

2022

Skogman Lake Shoreline Assessment



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Executive Summary

The majority of Skogman Lake is located within Cambridge Township of Isanti County, Minnesota. On the northeast side of the lake, a small portion (59 acres) merges into Chicago County.

This study provides recommendations for cost effectively restoring and protecting the shoreline. A similar study was completed by the Anoka Soil and Water Conservation District in 2014. This study is an update to the “shoreline restoration” section of the 2014 study. 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. Site specific planning, designs and refined cost estimates should be done after committed partnerships for project installation are in place.

Skogman Lake is part of a chain of lakes consisting of Fannie, Elms and Florence lakes. Of the four lakes within the lake chain, Skogman lake is the second largest (228 acres) but has the most length of shoreline (6.1 miles). Skogman Lake begins the chain of lakes that eventually outlets into the Rum River. Addressing natural resource concerns around Skogman Lake will also benefit downstream waterbodies.

The Isanti SWCD has identified Skogman Lake as a high priority waterbody for improving water quality. Skogman Lake was listed on the Minnesota impaired waters list due to high nutrient concentrations (Phosphorus) in 2013. These concentrations are often above state water quality standards for phosphorus, 40 ug/L. Frequent midsummer algae blooms accompanied with low water clarity, is an indication of high nutrient concentrations in a lake. Other indications might include, fish kills, low oxygen levels and dense nutrient-fed aquatic vegetation such as coontail.

To better understand lake water quality trends, in 2022, volunteers from the lake improvement district (LID) monitored (by-weekly) total phosphorus, chlorophyll and water clarity. Furthermore, the Isanti SWCD partnered with the LID to collect additional field data from the lake as well as three streams that outlet to Skogman Lake. Updated data will provide insight into potential variables contributing to water quality health and guide decisions for installing best management practices (BMPs). The ultimate goal is to install BMPs in the watershed, to capture nutrients, stabilize soil and improve and protect water quality.

Analysis and Project Targeting:

The watershed (land draining to Skogman Lake) was delineated using available digital mapping information. The watershed area was divided into two target areas, rural watershed and nearshore watershed. In this study we focused only on the nearshore watershed. More specifically, the shoreline adjacent to the lake.

To help identify where installing shoreline restorations could be most effective, both desktop and field analysis was conducted. Desktop analysis involved using computer programs (ArcMap, Google Earth) to overlay lay specific natural resource data (soils, vegetation, elevation, hydrologic conditioning) to pinpoint areas with the highest potential for stormwater runoff and erosion. In addition to using desktop information, a boat survey was conducted to help further understand the landscape and identify specific areas where shoreline restorations would be most effective. Combining these investigative analysis helped identify where shoreline restorations could be installed.

Shoreline Restorations:

Shoreline restoration consists of converting a section of shoreline from an altered landscape (manicured turf grass, erosion, rock rip rap, failing retaining walls, nonnative beaches, etc.) to a shoreline mimicking a natural undisturbed Minnesota lake shoreline.

Restoring shoreline may include:

- Planting native vegetation (flowers, grasses and sedges)
- Installing biodegradable erosion control (willow bundles, coir logs, soil wraps)
- Regrading slope
- Invasive plant control

The purpose of shoreline restorations is to reduce shoreline loss, capture and filter stormwater runoff, reduce sediment and nutrients from entering the lake and improve wildlife habitat. These factors combined will assist in improving and protecting water quality and aquatic habitat.

Project Modeling:

Project modeling involves using specific computer programs and modeling tools to help estimate nutrient reductions based on the selected project. In this study, ArcMap, WinSLAMM and the Board of Water and Soil Resources (BWSR) pollutant reduction calculator were used. WinSLAMM was used to identify the amount of potential nutrient loading, to the lake, based on the current landscape. Additionally, WinSLAMM was used to determine the nutrient reduction potential based on project type and size.

Using the BWSR pollutant reduction calculator, we were able to identify the intensity of erosion on the shoreline and how that correlates with the potential nutrient loading. Like WinSLAMM, we are able to determine nutrient reduction potential based on the proposed project.

Cost Estimates:

For the purpose of this analysis, cost/linear foot was estimated based on erosion severity and the likely approach to stabilization efforts falling into one of two categories; 1) complex bioengineering restoration with heavy equipment grading, \$150/linear, or 2) basic bioengineering restoration with manual grading and plantings, \$75/linear foot. A vegetated shoreline buffer was also included for each proposed practice to help treat runoff from the watershed and offer near-shore wildlife habitat.

Project Ranking:

Data was inputted into a ranking table to identify which project would achieve Phosphorus reduction in the most cost-effective manner. When ranking shoreline restoration on a large scale, like in this report, we focus on the shoreline as a whole not individual landowner parcels. Lakeshore restoration designs are site specific and need to take into account soil type, existing vegetation, slope, overland flow, wave action due to recreational activity, fetch, orientation, and landowner desires. These criteria are best understood during individual site visits. This report provides an excellent starting point on where shoreline restorations are beneficial along with providing reasonable project costs and nutrient reduction estimates. See ranking table on page 5.

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

Project Rank	Shoreline ID	Project Type	TP Reduction (lb/yr)	Total Project Cost	Estimated Annual Operations & Maintenance Cost	Estimated cost/ lb-TP (30-year)
1	SL - 17	Basic Shoreline Restoration	0.66	\$11,500.00	\$50.00	\$660.24
2	SL - 8	Basic Shoreline Restoration	0.93	\$19,225.00	\$50.00	\$746.77
3	SL - 11	Basic Shoreline Restoration	0.36	\$7,300.00	\$50.00	\$810.77
4	SL - 14	Basic Shoreline Restoration	0.28	\$6,250.00	\$50.00	\$934.88
5	SL - 7	Basic Shoreline Restoration	0.64	\$17,875.00	\$50.00	\$1,009.26
6	SL - 18	Basic Shoreline Restoration	1.03	\$30,025.00	\$50.00	\$1,023.57
7	SL - 15	Basic Shoreline Restoration	0.53	\$15,400.00	\$50.00	\$1,054.72
8	SL - 5	Basic Shoreline Restoration	0.20	\$5,050.00	\$50.00	\$1,116.35
9	SL - 13	Basic Shoreline Restoration	0.28	\$8,350.00	\$50.00	\$1,161.36
10	SL - 4	Basic Shoreline Restoration	0.29	\$9,100.00	\$50.00	\$1,213.56
11	SL - 6	Basic Shoreline Restoration	0.29	\$9,250.00	\$50.00	\$1,223.64
12	SL - 12	Basic Shoreline Restoration	0.52	\$17,875.00	\$50.00	\$1,242.21
13	SL - 16	Basic Shoreline Restoration	0.70	\$25,750.00	\$50.00	\$1,300.35
14	SL - 1	Basic Shoreline Restoration	0.19	\$6,100.00	\$50.00	\$1,351.88
15	SL - 9	Basic Shoreline Restoration	0.41	\$15,400.00	\$50.00	\$1,367.14
16	SL - 3	Basic Shoreline Restoration	0.22	\$8,875.00	\$50.00	\$1,581.87
17	SL - 2	Basic Shoreline Restoration	0.08	\$4,450.00	\$50.00	\$2,366.04
18	SL - 10	Basic Shoreline Restoration	0.06	\$2,875.00	\$50.00	\$2,386.77

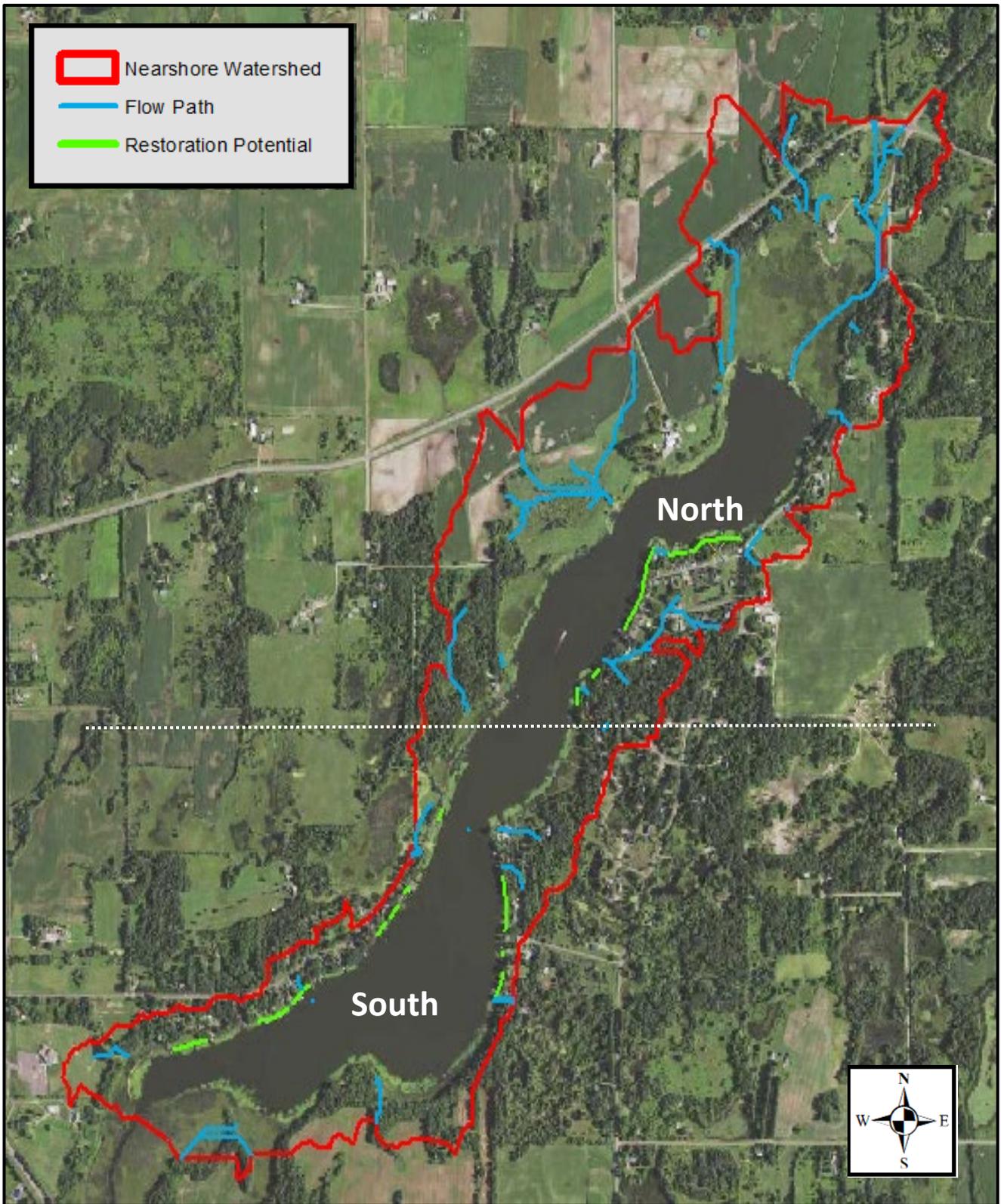
Table1: Ranking Table

Shoreline Restoration

The primary focus of this report was identifying resource concerns directly adjacent to the lake and potential options for addressing those concerns. A total of 3,467 linear feet of shoreline was identified as benefitting from a shoreline restoration. If 65% of that total (2,256 ln/ft) was restored, we estimate a phosphorus (P) reduction of 7.0 pounds annually (1lb. of P can produce 500lbs. of algae).

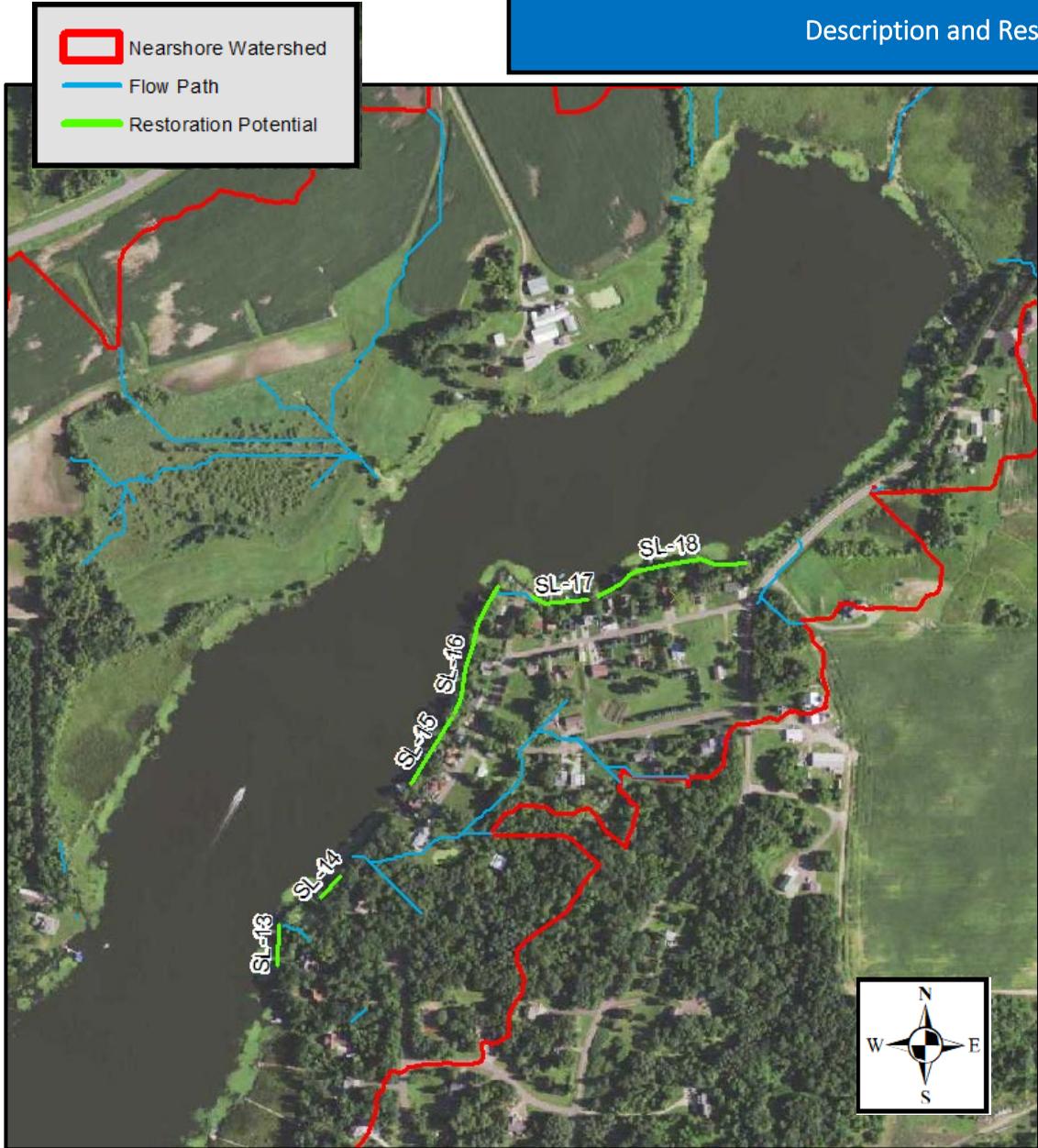
Overall, the shoreline is in good condition in terms of erosion. Much of the shoreline is lined with rock rip-rap, which does not provide any stormwater filtering benefits but has some benefits when addressing shoreline loss/erosion. The main resource concern is the potential for undesirable nutrients reaching the lake via stormwater runoff. Almost half of the Skogman Lake shoreline is residentially developed. Also, much of the development is high density. Typically, high density residential areas result a significant amount of impervious surface (roofs, driveways, sidewalks). These conditions hinder natural stormwater filtering and increases the volume of stormwater and nutrient reaching the lake. Furthermore, manicured lawns and landscaping are typical land use for residential lakeshore. These land use characteristics generally are not ideal for protecting lake water quality.

The majority of the shoreline identified, for restoration opportunities, is adjacent to high density residential areas. Like many similar shorelines in Minnesota, the main resource concern around Skogman Lake is the lack of vegetative shoreline buffer. Installing shoreline buffers and erosion control methods, has the potential to improve and protect water quality in Skogman Lake.



Map1: Overview Map

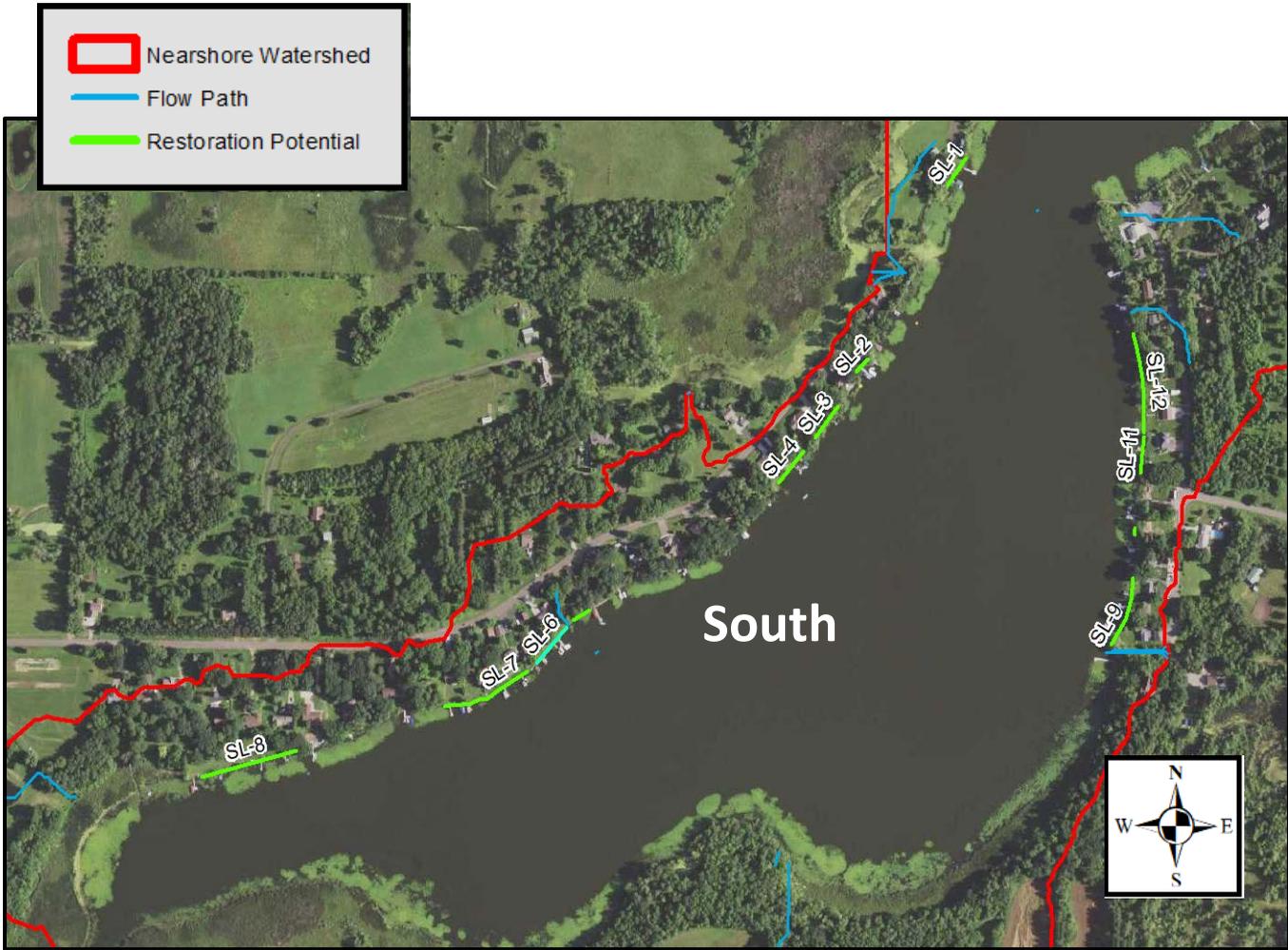
North Shoreline: Description and Restoration Recommendation



On the north end of Skogman Lake, a total of 928 linear feet of shoreline was identified for potential restoration opportunities. If all 928 linear feet was addressed, an estimated 3.0 pounds of phosphorus would be prevented from flowing into the lake each year. One the North end of the lake, identified shorelines were labeled from SL- 13 to SL 18. Information on each identified shoreline is outlined in this report.

Shoreline Restorations		
<i>Cost/Removal Analysis</i>		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	928
	TP (lb/yr)	3.0
	TSS (lb/yr)	2,467
Cost	Design Costs and Admin	\$4,000
	Construction Costs and Material**	\$59,600
	Total Estimated Project Cost	\$63,600
	Annual O&M***	\$50
Efficiency	30-yr Average Cost/lb-TP	\$728

South Shoreline: Description and Restoration Recommendation



On the South end of Skogman Lake, a total of 1,328 linear feet of shoreline was identified for potential restoration opportunities. If all 1,328 linear feet was addressed, an estimated 3.9 pounds of phosphorus would be prevented from flowing into the lake each year. One the south end of the lake, identified shorelines were labeled from SL- 1 to SL 12. Information on each identified shoreline is outlined in this report.

Shoreline Restorations		
<i>Cost/Removal Analysis</i>		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	1,328
	TP (lb/yr)	3.9
	TSS (lb/yr)	2,747
Cost	Design Costs and Admin	\$5,000
	Construction Costs and Material**	\$89,600
	Total Estimated Project Cost	\$94,600
	Annual O&M***	\$50
Efficient	30-yr Average Cost/lb-TP	\$831

Shoreline 1: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.22
Land Management	Beach and Lawn
TP (lbs/yr)	.34
Shore Erosion Severity	Mild



Location – Southwest shore of Skogman Lake
Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Shoreline Restoration		
<i>Cost/Removal Analysis</i>		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	68
	TP (lb/yr)	0.2
	TSS (lb/yr)	162
	Cost	Total Estimated Project Cost
Annual O&M***		\$50
Efficiency	30-yr Average Cost/lb-TP	\$1,352



Native Plant Buffer and Willow Bundle

Shoreline 2: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.05
Land Management	Lawn
TP (lbs/yr)	.1
Shore Erosion Severity	Minimal



Location – Southwest shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

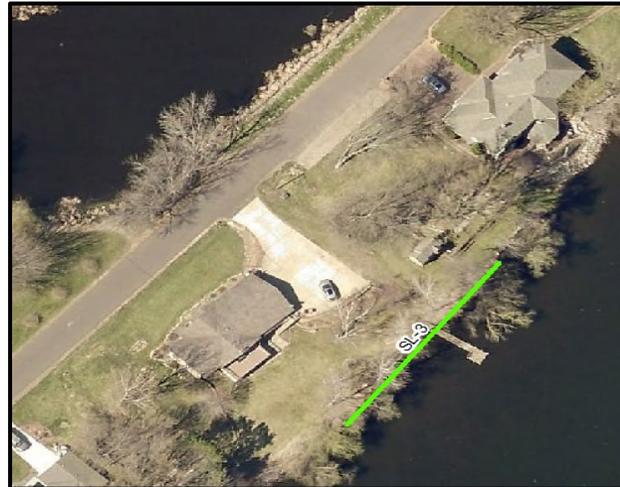
Lakeshore Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	1
	Shoreline Addressed Lnft.	46
	TP (lb/yr)	0.1
	TSS (lb/yr)	71
	Total Estimated Project Cost	\$4,450
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$2,366



Native Plant Buffer and Willow Bundle

Shoreline 3: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.32
Land Management	Lawn
TP (lbs/yr)	.25
Shore Erosion Severity	Minimal



Location – Southwest shore of Skogman Lake
Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	105
	TP (lb/yr)	0.2
	TSS (lb/yr)	170
	Cost	Total Estimated Project Cost
Annual O&M***		\$50
Efficiency	30-yr Average Cost/lb-TP	\$1,582



Native Plant Buffer and Willow Bundle

Shoreline 4: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.8
Land Management	Lawn/Beach/Rock
TP (lbs/yr)	.54
Shore Erosion Severity	Minimal



Location – Southwest shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
<i>Cost/Removal Analysis</i>		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	108
	TP (lb/yr)	0.3
	TSS (lb/yr)	198
Cost	Total Estimated Project Cost	\$9,100
	Annual O&M***	\$50
Efficiency	30-yr Average Cost/lb-TP	\$1,214



Native Plant Buffer and Willow Bundle

Shoreline 5: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.7
Land Management	Lawn
TP (lbs/yr)	.34
Shore Erosion Severity	Minimal



Location – Southwest shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	54
	TP (lb/yr)	0.2
	TSS (lb/yr)	162
	Total Estimated Project Cost	\$5,050
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$1,116



Native Plant Buffer and Willow Bundle

Shoreline 6: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	3.6
Land Management	Lawn
TP (lbs/yr)	.5
Shore Erosion Severity	Minimal



Location – Southwest shore of Skogman Lake
Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

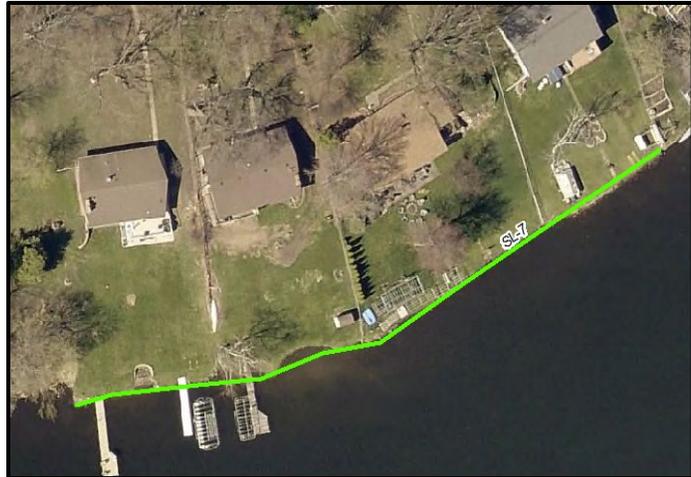
Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	110
	TP (lb/yr)	0.3
	TSS (lb/yr)	218
	Cost	Total Estimated Project Cost
Annual O&M***		\$50
Efficiency	30-yr Average Cost/lb-TP	\$1,224



Native Plant Buffer and Willow Bundle Example

Shoreline 7: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	1.35
Land Management	Lawn/rock
TP (lbs/yr)	1.0
Shore Erosion Severity	Minimal



Location – Southwest shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	225
	TP (lb/yr)	0.6
	TSS (lb/yr)	431
Cost	Total Estimated Project Cost	\$17,875
	Annual O&M***	\$50
Efficiency	30-yr Average Cost/lb-TP	\$1,009



Native Plant Buffer and Willow Bundle Example

Shoreline 8: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	2.2
Land Management	Lawn
TP (lbs/yr)	1.0
Shore Erosion Severity	Minimal



Location – Southwest shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	243
	TP (lb/yr)	0.9
	TSS (lb/yr)	534
Cost	Design Costs and Admin	\$1,000
	Annual O&M***	\$50
Efficiency	30-yr Average Cost/lb-TP	\$747



Native Plant Buffer and Willow Bundle Example

Shoreline 9: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.6
Land Management	Lawn/rock
TP (lbs/yr)	.5
Shore Erosion Severity	Minimal



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	192
	TP (lb/yr)	0.4
	TSS (lb/yr)	315
	Total Estimated Project Cost	\$15,400
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$1,367



Native Plant Buffer and Willow Bundle Example

Shoreline 10: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.5
Land Management	Lawn/Beach
TP (lbs/yr)	.07
Shore Erosion Severity	Moderate



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	25
	TP (lb/yr)	0.06
	TSS (lb/yr)	44
	Total Estimated Project Cost	\$2,875
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$2,387



Shoreline 11:

Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.8
Land Management	Lawn
TP (lbs/yr)	.6
Shore Erosion Severity	Moderate



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

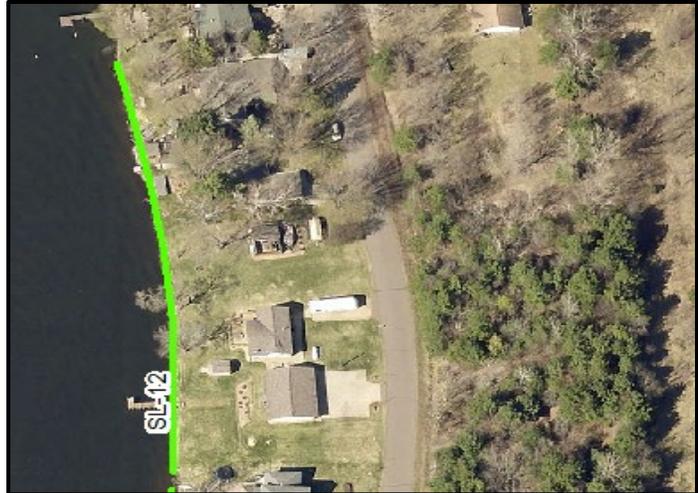
Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	84
	TP (lb/yr)	0.4
	TSS (lb/yr)	280
	Total Estimated Project Cost	\$7,300
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$811



Native Plant Buffer and Willow Bundle Example

Shoreline 12: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.8
Land Management	Lawn/rock
TP (lbs/yr)	.7
Shore Erosion Severity	Minimal



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	225
	TP (lb/yr)	0.5
	TSS (lb/yr)	391
	Total Estimated Project Cost	\$17,875
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$1,242

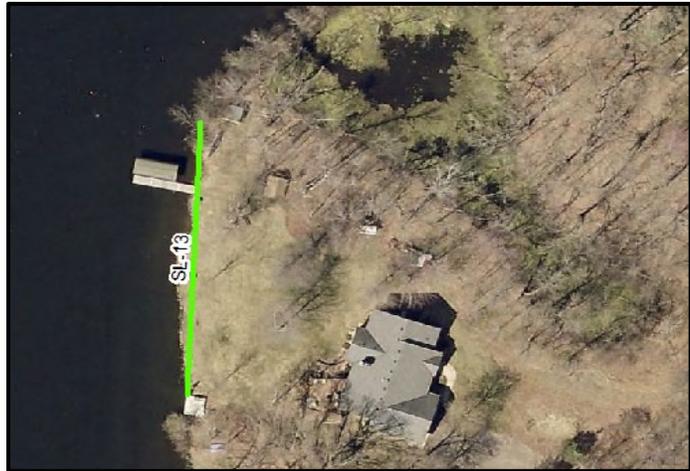


Native Plant Buffer and Willow Bundle Example

Shoreline 13:

Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	2.4
Land Management	Lawn/rock
TP (lbs/yr)	.4
Shore Erosion Severity	Minimal



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	98
	TP (lb/yr)	0.3
	TSS (lb/yr)	178
	Cost	Total Estimated Project Cost
Annual O&M***		\$50
Efficiency	30-yr Average Cost/lb-TP	\$1,161



Native Plant Buffer and Willow Bundle Example

Shoreline 14: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.1
Land Management	Lawn/rock
TP (lbs/yr)	.35
Shore Erosion Severity	Minimal



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	70
	TP (lb/yr)	0.3
	TSS (lb/yr)	363
	Total Estimated Project Cost	\$6,250
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$935

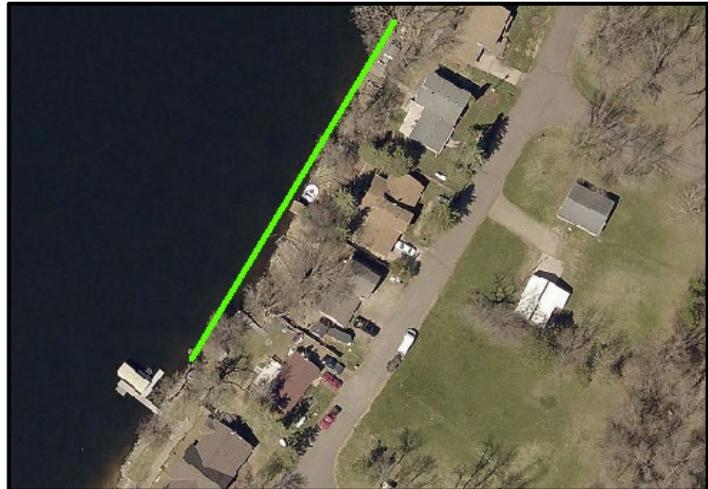


Native Plant Buffer and Willow Bundle Example

Shoreline 15:

Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	.53
Land Management	Lawn/rock
TP (lbs/yr)	.62
Shore Erosion Severity	Minimal



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	192
	TP (lb/yr)	0.5
	TSS (lb/yr)	546
	Total Estimated Project Cost	\$15,400
Cost	Annual O&M***	\$50
	Efficiency	
	30-yr Average Cost/lb-TP	\$1,055



Native Plant Buffer and Willow Bundle Example

Shoreline 16:

Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	1.0
Land Management	Lawn
TP (lbs/yr)	.9
Shore Erosion Severity	Minimal



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	330
	TP (lb/yr)	0.7
	TSS (lb/yr)	545
	Total Estimated Project Cost	\$25,750
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$1,300



Native Plant Buffer and Willow Bundle Example

Shoreline 17: Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	1.03
Land Management	Lawn
TP (lbs/yr)	.9
Shore Erosion Severity	Mild



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lnft.	140
	TP (lb/yr)	0.7
	TSS (lb/yr)	473
	Total Estimated Project Cost	\$11,500
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$660

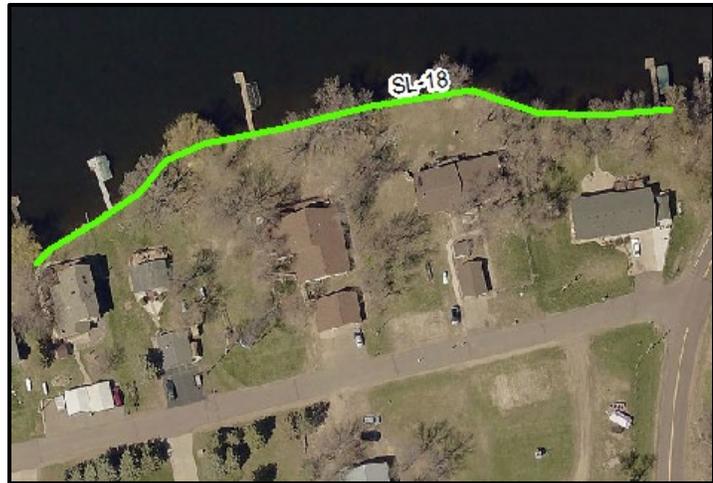


Native Plant Buffer and Willow Bundle Example

Shoreline 18:

Description and Restoration Recommendation

Existing Shoreline Summary	
Watershed Acres	1.7
Land Management	Lawn/rock
TP (lbs/yr)	1.3
Shore Erosion Severity	Minimal



Location – Southeast shore of Skogman Lake

Project recommendation: Shoreline Restoration

For this section of shoreline, a basic shoreline restoration is proposed. Based on the shoreline characteristics, installing a native plant buffer along the shoreline will help capture and filter stormwater runoff from the watershed as well as stabilize the shoreline soils. In addition to the vegetative buffer, installing a biolog or willow bundles at the water’s edge will reduce soil loss and erosion from excessive wave action as well as encourage the success of the native plant buffer.

Proposed Project Details and Cost Estimate:

Shoreline Restorations		
Cost/Removal Analysis		
Treatment	Total Buffer Depth ft.	15
	Shoreline Addressed Lft.	387
	TP (lb/yr)	1.0
	TSS (lb/yr)	709
	Total Estimated Project Cost	\$30,025
Cost	Annual O&M***	\$50
	30-yr Average Cost/lb-TP	\$1,024



Native Plant Buffer and Willow Bundle Example