33.9 acres
Property Ownership – Private
Site Specific Information – This is a large basin. A lowland strip separates this large basin into two sections. The east section is row cropped and has significant slope towards the lowland area. A filter strip along the field border would benefit this area.



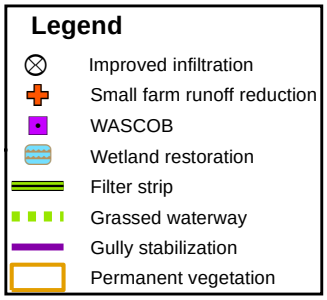
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,064.46	5.13	$207.50

Current Conditions		Added Practice		Reduction	
Sub-Basin	11	Type	Filter Strip	Sediment reduction (t/yr)	3.1
Acres	33.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.7
Soil	Chetek loamy sand, 7-12% slopes	Length (ft)	1100	Phosphorus reduction (lb/yr)	4.2
Slope length (ft)	175	Area (acres)	1.26		
Average slope	5.4	Contr. Area (acres)	7.9		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – WASCOB
Zone 7a
Sub-Basin 12

Drainage Area – 13.2 acres
Property Ownership – Private
Site Specific Information – A WASCOB is recommend for this row cropped field. A concentrated flow path and steep slopes were identified in the field which could possibly lead to a gully formation if a BMP is not implemented. The far eastern section of the basin is wooded.



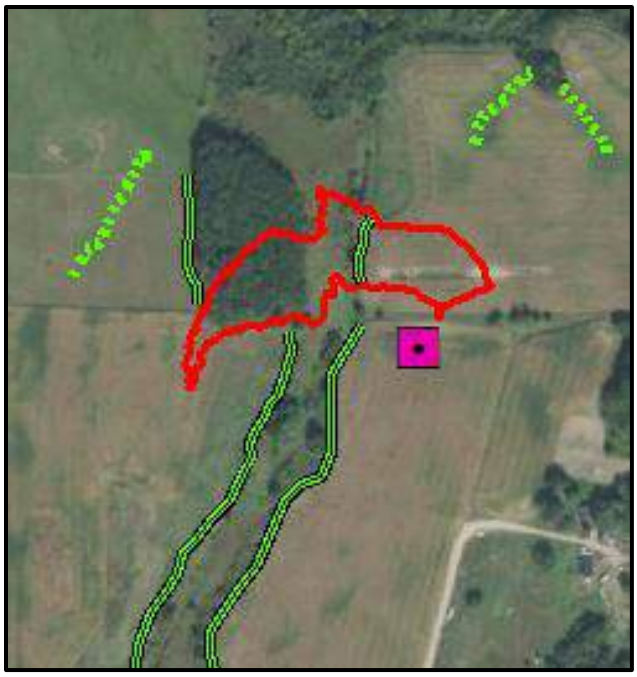
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$13,087.50	5.41	$2,419.13

Current Conditions		Added Practice		Reduction	
Sub-Basin	12	Type	WASCOB	Sediment reduction (t/yr)	6.37
Acres	13.2	Contributing acres	11.7	Soil Loss reduction (t/yr)	22
Soil	Chetek loamy sand, 7-12% slopes, mod eroded	Vol Voided (ft^3)	600	Phosphorus reduction (lb/yr)	5.41
Slope length (ft)	100	Length (ft)	600		
Average slope	7.6	Years	1		
		Distance to SW (ft)	400		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7a
Sub-Basin 13



Drainage Area – 3.7 acres
Property Ownership – Private
Site Specific Information – Basin 13 is relatively small and is made up of half row cropped land and half forested land. A concentrated flow path was identified running off the field into the forested area. A filter strip implemented along the field edge will intercept any runoff from the field at this location.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$142.38	0.65	$219.05

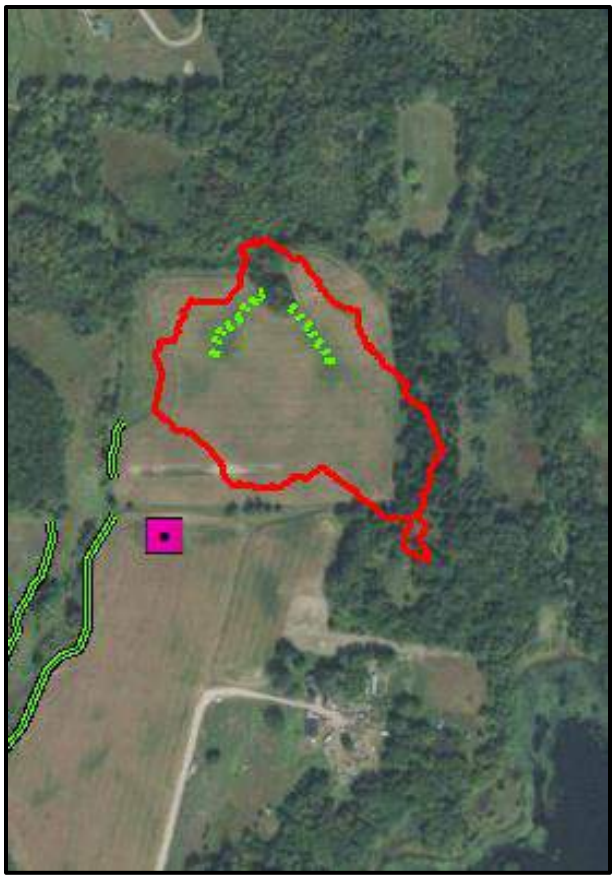
Current Conditions		Added Practice		Reduction	
Sub-Basin	13	Type	Filter Strip	Sediment reduction (t/yr)	0.49
Acres	3.7	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.12
Soil	Chetek loamy sand, 7-12% slopes, mod eroded	Length (ft)	185	Phosphorus reduction (lb/yr)	0.65
Slope length (ft)	250	Area (acres)	0.21		
Average slope	6.1	Contr. Area (acres)	1.25		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 7a
Sub-Basin 14

Drainage Area – 10.6 acres
Property Ownership – Private
Site Specific Information – Basin 14 has two concentrated flow paths that run through the middle of the basin and merge at the north end where the row cropped field becomes forested. This grassed waterway is on the western side of the basin.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,630.75	4.1	$397.74

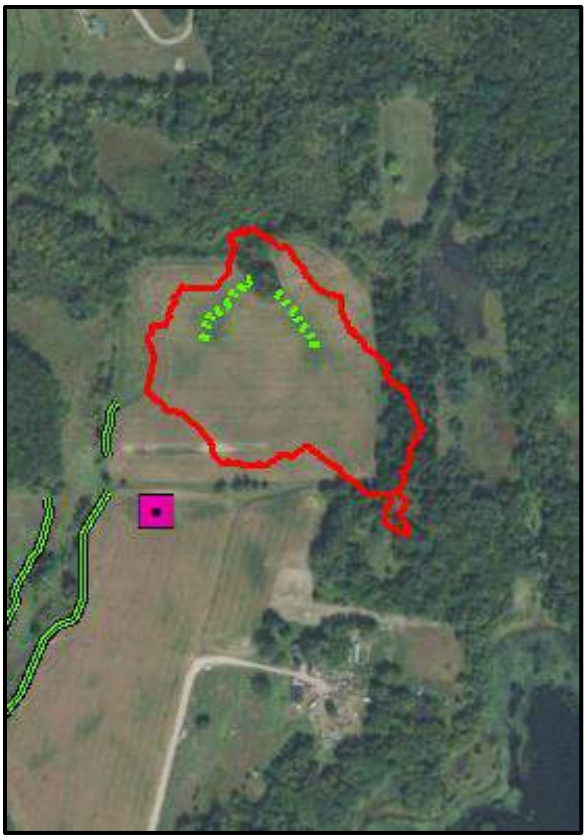
Current Conditions		Added Practice		Reduction	
Sub-Basin	14	Type	Grassed waterway	Sediment reduction (t/yr)	4.83
Acres	10.6	Contributing acres	4.3	Soil Loss reduction (t/yr)	15.1
Soil	Chetek loamy sand, 7-12% slopes, mod eroded	Vol Voided (ft^3)	275	Phosphorus reduction (lb/yr)	4.1
Slope length (ft)	100	Length (ft)	275		
Average slope	5.5	Area (acres)	0.32		
		Years	1		
		Distance to SW (ft)	250		

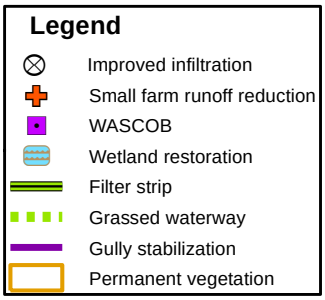
Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 7a
Sub-Basin 14

Drainage Area – 10.6 acres
Property Ownership – Private
Site Specific Information – Basin 14 has two concentrated flow paths that run through the middle of the basin and merge at the north end where the row cropped field becomes forested. This recommended grassed waterway project is on the eastern side of the basin.





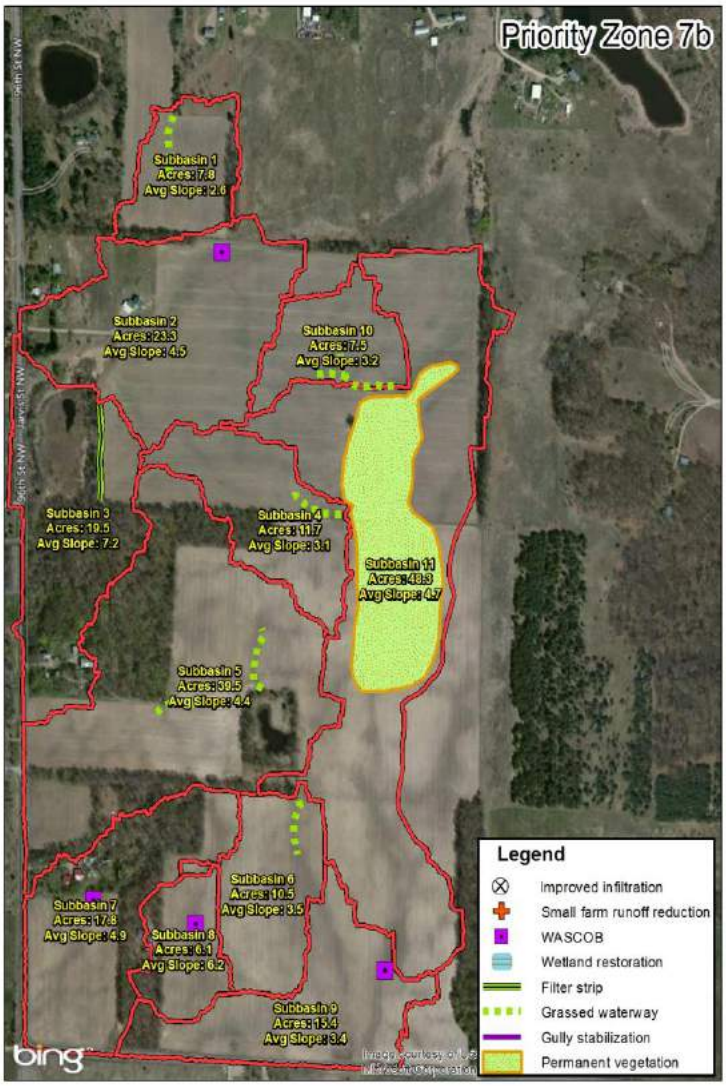
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,423.20	3.75	$379.52

Current Conditions		Added Practice		Reduction	
Sub-Basin	14	Type	Grassed waterway	Sediment reduction (t/yr)	4.41
Acres	10.6	Contributing acres	4.9	Soil Loss reduction (t/yr)	13.2
Soil	Chetek loamy sand, 7-12% slopes, mod eroded	Vol Voided (ft^3)	240	Phosphorus reduction (lb/yr)	3.75
Slope length (ft)	100	Length (ft)	240		
Average slope	5.5	Area (acres)	0.28		
		Years	1		
		Distance to SW (ft)	200		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Priority Zone 7b

Priority Zone 7b Summary	
Acres addressed	247
Dominant Land Cover	Agricultural
Total Sub-Basins	11
Potential BMPs	12
Potential TP reduction (lb/yr)	47.55
Potential TSS reduction (tons/yr)	44.55

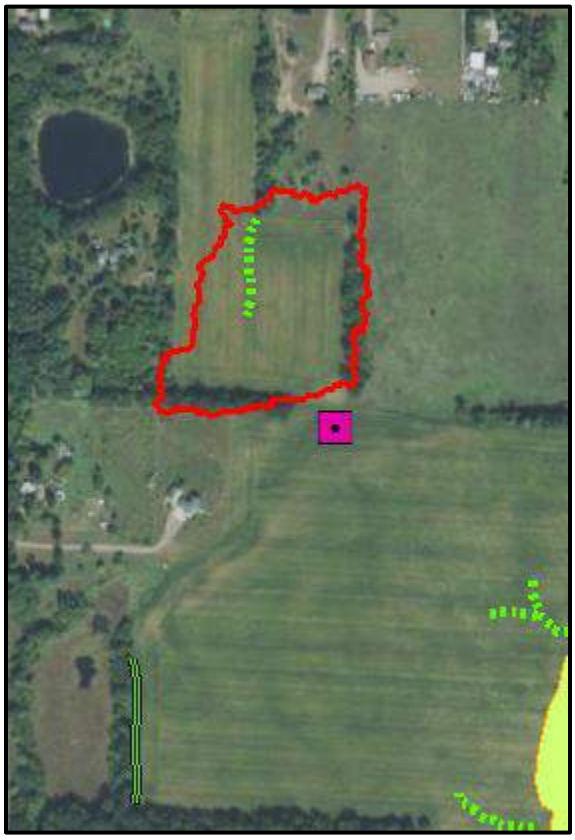


The results of the Targeting and Mapping study indicated that the region surrounding Priority Zone 7 was quite large. Therefore, it was decided to split this into two smaller and more manageable priority zones, Priority Zone 7a and 7b. Zone 7a is roughly 218 acres in size and is primarily agricultural land. GIS tools indicate areas of steep slopes and concentrated flow paths that could benefit from BMPs to improve the areas water quality. A large permanent vegetation project is proposed in this area. This would consist of the current row cropped land being taken out.

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Filter Strip
Zone 7b
Sub-Basin 1

Drainage Area – 7.8 acres
Property Ownership – Private
Site Specific Information – The majority of this basin is row cropped and has moderate slope. A stream network was identified and I runs perpendicular to contour lines which indicates the potential for a gully formation. A grassed waterway is recommended to stabilize the soil and prevent nutrient loss into the nearby lowland.



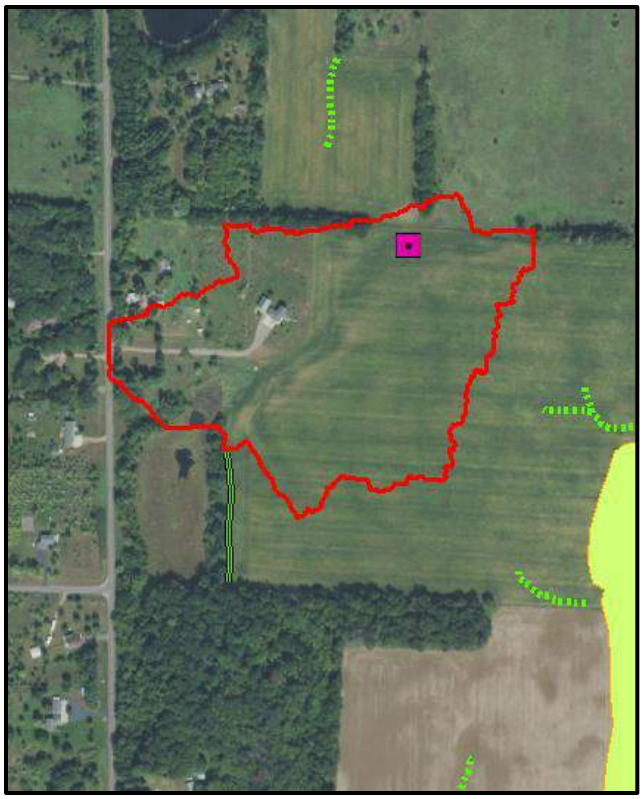
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$1,186.00	2.69	$440.89

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	Grassed waterway	Sediment reduction (t/yr)	3.16
Acres	7.8	Contributing acres	6.5	Soil Loss reduction (t/yr)	11.00
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	200	Phosphorus reduction (lb/yr)	2.69
Slope length (ft)	100	Length (ft)	200		
Average slope	2.5	Area (acres)	0.23		
		Years	1		
		Distance to SW (ft)	415		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – WASCOB
Zone 7b
Sub-Basin 2

Drainage Area – 23.3 acres
Property Ownership – Private
Site Specific Information – Steep slopes and identified concentrated flow path makes this area an ideal location for a WASCOB implemented at the north end of the basin. Allowing water to infiltrate at the top of the hill would prevent gully formations and nutrient loss.



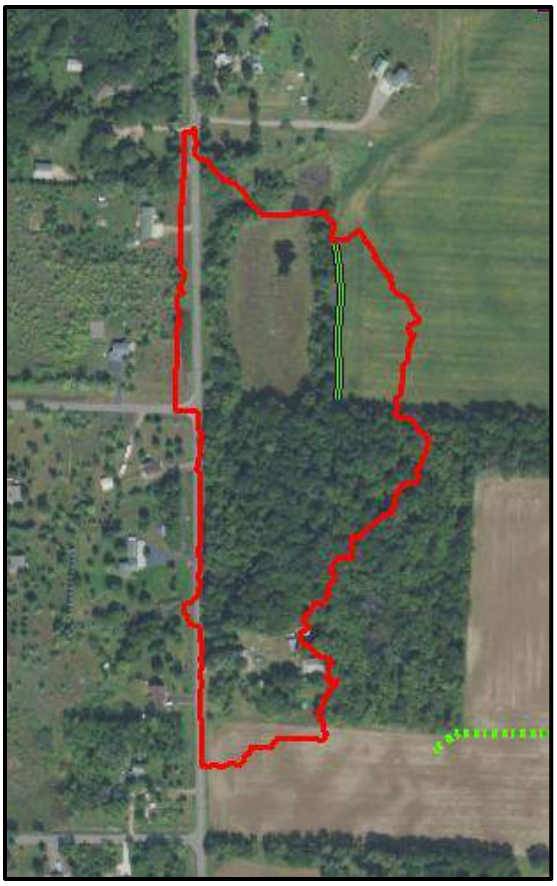
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$13,087.50	3.80	$3,444.08

Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	WASCOB	Sediment reduction (t/yr)	4.48
Acres	23.3	Contributing acres	13.5	Soil Loss reduction (t/yr)	22.00
Soil	Sanburn fine sandy loam, 7-18% slopes	Vol Voided (ft^3)	400	Phosphorus reduction (lb/yr)	3.80
Slope length (ft)	160	Length (ft)	400		
Average slope	4.5	Years	1		
		Distance to SW (ft)	2200		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 7b
Sub-Basin 3



Drainage Area – 19.6 acres
Property Ownership – Private
Site Specific Information – a steep slope run west off of the row cropped field. The field borders a standing water wetland. Implementing a filter strip along the field edge to trap sediment and nutrients from the agricultural field is proposed. The majority of the basin is wetland and forest. The row cropped field being addressed is located at the northeast section of the basin.

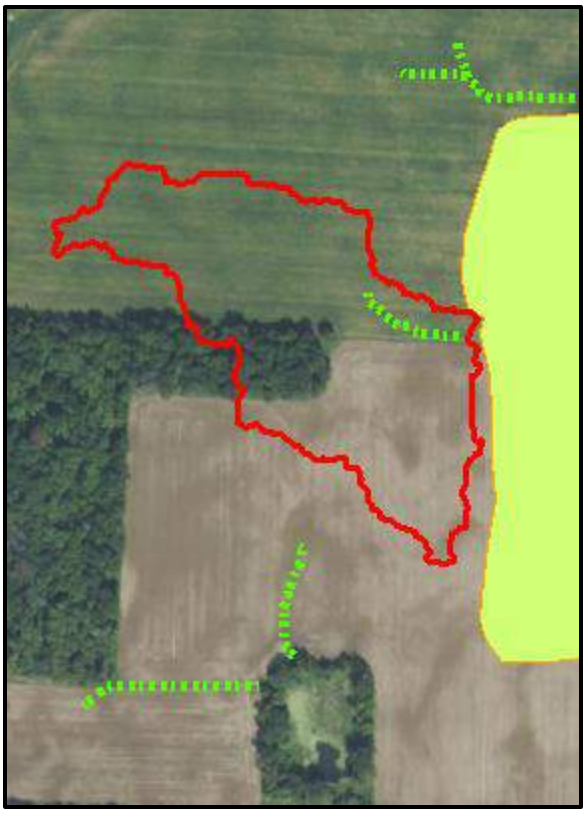
Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$359.34	1.49	$241.17

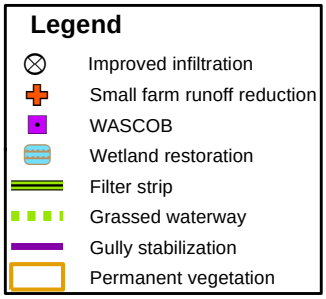
Current Conditions		Added Practice		Reduction	
Sub-Basin	3	Type	Filter Strip	Sediment reduction (t/yr)	1.10
Acres	19.6	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.68
Soil	Sanburn fine sandy loam, 7-18% slopes	Length (ft)	460	Phosphorus reduction (lb/yr)	1.49
Slope length (ft)	50	Area (acres)	0.53		
Average slope	7.2	Contr. Area (acres)	2		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

Project ID – Grassed Waterway
Zone 7b
Sub-Basin 4

Drainage Area – 11.7 acres
Property Ownership – Private
Site Specific Information – A concentrated flow path was identified flowing down a steep hill. To prevent erosion and nutrient loss a grass waterway is recommended at this location. The majority of the basin is row cropped.





Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$1,186.00	2.69	$440.89

Current Conditions		Added Practice		Reduction	
Sub-Basin	4	**Type**	Grassed waterway	**Sediment reduction (t/yr)**	3.16
Acres	11.7	**Contributing acres**	6.5	**Soil Loss reduction (t/yr)**	11.00
Soil	Sanburn fine sandy loam, 2-7% slopes	**Vol Voided (ft^3)**	200	**Phosphorus reduction (lb/yr)**	2.69
Slope length (ft)	100	**Length (ft)**	200		
Average slope	3.1	**Area (acres)**	0.23		
		Years	1		
		Distance to SW (ft)	415		

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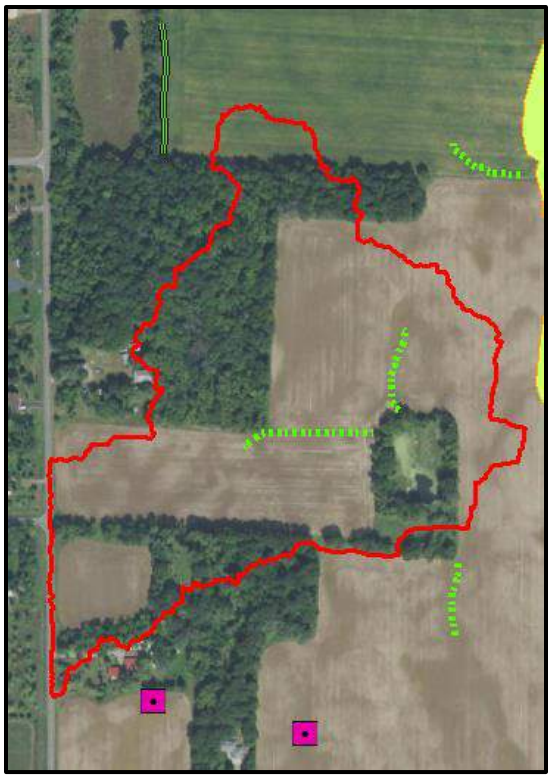
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 7b
Sub-Basin 5



Drainage Area – 39.5 acres
Property Ownership – Private
Site Specific Information – Two concentrated flow paths lead towards wetland pond located on the southeast boarder of the basin. The flow paths travel over the row cropped field. A grassed waterway would help prevent soil and nutrient loading into the adjacent wetland.

Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$1,897.60	5.00	$379.52

Current Conditions		Added Practice		Reduction	
Sub-Basin	5	**Type**	Grassed waterway	**Sediment reduction (t/yr)**	5.88
Acres	39.5	**Contributing acres**	6.8	**Soil Loss reduction (t/yr)**	17.60
Soil	Sanburn fine sandy loam, 7-18% slopes	**Vol Voided (ft^3)**	320	**Phosphorus reduction (lb/yr)**	5.00
Slope length (ft)	75	**Length (ft)**	320		
Average slope	4.4	**Area (acres)**	0.37		
		Years	1		
		Distance to SW (ft)	200		

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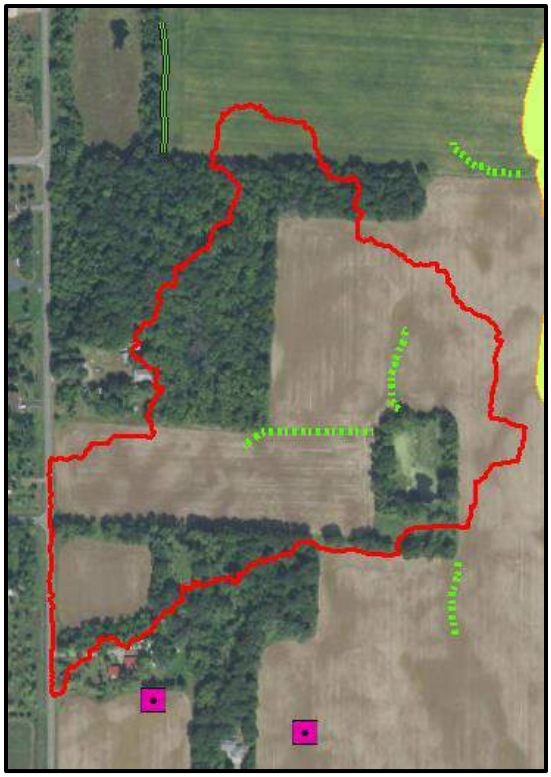
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 7b
Sub-Basin 5

Drainage Area – 39.5 acres
Property Ownership – Private
Site Specific Information – Two concentrated flow paths lead towards wetland pond. The flow paths travel over the row cropped field. A grassed waterway would help prevent soil and nutrient loading into the adjacent wetland. The majority of the basin is row cropped but has areas of forest and wetland



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,787.10	7.34	$379.71

Current Conditions		Added Practice		Reduction	
Sub-Basin	5	Type	Grassed waterway	Sediment reduction (t/yr)	8.64
Acres	39.5	Contributing acres	6.5	Soil Loss reduction (t/yr)	25.85
Soil	Sanburn fine sandy loam, 7-18% slopes	Vol Voided (ft^3)	470	Phosphorus reduction (lb/yr)	7.34
Slope length (ft)	75	Length (ft)	470		
Average slope	4.4	Area (acres)	0.54		
		Years	1		
		Distance to SW (ft)	200		

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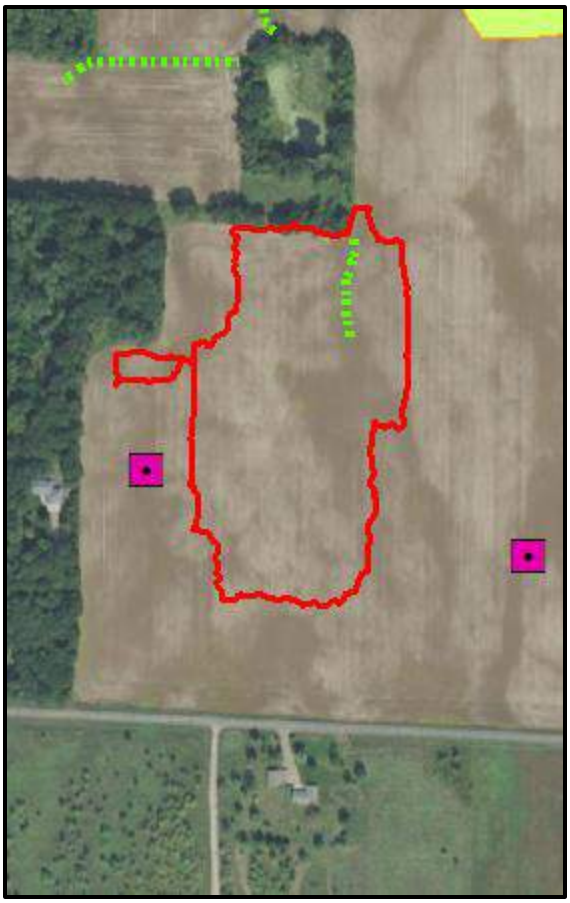
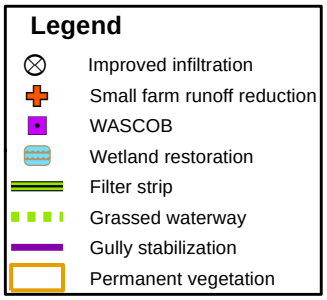
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 7b
Sub-Basin 6



Drainage Area – 10.5 acres
Property Ownership – Private
Site Specific Information – A concentrated flow path was identified traveling across the row cropped field. Implementing a grassed waterway at the northeast section of the basin would prevent soil erosion and nutrient loss.

Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$1,186.00	1.68	$705.95



Current Conditions		Added Practice		Reduction	
Sub-Basin	6	**Type**	Grassed waterway	**Sediment reduction (t/yr)**	1.98
Acres	10.5	**Contributing acres**	9	**Soil Loss reduction (t/yr)**	11.00
Soil	Sanburn fine sandy loam, 2-7% slopes	**Vol Voided (ft^3)**	200	**Phosphorus reduction (lb/yr)**	1.68
Slope length (ft)	100	**Length (ft)**	200		
Average slope	3.5	**Area (acres)**	0.23		
		Years	1		
		Distance to SW (ft)	4000		

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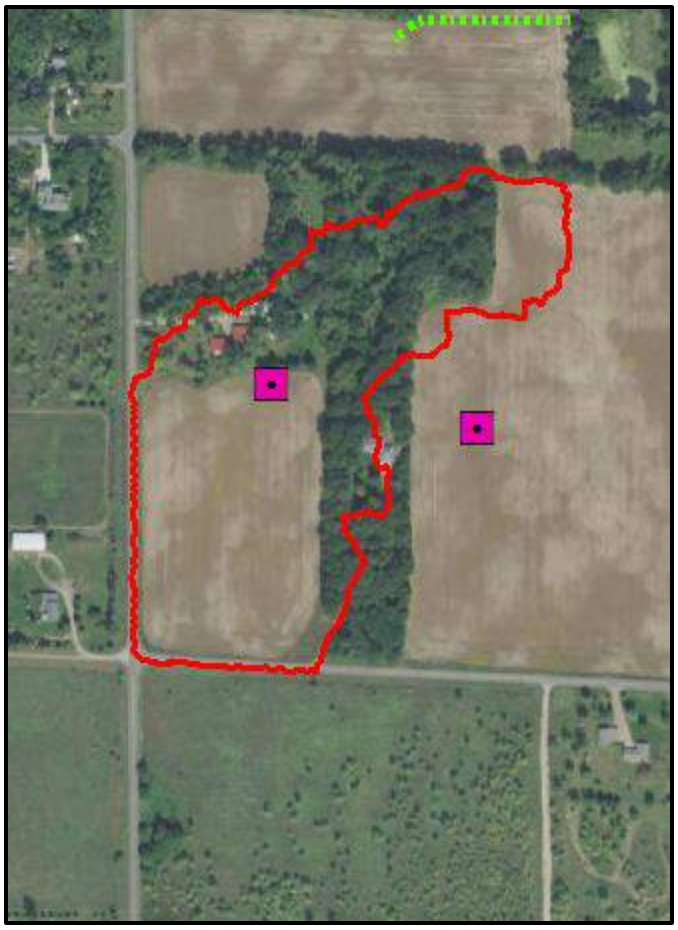
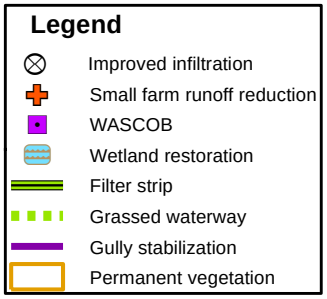
Project ID – WASCOB
Zone 7b
Sub-Basin 7

Drainage Area –17.8acres
Property Ownership – Private
Site Specific Information – A concentrated flow path as well as a possible gully was identified in the northeast section of the row cropped field. Implementing a WASCOB here would allow water to infiltrate and reduce soil erosion and nutrient loss.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	1.61	$6,089.25



Current Conditions		Added Practice		Reduction	
Sub-Basin	7	Type	WASCOB	Sediment reduction (t/yr)	1.89
Acres	17.8	Contributing acres	7.4	Soil Loss reduction (t/yr)	11.00
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	200	Phosphorus reduction (lb/yr)	1.61
Slope length (ft)	200	Length (ft)	200		
Average slope	4.9	Years	1		
		Distance to SW (ft)	5000		

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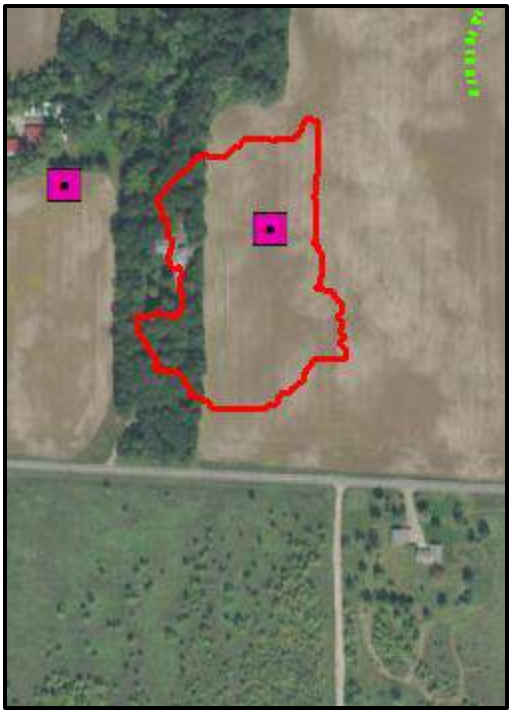
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 7b
Sub-Basin 8



Drainage Area – 6.1 acres
Property Ownership – Private
Site Specific Information – The row cropped field has steep slopes and concentrated flow path following a contour depression. Implementing a WASCOB to allow for water infiltration would benefit the water quality in this area. The majority of the basin is row cropped.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	0.80	$12,254.63

Current Conditions		Added Practice		Reduction	
Sub-Basin	8	Type	WASCOB	Sediment reduction (t/yr)	0.94
Acres	6.1	Contributing acres	4	Soil Loss reduction (t/yr)	5.50
Soil	Sanburn fine sandy loam, 7-18% slopes	Vol Voided (ft^3)	100	Phosphorus reduction (lb/yr)	0.80
Slope length (ft)	40	Length (ft)	100		
Average slope	6.2	Years	1		
		Distance to SW (ft)	5000		

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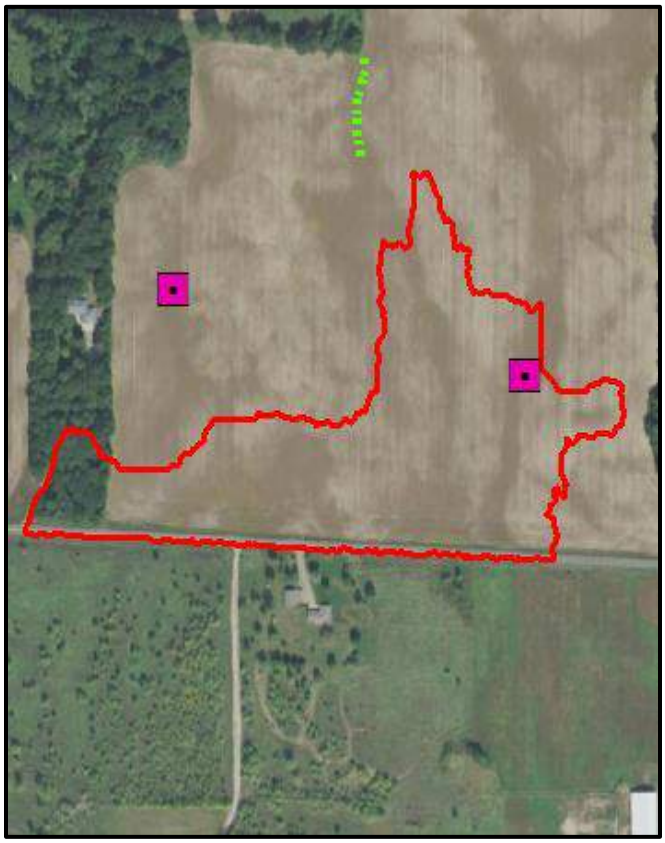
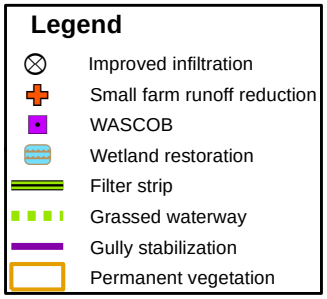
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 7b
Sub-Basin 9



Drainage Area – 15.4 acres
Property Ownership – Private
Site Specific Information – A concentrated flow path as well as a possible gully was identified at this location. Implementing a WASCOB here would allow water to infiltrate and reduce soil erosion and nutrient loss. All but a small section to the southwest is row cropped land use.



Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$13,087.50	2.81	$4,657.47

Current Conditions		Added Practice		Reduction	
Sub-Basin	9	Type	WASCOB	Sediment reduction (t/yr)	3.30
Acres	15.4	Contributing acres	13	Soil Loss reduction (t/yr)	19.25
Soil	Chetek loamy sand, 2-7% slopes	Vol Voided (ft^3)	350	Phosphorus reduction (lb/yr)	2.81
Slope length (ft)	250	Length (ft)	350		
Average slope	3.4	Years	1		
		Distance to SW (ft)	5000		

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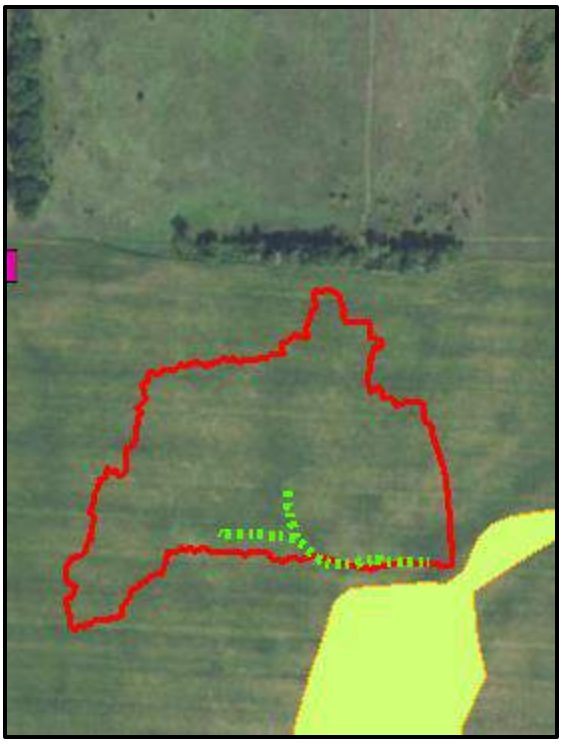
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 7b
Sub-Basin 10

Drainage Area – 7.5 acres
Property Ownership – Private
Site Specific Information – A concentrated flow path was identified at this location. The slopes are not as steep, however flow is still a concern. A grassed waterway at southeast section of the basin would prevent the flow from eroding the soil and carrying nutrients into the adjacent lowland area.

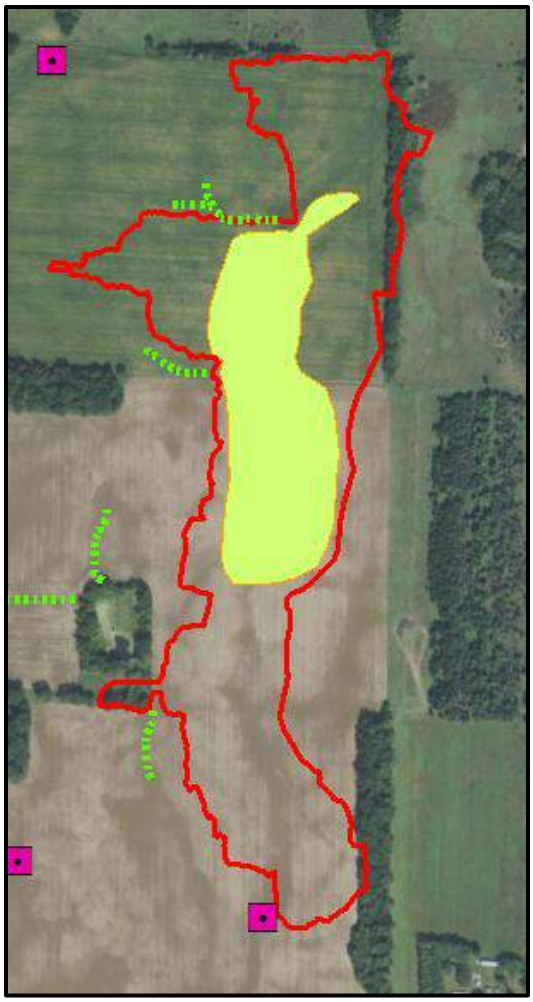


Cost-Benefit		
Practice Cost	**P reduction (lb/yr)**	**$ per lb TP Removed**
$1,779.00	2.78	$639.93

Current Conditions		Added Practice		Reduction	
Sub-Basin	10	**Type**	Grassed waterway	**Sediment reduction (t/yr)**	3.27
Acres	7.5	**Contributing acres**	6.5	**Soil Loss reduction (t/yr)**	16.50
Soil	Sanburn fine sandy loam, 2-7% slopes	**Vol Voided (ft^3)**	300	**Phosphorus reduction (lb/yr)**	2.78
Slope length (ft)	100	**Length (ft)**	300		
Average slope	3.2	**Area (acres)**	0.34		
		Years	1		
		Distance to SW (ft)	2500		

Project ID – Permanent Vegetation
Zone 7b
Sub-Basin 11

Drainage Area – 48.3 acres
Property Ownership – Private
Site Specific Information – This large sub-basin has several internally draining depressions, which made computer-based watershed delineation difficult. Water would need to rise several feet to outlet. Steep slopes could be converted to a hay / alfalfa permanent cover to retain and infiltrate water.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$14,300.00	12.43	$1,150.44

Current Conditions		Added Practice		Reduction	
Sub-Basin	11	Type	Permanent vegetation	Sediment reduction (t/yr)	6.75
Acres	48.3	Specs	On steep slope	Soil Loss reduction (t/yr)	10.57
Soil	Chetek loamy sand, 7-12% slopes, mod eroded	Distance to water	2000	Phosphorus reduction (lb/yr)	12.43
Slope length (ft)	175	Contr. Area (acres)	40.00		
Average slope	4.6	acres applied	13		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

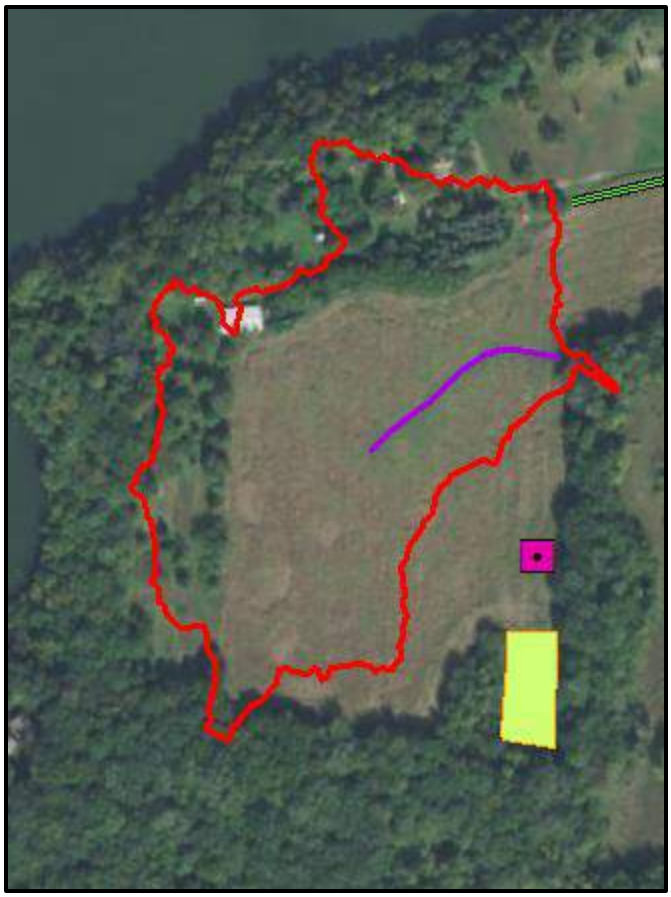
Priority Zone 8

Priority Zone 8 Summary	
Acres addressed	19.9
Dominant Land Cover	Agricultural
Total Sub-Basins	4
Potential BMPs	5
Potential TP reduction (lb/yr)	16.48
Potential TSS reduction (tons/yr)	

Priority Zone 8 is a bit small in size, however given its very close proximity to the lake and the eastern tributary along with signs of gully formation in its sole agricultural field this location was highlighted in the Targeting study and is considered high priority. The slopes are largely moderate (3%-4%) in this region with the exception of a single sub-basin in which slopes of 7% and greater are noted.

Project ID – Gully Stabilization
Zone 8
Sub-Basin 1

Drainage Area – 9.8 acres
Property Ownership – Private
Site Specific Information – There is a visible gully located in this basin. The basin is row cropped and has moderately wet soils that hinder infiltration. A stream network was identified using GIS tool. A gully stabilization at this location would benefit the areas water quality by preventing sediment and nutrient loss.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$2,283.05	6.01	$379.88

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	Gully stabilization	Sediment reduction (t/yr)	7.08
Acres	9.8	Contributing acres	9.5	Soil Loss reduction (t/yr)	21.18
Soil	Chetek loamy sand, moderately wet	Vol Voided (ft^3)	385	Phosphorus reduction (lb/yr)	6.01
Slope length (ft)	200	Length (ft)	385		
Average slope	3.5	Area (acres)	0.44		
		Years	1		
		Distance to SW (ft)	200		

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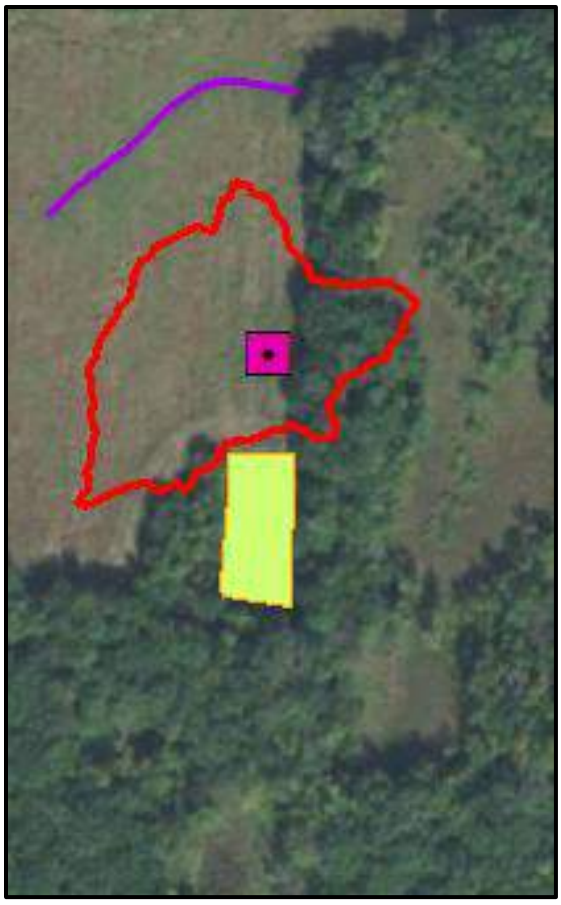
CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – WASCOB
Zone 8
Sub-Basin 2



Drainage Area – 2.2 acres
Property Ownership – Private
Site Specific Information – Steep slopes and an identified stream network in this area would benefit from the implementation of a WASCB. The WASCOB would allow water to infiltrate at the top of the slope rather than running down the steep slope and creating a gully, eroding the soil and losing nutrients.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	3.80	$2,579.92

Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	WASCOB	Sediment reduction (t/yr)	4.48
Acres	2.2	Contributing acres	1.3	Soil Loss reduction (t/yr)	22
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	400	Phosphorus reduction (lb/yr)	3.8
Slope length (ft)	300	Length (ft)	400		
Average slope	4.7	Years	1		
		Distance to SW (ft)	2200		

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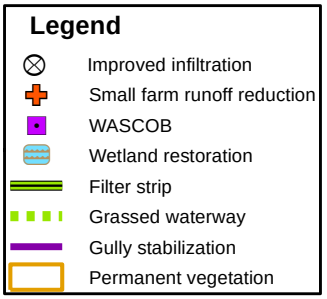
Project ID – Permanent Vegetation
Zone 8
Sub-Basin 3

Drainage Area – 1.0 acres
Property Ownership – Private
Site Specific Information – Steep slopes indicated by NRCS topography data provides valid information the implementing permanent vegetation on the hillside would prevent soil and nutrient loss into the adjacent wetland.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$407.00	0.72	$565.28

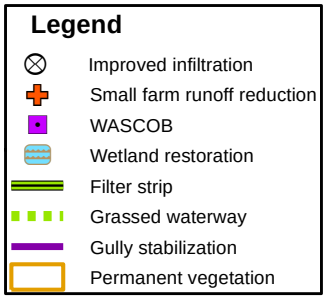
Current Conditions		Added Practice		Reduction	
Sub-Basin	3	Type	Permanent	Sediment reduction (t/yr)	0.56
Acres	1	Specs	on hillslope	Soil Loss reduction (t/yr)	0.61
Soil	Sanburn fine sandy loam, 2-7% slopes	Distance to water	75	Phosphorus reduction (lb/yr)	0.72
Slope length (ft)	120	Contr. Area (acres)	0.50		
Average slope	7.1	acres applied	0.37		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 8
Sub-Basin 4

Drainage Area – 6.9 acres
Property Ownership – Private
Site Specific Information – This basin is mostly lowland area. There is row cropped field located in the North West section that has a moderate slope draining to the east. A filter strip along the road would benefit the areas water quality.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$366.12	0.95	$385.39

Current Conditions		Added Practice		Reduction	
Sub-Basin	4	Type	Filter Strip	Sediment reduction (t/yr)	0.73
Acres	6.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.47
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	470	Phosphorus reduction (lb/yr)	0.95
Slope length (ft)	150	Area (acres)	0.54		
Average slope	4.7	Contr. Area (acres)	1.3		

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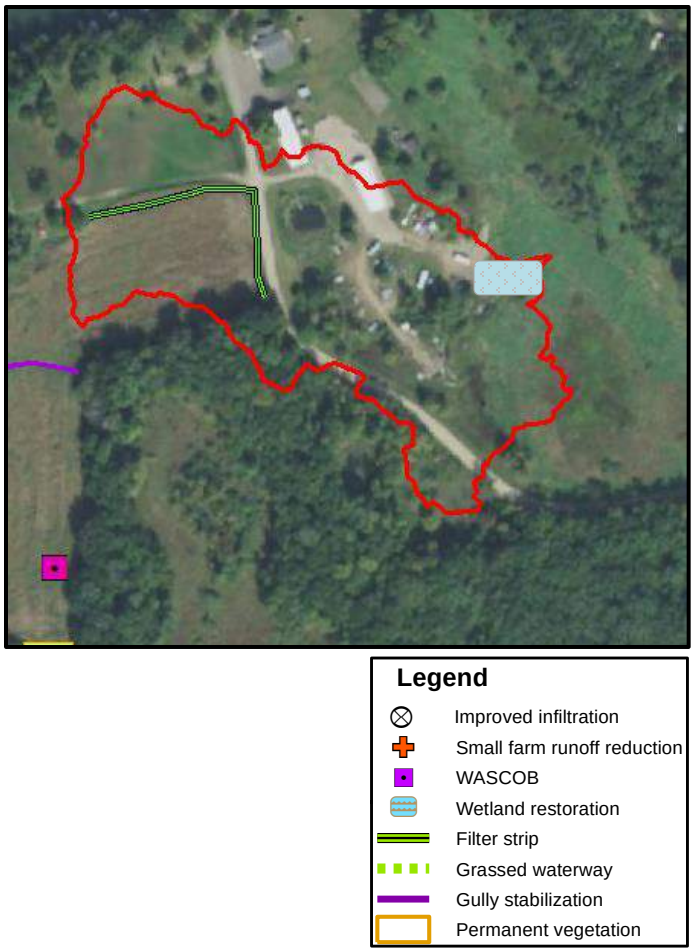
Project ID – Wetland Restoration
Zone 8
Sub-Basin 4

Drainage Area – 6.9 acres
Property Ownership – Private
Site Specific Information – A large wetland was identified in this basin. Improving the quality of the wetland would increase its capability to take up nutrients. Further engineering data is recommended to investigate restoration possibilities. This area was also identified in the urban watershed assessment as priority.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed

Current Conditions		Added Practice		Reduction	
Sub-Basin	4	Type	Wetland	Sediment reduction (t/yr)	5.88
Acres	6.9			Soil Loss reduction (t/yr)	17.60
Soil	Sanburn fine sandy loam, 2-7% slopes			Phosphorus reduction (lb/yr)	5.00
Slope length (ft)	150				
Average slope	4.7				

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CLEAN WATER LAND & LEGACY AMENDMENT

Priority Zone 9

Priority Zone 1 Summary	
Acres addressed	15.9
Dominant Land Cover	Agricultural
Total Sub-Basins	3
Potential BMPs	3
Potential TP reduction (lb/yr)	5.00
Potential TSS reduction (tons/yr)	4.97

Priority Zone 9 is the smallest of all the targeted zones in the Blue Lake Watershed, at only 16 acres. However, the area is quite close to the southwestern side of the lake and holds slopes ranging from 5% to 11%, making it a prime candidate for conservation work. There is a row cropped field located in the middle of the Zone and there has been three areas identified that would benefit from a BMP implementation.

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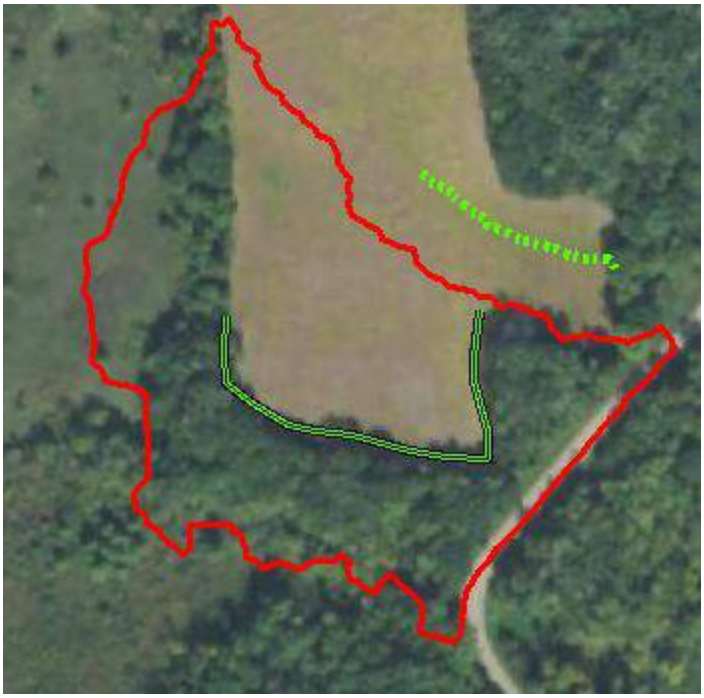
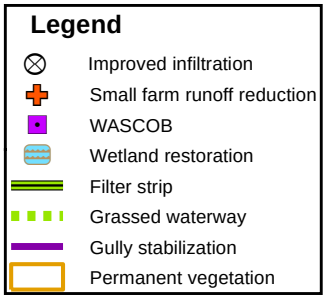
Project ID – Filter Strip
Zone 9
Sub-Basin 1



Drainage Area – 4.9 acres
Property Ownership – Private
Site Specific Information – Water flows to the south, entering a southwest tributary eventually. The majority of the basing is row cropped and forested land. A filter strip is recommended at the field border to the south to reduce nutrient loading into the south west tributary. It should also be noted that the southwest tributary is monitored by the SWCD for water quality.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$454.26	1.30	$349.43

Current Conditions		Added Practice		Reduction	
Sub-Basin	1	Type	Filter Strip	Sediment reduction (t/yr)	0.95
Acres	4.9	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.62
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	580	Phosphorus reduction (lb/yr)	1.3
Slope length (ft)	100	Area (acres)	0.67		
Average slope	4.5	Contr. Area (acres)	2		

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CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Grassed Waterway
Zone 9
Sub-Basin 2

Drainage Area – 5.3 acres
Property Ownership – Private
Site Specific Information – This basin is half row cropped half forested. GIS tools indicated a concentrated flow path flowing southeast towards the lake. The topography indicates land conditions are prime for gully formation. Implementing a grassed waterway would reduce the chances of gully formation and protect the areas water quality.

Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$9,803.70	2.86	$3,427.87

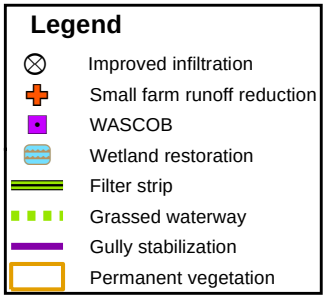
Current Conditions		Added Practice		Reduction	
Sub-Basin	2	Type	Grassed waterway	Sediment reduction (t/yr)	3.36
Acres	5.3	Contributing acres	1.3	Soil Loss reduction (t/yr)	14.58
Soil	Sanburn fine sandy loam, 2-7% slopes	Vol Voided (ft^3)	265	Phosphorus reduction (lb/yr)	2.86
Slope length (ft)	75	Length (ft)	265		
Average slope	5.2	Years	1		
		Distance to SW (ft)	1200		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Project ID – Filter Strip
Zone 9
Sub-Basin 3

Drainage Area – 5.7 acres
Property Ownership – Private
Site Specific Information – A small section of this basin is row cropped. The agricultural field bumps up to forest. A filter strip is recommended at the field edge where slope is steepest. The majority of the basin is forested with only a small portion being row cropped.



Cost-Benefit		
Practice Cost	P reduction (lb/yr)	$ per lb TP Removed
$210.18	0.84	$250.21

Current Conditions		Added Practice		Reduction	
Sub-Basin	3	Type	Filter Strip	Sediment reduction (t/yr)	0.66
Acres	5.7	Specs	50 ft Cool season	Soil Loss reduction (t/yr)	0.36
Soil	Sanburn fine sandy loam, 2-7% slopes	Length (ft)	270	Phosphorus reduction (lb/yr)	0.84
Slope length (ft)	120	Area (acres)	0.31		
Average slope	6	Contr. Area (acres)	1.1		

Funding provided in part by the Clean Water Fund of the Clean Water, Land, and Legacy Amendment

CLEAN WATER LAND & LEGACY AMENDMENT

Appendices:

References:

WinSLAMM Version 10.2, Source Loading Management Model – Copyright 1996-2014

The Natural Resource Conservation Service (NRCS) Engineering Tool

Chisago SWCD, 2015. Rural Subwatershed Analysis Protocol, Part 1 – Targeting. Version 1.0. http://chisagoswcd.org/

Chisago SWCD, 2015. Rural Subwatershed Analysis Protocol, Part 2 – Prioritizing. Version 1.0. http://chisagoswcd.org/

Chisago SWCD, 2014. Chisago Lakes Chain of Lakes Watershed Rural Subwatershed Analysis. http://chisagoswcd.org/

BWSR Water Erosion Pollution Reduction Estimator. Available for download at http://www.bwsr.state.mn.us/outreach/eLINK/index.html

Revised Universal Soil Loss Equation 2 (RUSLE2). United States Department of Agriculture Natural Resource Conservation Service.

Definitions:

Bioretention/raingarden: A BMP that uses soil and vegetation to treat stormwater runoff from roads, driveways, roof tops, and other impervious surfaces.

Residential curb-cut raingardens: A bioretention basin along a road side where a section of a curb is removed in order to direct storm water into the raingarden.

Lakeshore Restorations: Lakeshore restoration involves the correction or prevention of erosion at the shoreline, often with the addition of native plants that filter runoff and offer habitat benefits.

Hillside and gully erosion restoration and stabilization: An area that uses soil and vegetation to stabilize a landscape that is eroding or has the potential to erode. These areas generally correlate with steep slopes and little to now land cover.

Iron enhanced sand filter (IESF): Iron-enhanced sand filters are filtration Best Management Practices (BMPs) that incorporate filtration media mixed with iron. The iron removes several dissolved constituents, including phosphate, from stormwater. (MPCA website)

Sediment Pond: a basin where stormwater is directed to allow sediment to settle at the bottom of the basin rather than washing into surface water.

Stormdrain sediment catch basins (SUMP): A sump is a deep well below the catch basin which stormwater is directed. The SUMP has a deep basin that accumulates sediment, not allowing the sediment to enter the surface water.

Water and sediment control basins: An earthen embankment that traps water and sediment running off cropland upslope from the structure, and reduces gully erosion by controlling flow within the drainage area.

Grassed waterways: Are broad, shallow channels designed to move surface water across farmland without causing soil erosion. The vegetative cover in the waterway slows the water flow and protects the channel surface from rill and gully erosion. (NRCS)

Permanent vegetation: An area permanently vegetated with a variety of grasses in order to stabilize the soil, filter runoff, utilize nutrients and increase the biodiversity.

Wetland restoration: Improving or creating an area of land with the characteristics of a wetland; hydrology, vegetation and soils.