

Sabbathday Lake Watershed Survey Report



**Cumberland County Soil and Water Conservation District
Sabbathday Lake Association
Maine Department of Environmental Protection**

April 2009

Acknowledgments

The following people and organizations were instrumental in the Sabbathday Lake Watershed Survey Project and deserve special recognition for their efforts:

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Sabbathday Lake Association (SLA)
Sabbathday Lake Shaker Society
US Environmental Protection Agency
Town of New Gloucester

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Sabbathday Lake Watershed Survey volunteers on May 3rd, 2008.

Introduction

Background

WATERSHED
All the land that surrounds a lake that drains or sheds its water into the lake through streams, ditches, directly over the ground surface or through ground water.

In 1996, the Cumberland County Soil and Water Conservation District (CCSWCD) partnered with the Maine Department of Environmental Protection (Maine DEP) and local residents to survey the Sabbathday Lake Watershed for sources of polluted runoff to the lake. Surveying was conducted by volunteers throughout the months of April and May. Seventy-five water quality impact sites were documented. The largest number of sites identified were road related (state and town). Other types of sites included residential sites, driveways, boat accesses, beaches, commercial sites and a logging road (See page 13 for a comparison of 1996 data to 2008). Over the following decade,

many of these sites were fixed through two grant projects and other local programs.

In 1998, CCSWCD received a grant from Maine DEP and the US Environmental Protection Agency (EPA) through Section 319 of the Federal Clean Water Act to implement the *Sabbathday Lake Demonstration Project*. This project provided:

- ◆ Cost sharing to fix nine water quality impact demonstration projects
- ◆ Technical assistance to over 27 watershed residents on erosion control and conservation measures to protect lake water quality
- ◆ Community involvement and education opportunities through plant buffer workshops and tour of demonstration projects addressed

In 2001, funding for a second phase of implementation funding was awarded to CCSWCD to conduct the *Sabbathday Lake Water Quality Improvement Project*. This project continued previous water quality protection efforts by:

- ◆ Cost sharing improvements of 16 water quality impact sites
- ◆ Providing over 30 technical assistance visits
- ◆ Community involvement and education opportunities through plant buffer and camp road maintenance workshops

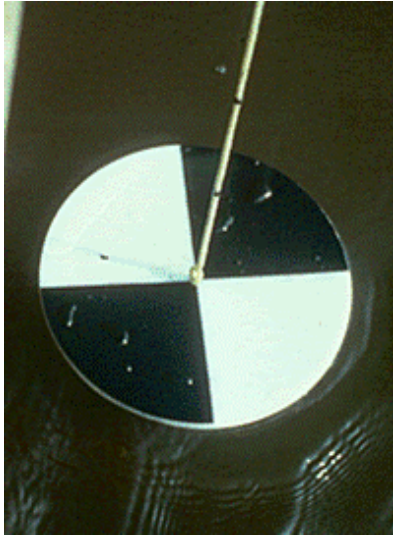
During the *Sabbathday Lake Water Quality Improvement Project*, the Sabbathday Lake Youth Conservation Corps (SLYCC) was formed. This group consisted of local high school students who installed residential conservation practices throughout the watershed. In 2004, SLYCC evolved into the Royal River Youth Conservation Corps to expand their scope of projects and funding sources. This YCC continued to work on Sabbathday Lake each year and completed 14 projects from 2004-2008.

In May of 2008, an updated watershed survey was conducted to continue the positive momentum of water quality protection within the Sabbathday Lake Watershed. The intent of this data is to help direct future water quality protection efforts based on past successes and current conditions.



2001 Sabbathday Lake Youth Conservation Corps.

Reports from past Sabbathday Lake implementation projects can be accessed online at www.cumberlandswcd.org



Secchi disk being lowered into the water to determine water clarity.

Sabbathday Lake's Water Quality

Water quality data for Sabbathday Lake has been collected since 1975. According to Maine DEP and the Volunteer Lake Monitoring Program, the water quality of Sabbathday Lake is considered to be above average. However, Sabbathday Lake's water quality is still at risk. Recent monitoring indicates moderate dissolved oxygen depletion in deep areas of the lake. Low levels of dissolved oxygen can cause phosphorous to leave the lake bottom leading to increased algal growth (please refer to page 3). Low levels of dissolved oxygen also impact cold-water fish and other aquatic species as they need oxygen in the water to survive. For these reasons, plus its regional significance, Maine DEP has placed Sabbathday Lake on the State's list of *Nonpoint Source Priority Watersheds*. Sabbathday Lake is also on Maine DEP's list of *Lakes Most at Risk from New Development*.

POLLUTED RUNOFF

Also called:

- Surface Runoff
- Stormwater Runoff
- Overland Flow
- Nonpoint Source (NPS) Pollution

Why is the Water Quality at Risk?

The biggest pollution culprit in Sabbathday Lake and most other Maine lakes is **polluted runoff**. During and after storms and snowmelt, soil (and hitch-hiking nutrients like phosphorus and nitrogen) washes into the lake from the surrounding landscape through streams, ditches and overland flow.

In an undeveloped, forested watershed, runoff is slowed and filtered by tree and shrub roots, grasses, leaves, and other natural debris on the forest

floor. It then soaks into the uneven forest floor and filters through the soil. In a developed watershed, however, stormwater does not always receive the treatment the forest once provided. It gathers with other runoff shed from impervious surfaces like rooftops, compacted soil, gravel camp roads, and pavement, speeds up, and becomes a destructive, erosive force. If the phosphorus supply to the lake is great enough, the resulting cycle of increased algae growth, death, and decomposition can lead to oxygen depletion in the bottom portion of the lake. When lake-bottom oxygen is gone, a chemical change occurs that allows phosphorus previously locked in the bottom sediments to be re-released into the lake waters. This "internal recycling" of phosphorus continues the downward spiral in lake quality.

There are many ways residents of Sabbathday Lake can reduce the impacts of polluted runoff. This report outlines several of these options.



Raking removes the natural duff layer (pine needles, leaves, etc.), which results in increased runoff into the lake.

How Does Runoff Become Problem?



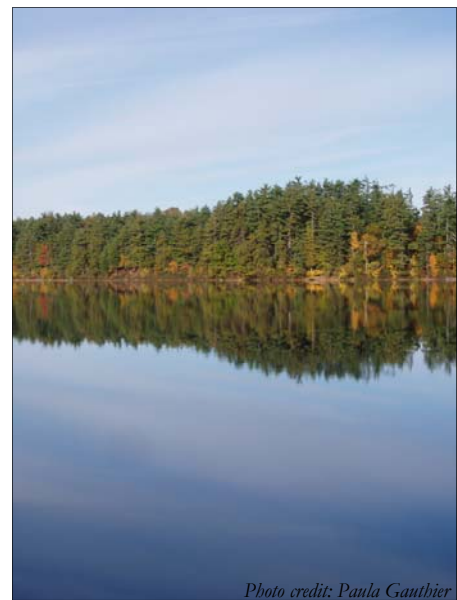
Excess **phosphorus** can “fertilize” a lake and lead to nuisance **algae blooms** like this one that occurred in 2002 on Pease Pond in Wilton, Maine.

The problem is not necessarily the water itself, it’s the sediment and nutrients in the surface runoff that can be bad news. Large volumes of sediment can settle out in the lake, creating an ideal substrate for nuisance and invasive aquatic plants such as variable-leaved water milfoil.

Phosphorus, a nutrient that is common in soils and dissolved in polluted runoff, is a primary food for all plants, including **algae**. In natural conditions, the scarcity of phosphorus in a lake limits algae growth. However, when a lake receives extra phosphorus from the watershed, algae growth increases dramatically. Sometimes this growth causes choking blooms, but more often it results in small, insidious changes in water quality that, over time, damage the ecology, aesthetics, and economy of lakes.

Why should we protect Sabbathday Lake from polluted runoff?

- ◆ The lake contains valuable habitat for fish, birds and other wildlife.
- ◆ Sabbathday Lake provides recreational opportunities to watershed residents and to visitors. It is an important contributor to the local economy.
- ◆ Sedimentation of a lake creates the perfect silty habitat for invasive aquatic plants, such as variable milfoil, which has become a threat to all Maine lakes.
- ◆ A 1996 University of Maine study demonstrated that lake water quality affects property values. For every meter (3 ft) decline in water clarity, shorefront property values can decline as much as 10 to 20 percent! Declining property values affect individual landowners as well as the economics of the entire community.
- ◆ Once a lake has declined, it can be difficult or impossible to restore.



Sabbathday Lake shoreline.

The Sabbathday Lake Association has been actively protecting its lake’s water quality for over 30 years. To learn more about SLA, visit their website at www.sabbathdaylakeassoc.org

The Purpose of the Watershed Survey

The primary purpose of the watershed survey was to:

- ◆ Identify and prioritize existing sources of polluted runoff, particularly soil erosion sites, in the Sabbathday Lake Watershed.
- ◆ Raise public awareness of the connection between land use and water quality and the impact of polluted runoff.
- ◆ Compare sites identified in this survey to those identified in 1996.
- ◆ Help direct future plans for remediation and protection efforts.
- ◆ Make general recommendations for fixing erosion problems documented.

The purpose of the survey was NOT to point fingers at landowners with problem spots, nor was it to seek enforcement action against landowners not in compliance with ordinances. The results of this survey are intended to provide landowners and the Sabbathday Lake Association the information needed to continue to protect Sabbathday Lake from polluted runoff.



The Survey Method

The survey was conducted by over 20 volunteers with the help of experienced technical staff. Volunteers were trained on survey techniques and erosion identification during a two hour classroom workshop on May 3rd, 2008. Following the classroom training, the volunteers and technical staff spent the remainder of the day in the field documenting erosion on the roads, shoreline, stream crossings, and foot trails in their assigned sectors by using cameras, GPS, and standardized forms. Sections that were not surveyed on May 3rd were completed by volunteers and technical staff throughout the summer. In the fall of 2008, technical staff conducted pollutant loading estimates of all identified medium and high impact sites.



Sabbathday Lake Watershed Survey volunteers.

The data collected was entered into a database, and the documented erosion sites were plotted on maps. The sites were broken out into categories (driveways, roads, private residences, etc.) and rated based on their impact on the lake and the estimated cost of fixing the problem. Maps and a description of sites and associated ratings are discussed in the next section of this report. A spreadsheet of the data collected is located in Appendix C.

Summary of Watershed Survey Findings

Volunteers and technical staff identified 58 erosion sites in the Sabbathday Lake Watershed that are currently impacting or have the potential to impact water quality.

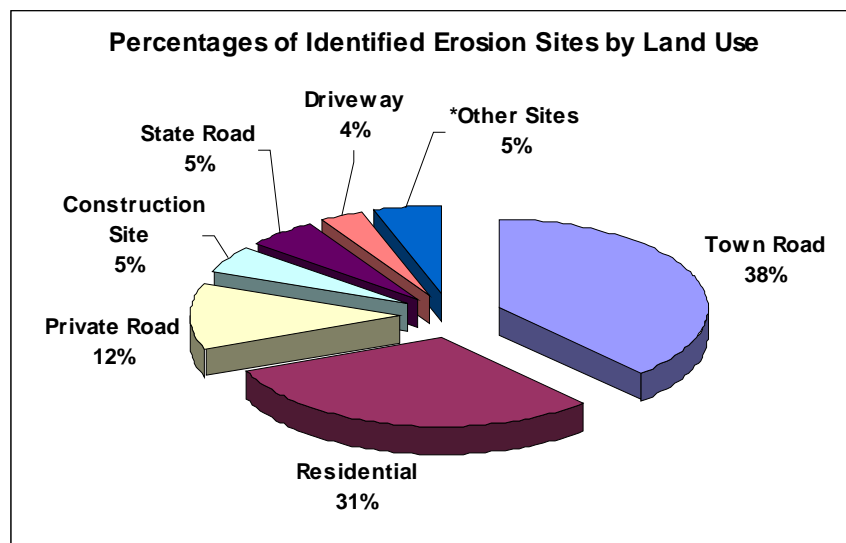
Table 1 represents the tally of sites in each category as well as their impact rating. Most sites were determined to have a low impact to the lake (34 total), but it is important to remember that the cumulative impact of all sites is what can cause water quality to decline. The different levels of impact are defined in the following pages.

The pie chart in Figure 1 below depicts the percentage of erosion sites documented in each land use category. Most sites were associated with town roads and residential properties. These areas accounted for 38% and 31% of all identified sites in the survey, respectively. Figure 2 at right shows a map of all documented sites.

Table 1. Summary of site categories and impacts

Land Use	High Impact	Medium Impact	Low Impact	Total
Town Road	1	10	11	22
Residential	0	7	11	18
Private Road	2	0	5	7
Construction Site	2	0	1	3
State Road	0	0	3	3
Driveway	0	0	2	2
Agriculture	0	1	0	1
Commercial	0	1	0	1
Beach Access	0	0	1	1
Total	5	19	34	58

Figure 1.



* Other sites include Agriculture (2%), Commercial (2%), and Beach Access (2%)

Figure 2.

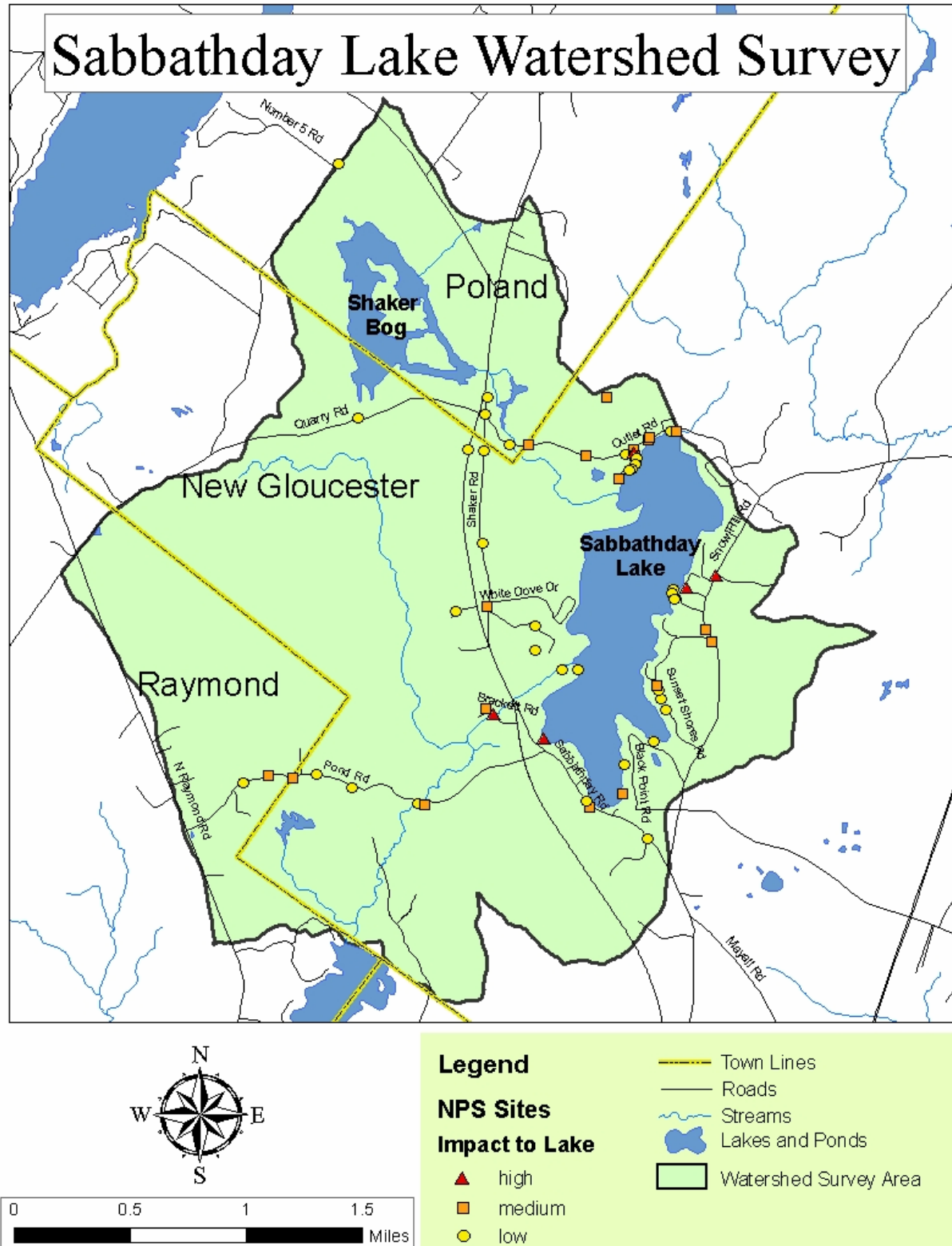
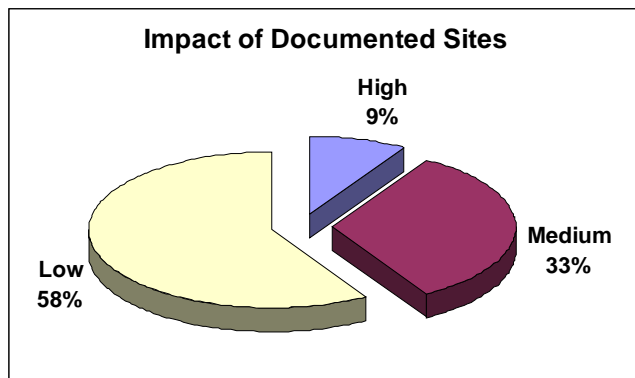


Figure 2. The Sabbathday Lake Watershed (5.33 square miles) with points representing the documented sites.

All of the documented sites were rated for their relative impact to water quality and the cost of materials and labor for the recommended fixes. Figures 3 and 4 depict these ratings.

Figure 3.

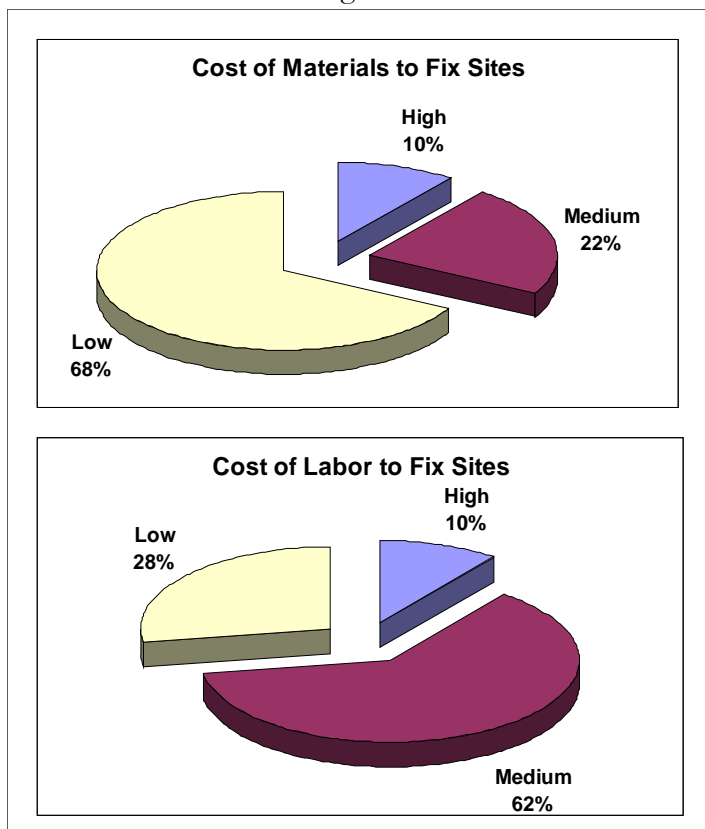


Impact was based on size of site, slope, amount of soil eroded and proximity to water.

- “Low” impact sites are those with limited soil transport off-site.
- At “medium” impact sites, sediment is transported off-site, but the erosion doesn’t reach a high magnitude.
- “High” impact sites are large sites where there is significant erosion that flows directly into a Sabbathday Lake or a waterbody flowing into the lake.

More than half of all documented sites were ranked low impact. It is important to keep in mind that, when combined with many other similar sites throughout a watershed, even erosion from small sources can have a significant impact on lake water quality.

Figure 4.



Cost is an important factor in planning for restoration. It is useful to consider costs for materials and labor individually, so as to not miss any “hidden” costs.

- “Low” cost sites were estimated to cost less than \$500 to fix.
- An estimate of \$500 to \$2,500 was rated “medium”.
- If the estimated cost to fix a site exceeded \$2,500, a “high” rating was assigned.

The majority of the sites identified had a low cost of materials and a medium cost of labor as due to the need to hire a contractor. Given these factors, we are hopeful that the Town of New Gloucester and Sabbathday Lake Watershed residents will take the initiative to address erosion problems on their properties. Fixing erosion problems are good for the community and good for the lake!

Town Roads

Of the 22 town road sites documented through the survey, 11 were low impact, 10 were medium impact, and one was high impact. These problems are fairly expensive to fix and most require technical assistance.

Common Problems Identified:

- Unstable culvert inlets and outlets
- Moderate shoulder erosion
- Buildup of winter sand
- Clogged, rusted, or broken culverts
- Unstable ditching / ditch erosion

Recommended Solutions:

- Clean out culverts and armor culvert inlets and outlets with riprap
- Vegetate or stabilize road shoulders
- Remove winter sand
- Replace clogged, rusted, or broken culverts
- Enlarge and lengthen culverts contributing to erosion
- Clean, reshape, and armor ditches with stone or vegetate with grass

The erosion problems associated with the town road pictured below were common on many other roads throughout the watershed.



(Sector and site number blocked from photos for generalization purposes.)

Problems:

- Unstable culvert inlet and outlet.
- Clogged culvert.
- Severe road shoulder erosion.
- Winter sand buildup.

Solutions:

- Armor culvert inlet and outlet with stone.
- Install larger culvert.
- Stabilize road shoulder with angular rip rap.
- Remove winter sand.

Erosion sites on town roads were identified as the most common land use impacting Sabbathday Lake (38%). Many of these sites simply require improved road maintenance whereas others require improving road culvert crossings.

Residential Areas

(Shoreline, footpaths, structures, recreation areas, etc.)

Of the 18 sites associated with residential areas documented through the survey, 11 were low impact, seven were medium impact, and none were high impact. The majority of the sites can be fixed with little technical expertise and low cost.

Common Problems Identified:

- Lack of shoreline vegetation
- Bare or sparsely vegetated areas
- Slight to moderate surface erosion
- Direct flow of surface runoff to lake
- Roof runoff causing erosion

Typical Solutions to these Problems:

- Establish or enhance shoreline vegetation
- Vegetate and mulch bare soil
- Limit foot traffic in eroding areas
- Define recreational areas on property
- Install waterbar, open-top culvert, rubber bar, or other runoff diverter
- Install dripline trench to catch roof runoff



The erosion problems associated with the property pictured at left were common on many other properties within the watershed.

Problems:

- Lack of shoreline vegetation.
- Bare soil with surface erosion.
- Direct flow of sediment to pond.
- Exposed tree roots.

Solutions:

- Plant native plants.
- Mulch bare areas.
- Infiltrate or redirect runoff above shoreline.
- Stop raking.

Residential areas were the second most common land use to impact Sabbathday Lake at 31%. This differs from the 1996 survey, where only 9% of erosion sites identified were associated with residential properties.

Private Roads

Of the seven private road sites documented through the survey, five were low impact, none were medium impact, and two were high impact. These problems vary in technical expertise and cost to fix.

Common Problems Identified:

- Moderate surface erosion
- Bare soil
- Unstable culvert inlet and outlet
- Plow or grader berms
- Severe ditch erosion
- Severe shoulder erosion
- Inadequate shoreline vegetation

Recommended Solutions:

- Crown and reshape to get water off road
- Install diverters such as waterbars, open top culverts, or rubber bars to get water off road
- Armor culvert inlets and outlets with riprap
- Remove grader berms and winter sand to allow proper drainage
- Clean, reshape, and armor ditches with stone or vegetate with grass
- Vegetate road shoulders / lake shoreline

The erosion problems associated with the private road pictured below were common on many other roads within the watershed.



Problems:

- Severe road shoulder erosion.
- Severe ditch erosion.
- Road surface erosion.
- Poor surface material.
- Direct flow of road material to stream.

Solutions:

- Add new / proper surface material.
- Reshape and crown road.
- Reshape and stabilize ditching.
- Install runoff diverters or turnouts to direct water to areas where it will infiltrate.
- Stabilize road shoulder with vegetation or stone.

Sediment is one of the biggest sources of pollution to Maine lakes.



A collapsed silt fence observed at a construction site in the Sabbathday Lake Watershed.

Construction Sites

Three construction sites were identified in this survey: two were high impact and one was low impact. Bare soil on construction sites is inevitable, however, proper use of silt fences, erosion control berms, and hay mulch limits the impact of construction activity. Maintenance of sediment barriers and inspections by the code enforcement officer helps to ensure that sediment will not leave the construction area.

For more information on construction Best Management Practices (BMPs), visit www.cumberlandswcd.org to download Maine DEP's "Maine Erosion and Sediment Control BMPs" manual.

State Roads

Three state road sites were documented, all of which were rated as low impact. These sites had similar issues to the town and private road sites, which included road shoulder erosion, bare soil, ditch erosion, and winter sand buildup. Recommendations for improving these issues include stabilizing road shoulders and ditching with vegetation or stone and removing winter sand build up.

Excess winter sand buildup can not only cause water quality problems, but can clog sediment basins and culverts used to filter and channel road runoff.

The photo at right shows excess winter sand washing off a state road site. Winter sand buildup was common in this survey.

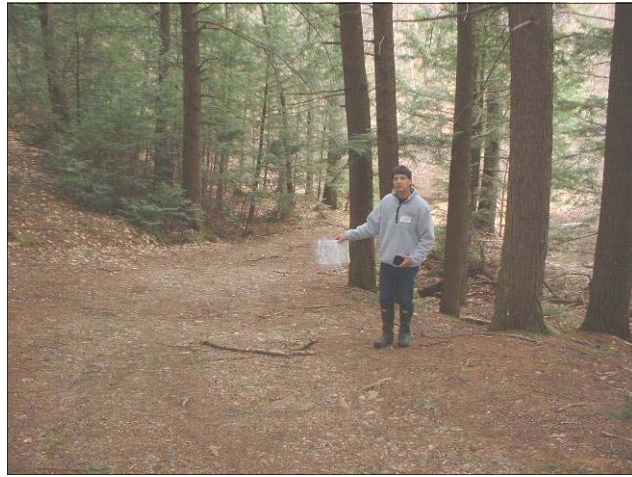


Driveways

Two low impact driveway sites were documented in this survey. Both sites showed signs of moderate surface erosion. Like gravel roads, driveways also need to be created with proper road material and crowned in order to get the water off the surface quickly.

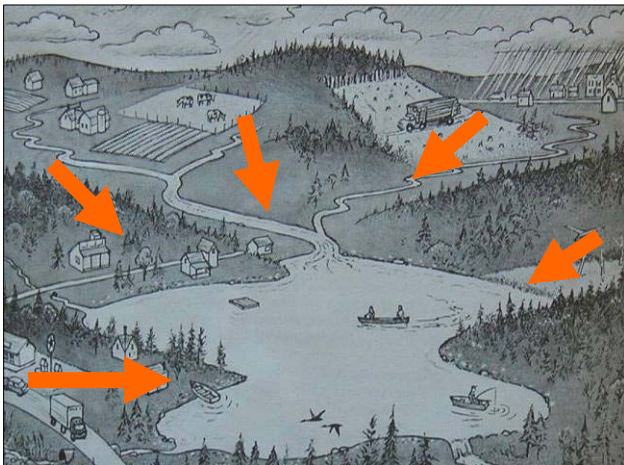
Preserve water quality and save time, money, and wear and tear on your vehicle by having a well crowned driveway. Use adequate surface material and add diverters to direct runoff into stable, vegetated areas.

The photo at right shows a gravel driveway lacking a proper crown. This causes water to wash down the driveway leading to erosion problems.



Other Impacts

One medium impact agricultural site, one medium impact commercial site, and one low impact beach access site were also identified in this survey.



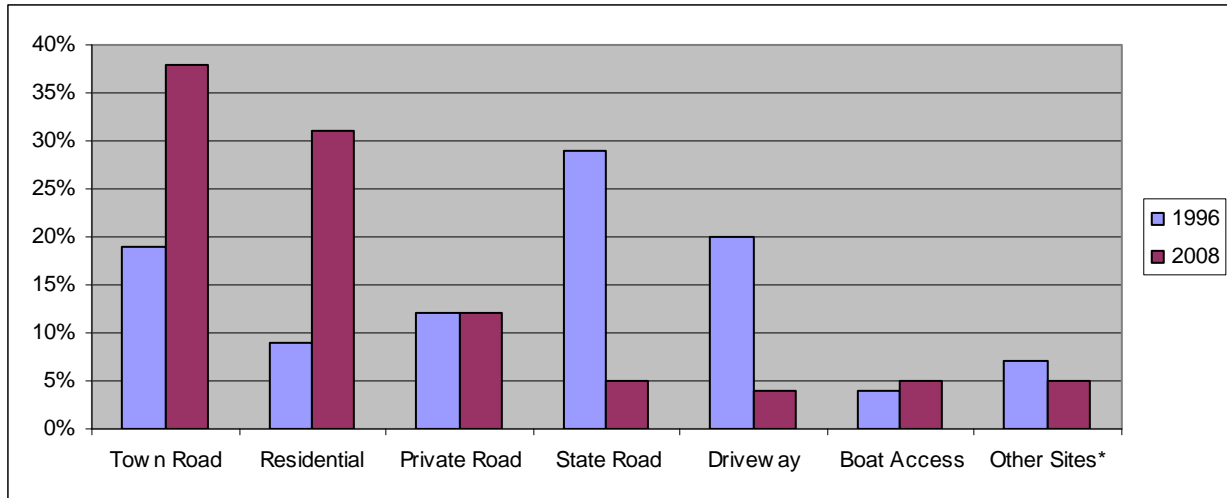
Remember, it is the cumulative impact of many sites that causes water quality to decline.

Also, erosion problems on one property may be the result of runoff from an adjacent property. Improving lake water quality involves addressing problems throughout the entire watershed.

Comparison of 1996 Survey Data to 2008

Figure 5.

Percentages of Identified Erosion Sites by Land Use



*Other sites include Beaches, Commercial, and Logging observed in 1996 and Agricultural, Commercial, and Beach Access observed in 2008.

In comparing data from both watershed surveys, 75 water quality impact sites were identified in 1996 whereas 58 were identified in 2008. In 1996, the majority of erosion sites identified were state roads, driveways, town roads and private roads. In 2008, the majority of erosion sites identified were town roads and residential properties (Please refer to Figure 5 above). Water quality impacts were observed at boat access and logging sites in 1996 and not in 2008 and impacts at agriculture and construction sites were observed in 2008 and not in 1996.

The construction of the Route 26 bypass helped address many of the state road sites identified in 1996. During this time, some state roads were also transferred to the Town of New Gloucester. These factors likely resulted in the different land uses observed between 1996 and 2008.

Table 2.

1996 Impact Ratings		2008 Impact Ratings	
High	61%	High	9%
Medium	20%	Medium	33%
Low	19%	Low	58%

Percentages based on 75 sites documented.

Percentages based on 58 sites documented.

In comparing overall impact ratings of the sites documented (Table 2 above), there was a much higher percentage of high impact sites documented in 1996 than in 2008. Although 2008 shows a decrease in the amount of high impact sites identified, it is important to remember that it is the cumulative impact of all sites that causes water quality to decline.

Based on current survey data, improving residential and town road sites is the current priority for water quality protection.

Next Steps ~ Where Do We Go From Here?

Fixing the sites identified in this survey will require efforts by Sabbathday Lake Association, the Town of New Gloucester, watershed residents, and road associations. Below are suggestions for next steps.

Sabbathday Lake Association

- Work with the Town of New Gloucester to create an action plan for addressing town road sites to protect Sabbathday Lake's water quality.
- Work with the Town of New Gloucester's Environmental Resources Committee to organize training on road impacts to water quality for public works, planning board, and select board.
- Organize work parties for landowners and private roads to improve problem sites or invest in hiring labor from the Youth Conservation Corps.
- Provide educational materials and guidance to the Sabbathday Lake Watershed community on the importance of protecting the lake from polluted runoff.

Town of New Gloucester

- Conduct regular maintenance on town roads in the watershed, and fix town road problems identified in this survey.
- Properly remove excess winter sand from roadways promptly.
- Promote training for road crews, boards, commissions, and other decision-makers.
- Continue strong enforcement of Shoreland Zoning Ordinances and the Erosion and Sediment Control Law to ensure protection of Sabbathday Lake.

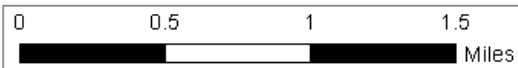
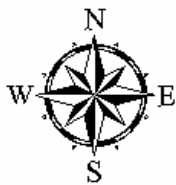
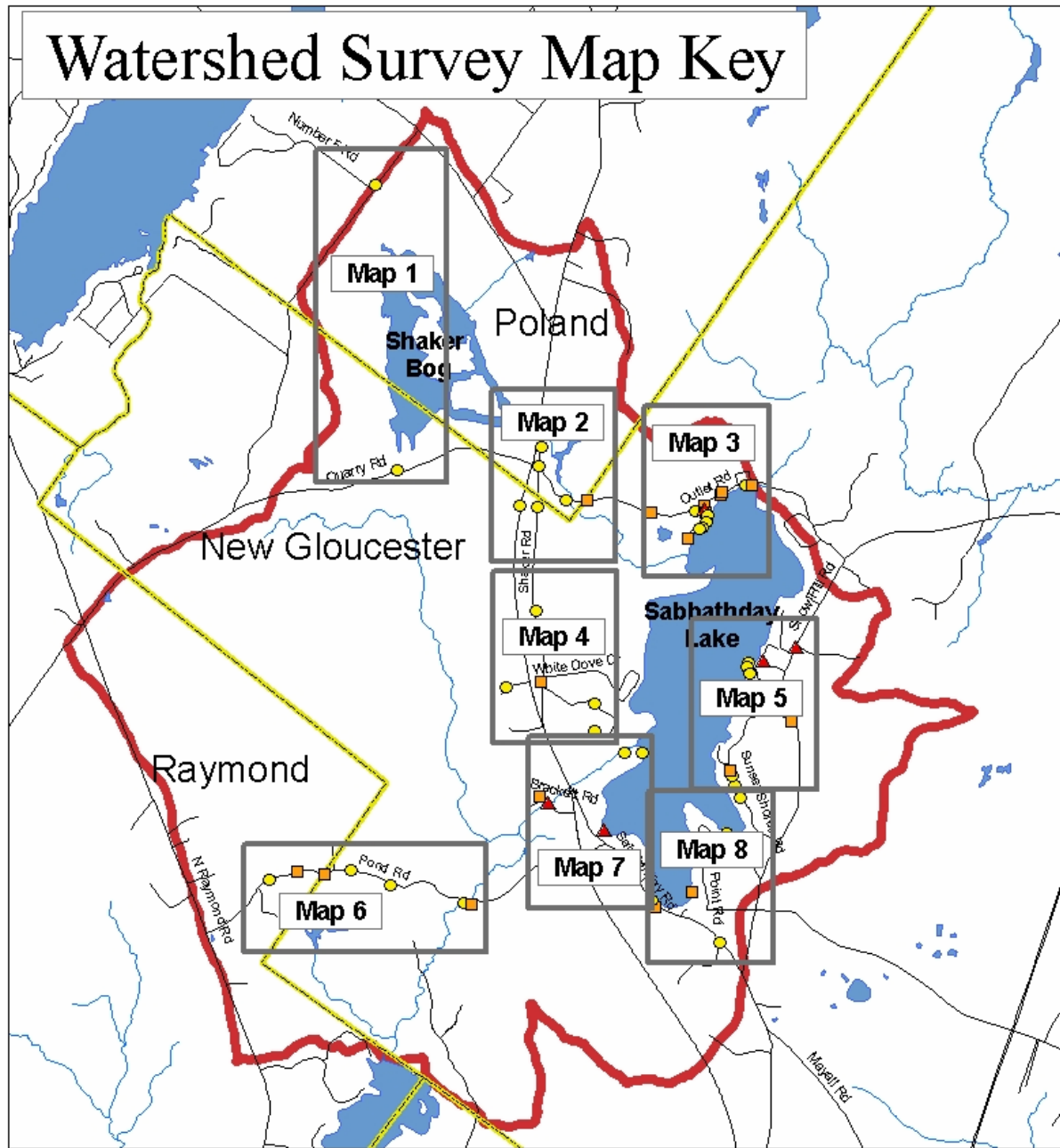
Individual Citizens

- Prevent polluted runoff from washing into the lake. Collect runoff in depressions or divert flow to vegetated areas for infiltration. Call CCSWCD or Maine DEP for free advice.
- Minimize the amount of cleared land and road surfaces on your property.
- Stop mowing and raking, and let lawns and raked areas revert back to native plants.
- Avoid exposing bare soil. Vegetate and mulch bare areas.
- Don't ever add sand to shorelines and don't rebuild beaches without permits and technical assistance.
- Call the Code Enforcement Officer before cutting vegetation within 250 feet of the shore.
- Maintain septic systems properly. Pump septic tanks (every 2-3 years for year round residences; 4-5 years if seasonal), and upgrade marginal systems.
- Join the Sabbathday Lake Association.

Road Associations (or private roads without associations)

- Minimize road runoff by doing regular, comprehensive maintenance. Form a road association if one does not already exist. (Free copies of *A Guide to Forming Road Associations* are available through the Maine DEP by calling 822-6300 or download a copy at www.cumberlandswcd.org).
- Get a copy of *Camp Road Maintenance Manual – A Guide for Landowners* and share it with contractors working on and/or plowing the road. This reference is a "must-have" for anyone managing a gravel road. (Call the Maine DEP at 822-6300 to order a free copy.)
- Contact the CCSWCD or Maine DEP to get help for extensive problems.

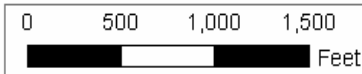
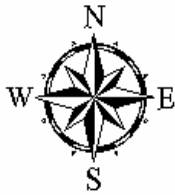
Appendix A: Sabbathday Lake Watershed Survey Maps



Legend	--- Town Lines
	— Roads
NPS Sites	~ Streams
Impact to Lake	Lakes and Ponds
▲ high	Watershed Survey Area
■ medium	
● low	



Survey Map 1



Legend		Town Lines Roads Streams Lakes and Ponds Watershed Survey Area	A Agricultural B Beach Access Cn Construction Cm Commerical D Driveway P Private Road R Residential S State Road T Town Road
NPS Sites Impact to Lake			
	high		
	medium		
	low		

Survey Map 2



Legend

NPS Sites

Impact to Lake

▲ high

■ medium

● low

— Town Lines

— Roads

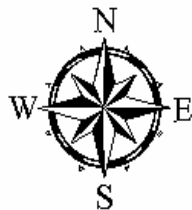
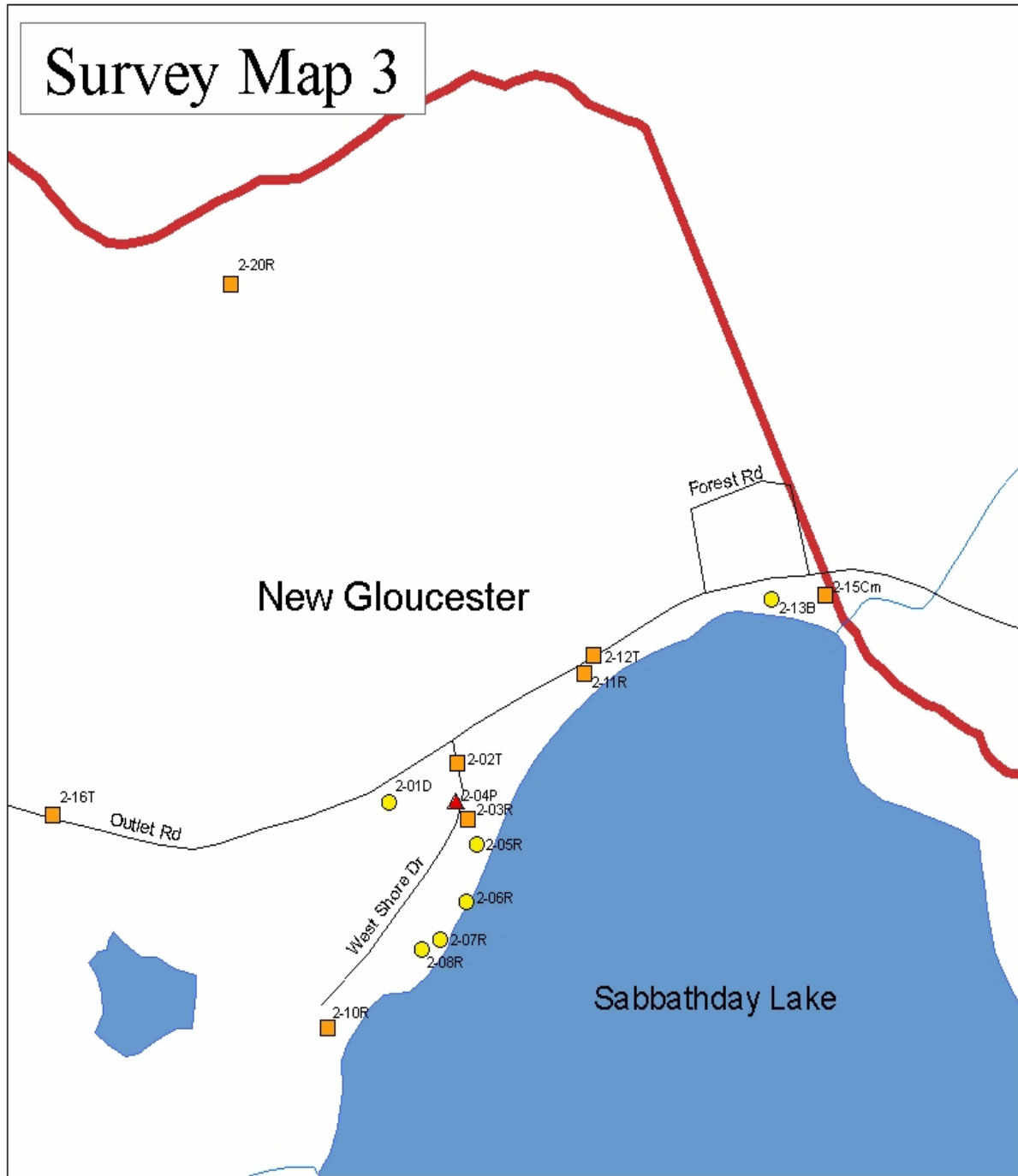
~ Streams

☞ Lakes and Ponds

▭ Watershed Survey Area

A Agricultural
 B Beach Access
 Cn Construction
 Cm Commerical
 D Driveway
 P Private Road
 R Residential
 S State Road
 T Town Road

Survey Map 3



Legend

NPS Sites

Impact to Lake

▲ high

■ medium

● low

--- Town Lines

— Roads

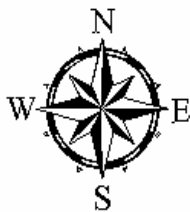
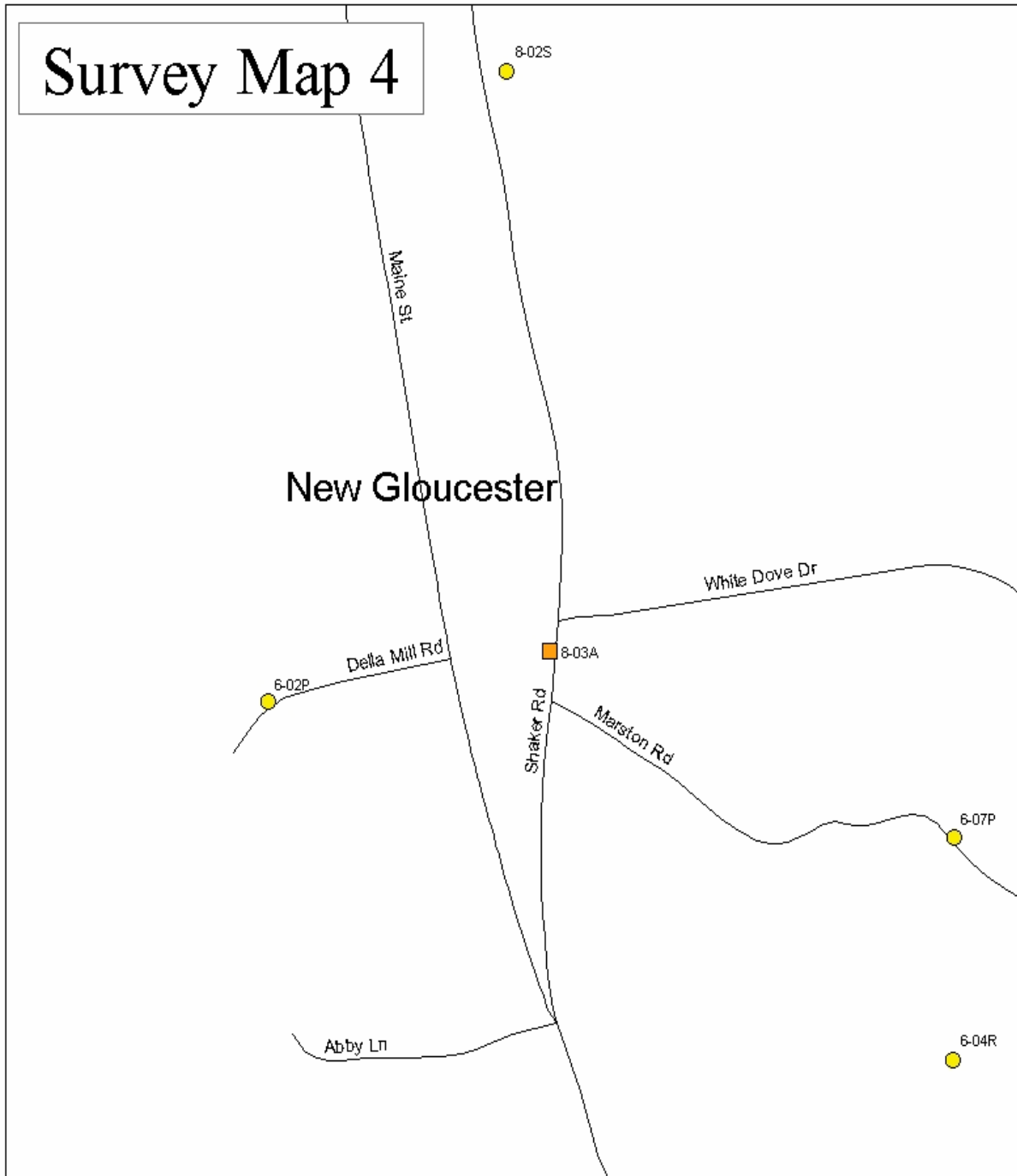
~ Streams

☪ Lakes and Ponds

▭ Watershed Survey Area

A Agricultural
 B Beach Access
 Cn Construction
 Cm Commerical
 D Driveway
 P Private Road
 R Residential
 S State Road
 T Town Road

Survey Map 4



Legend

NPS Sites

Impact to Lake

▲ high

■ medium

● low

--- Town Lines

— Roads

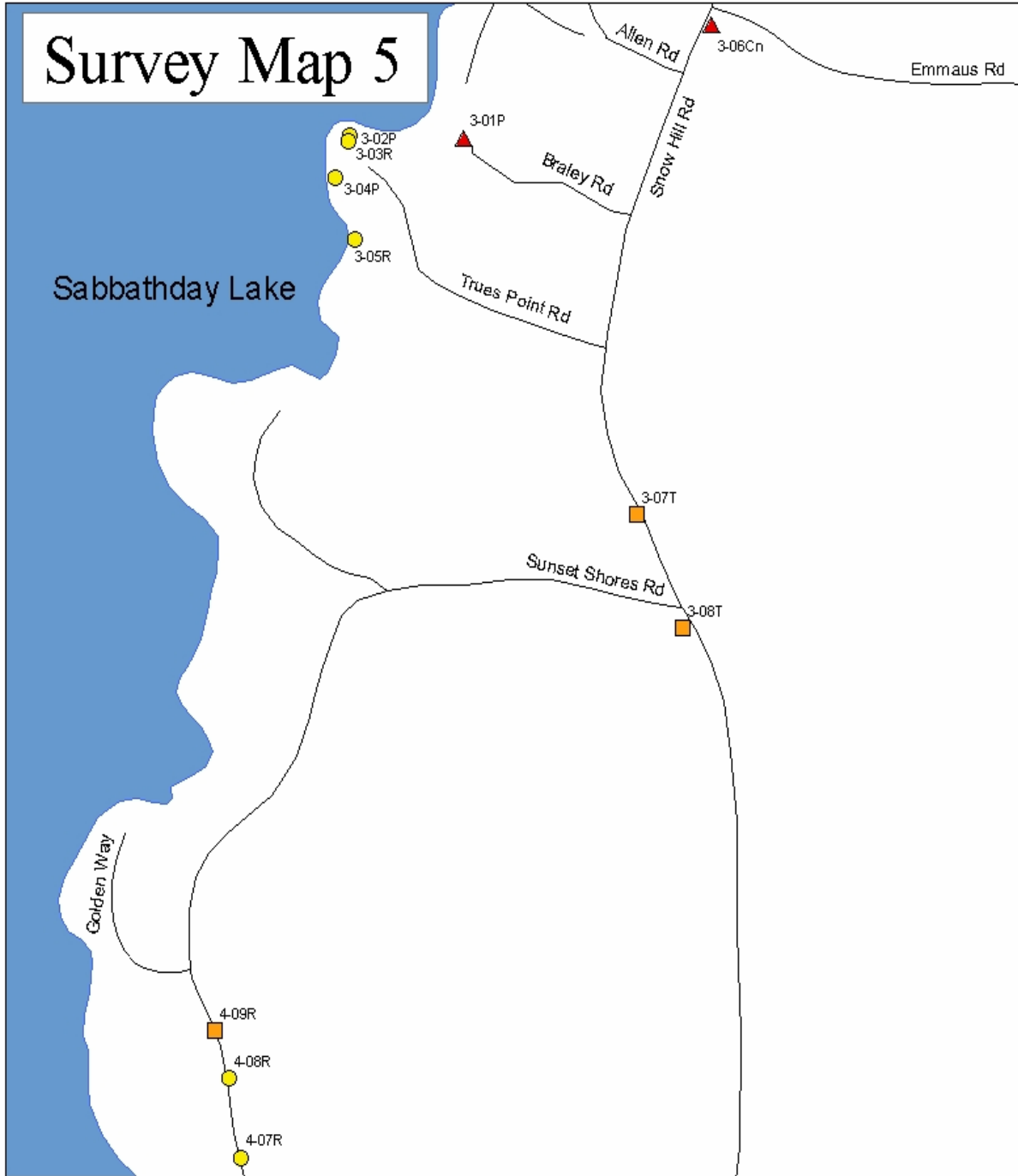
~ Streams

👉 Lakes and Ponds

▭ Watershed Survey Area

A Agricultural
 B Beach Access
 Cn Construction
 Cm Commerical
 D Driveway
 P Private Road
 R Residential
 S State Road
 T Town Road

Survey Map 5



Legend

NPS Sites

Impact to Lake

▲ high

■ medium

● low

--- Town Lines

— Roads

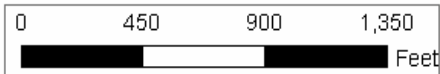
~ Streams

☞ Lakes and Ponds

▭ Watershed Survey Area

A Agricultural
 B Beach Access
 Cn Construction
 Cm Commerical
 D Driveway
 P Private Road
 R Residential
 S State Road
 T Town Road

Survey Map 6



Legend

NPS Sites

Impact to Lake

▲ high

■ medium

● low

--- Town Lines

— Roads

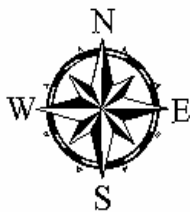
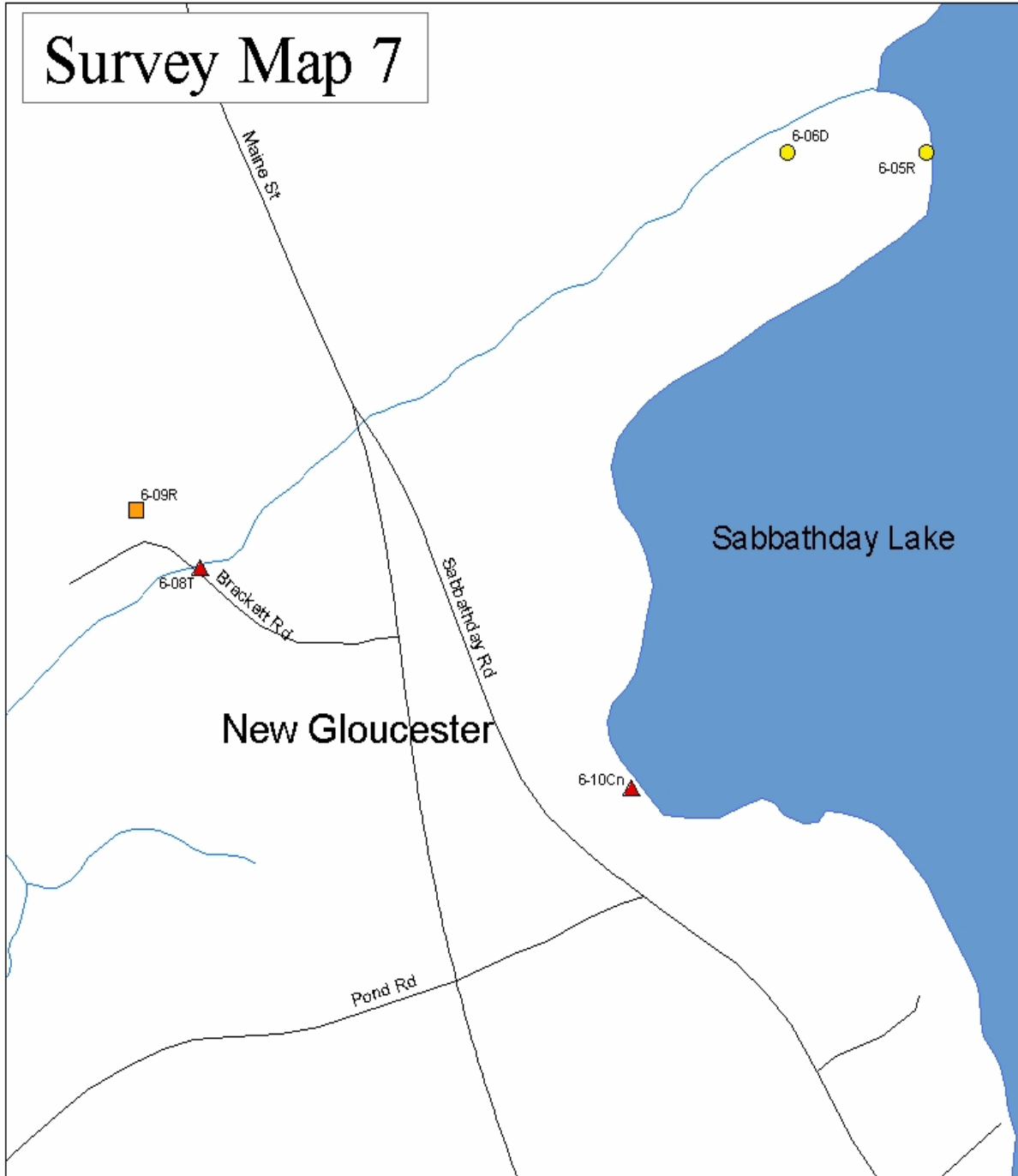
~ Streams

☪ Lakes and Ponds

▭ Watershed Survey Area

A Agricultural
 B Beach Access
 Cn Construction
 Cm Commerical
 D Driveway
 P Private Road
 R Residential
 S State Road
 T Town Road

Survey Map 7



Legend

NPS Sites

Impact to Lake

- ▲ high
- medium
- low

Town Lines

Roads

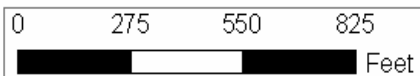
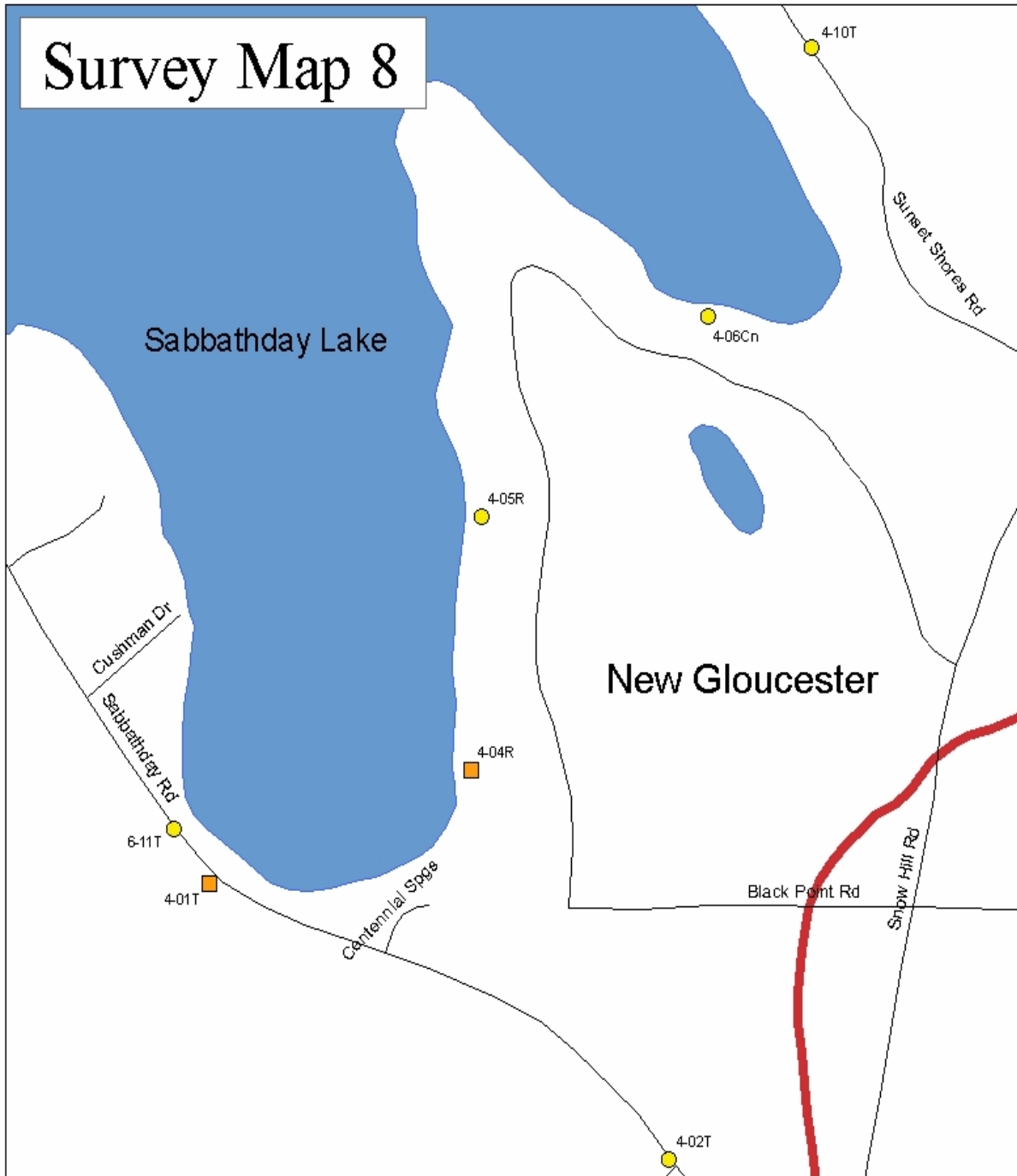
~ Streams

⊕ Lakes and Ponds

Watershed Survey Area

- A Agricultural
- B Beach Access
- Cn Construction
- Cm Commerical
- D Driveway
- P Private Road
- R Residential
- S State Road
- T Town Road

Survey Map 8



Legend

NPS Sites

Impact to Lake

- ▲ high
- medium
- low

Town Lines

Roads

~ ~ ~ Streams

⊕ Lakes and Ponds

Watershed Survey Area

- A Agricultural
- B Beach Access
- Cn Construction
- Cm Commerical
- D Driveway
- P Private Road
- R Residential
- S State Road
- T Town Road

Appendix B: Sabbathday Lake Watershed Survey Surveyors

Sector 1	Chris Dunn, Technical Leader Charlene Belden Stu Belden
Sector 2	Jami Fitch, Technical Leader Joan Cloutier Adam Shoukimas Dan Wheatley Greg Whitney
Sector 3	Phoebe Hardesty, Technical Leader David Anderson Carol Beyna Paul Gillis Ali Naqui Muneria Naqui
Sector 4	Ann Speers, Technical Leader Lisa Howell Joe James Anne Maurice Linda Schier
Sector 5	Betty Williams, Technical Leader Mike Cloutier Diane Salisbury John Salisbury
Sector 6	Kristin Feindel, Technical Leader Matt Johnson Chris Ricardi
Sector 7 and 8	Wendy Garland and Heather True, Technical Leaders Carol Lafond Cheri Schlenker

Appendix C: Sites Documented through the Sabbathday Lake Watershed Survey - 2008

Sector & Site*	Map #	Location	Tax Map**	Tax Lot**	Land Use / Activity	Description	Recommendations	Impact	Cost of Materials	Cost of Labor
1-01	2	End old Shaker Road			State Road	road shoulder erosion - slight; soil - bare	vegetation - establish buffer YCC/Volunteers: possible project to install native plants	low	low	low
1-02	1	Intersection of Colbath and #5 Road			Town Road	culvert - clogged; road shoulder erosion - slight; roadside plow/grader berm	culvert- replace; remove winter sand	low	medium	medium
2-01	3	Outlet Rd	5	4	Driveway	surface erosion - moderate	roads/driveway - install detention basin/install runoff diverters at outlet of diverter - rubber razor YCC/Volunteers: create and install rubber razor water diverter once other BMPs are in place	low	low	low
2-02	3	Outlet Rd @ West Shore Dr	5	7	Town Road	culvert - unstable inlet/outlet; ditch - slight erosion ; road shoulder erosion - moderate; soil - winter sand	culvert - armor inlet/outlet, lengthen; ditch - vegetate; other - remove winter sand; road - vegetate shoulder	medium	low	medium
2-03	3	Stream crossing on W. Shore Dr.	5	4	Residential	roadside plow/grader berm surface; erosion - slight	residential - define foot path, mulch/erosion control mix, infiltration steps YCC/Volunteers: create erosion control mulch (ECM) footpath, installation of infiltration steps	medium	low	low
2-04	3	West Shore Road at stream crossing	5	4	Private Road	culvert - unstable inlet/outlet; roadside plow/grader berm ;surface erosion - moderate	culvert - replace & lengthen; roads/driveway - build up, add new surface material, reshape (crown), grade, install runoff diverters - broad-based dip	high	high	high
2-05	3	West Shore Road	5	5	Residential	surface erosion - slight; shoreline - lack of vegetation	residential - mulch, vegetation - establish shrubs YCC/Volunteers: spread ECM and plant native plants	low	low	low
2-06	3	West Shore Road	5	7	Residential	shoreline - lack of vegetation, erosion	vegetation - establish shrubs YCC/Volunteers: plant native plants	low	low	low
2-07	3	West Shore Road	5	9	Residential	shoreline - undercut	residential - rip rap YCC/Volunteers: possibly hand placing angular rip rap once proper permits have been put into place	low	low	low
2-08	3	West Shore Road	5	10	Residential	shoreline - lack of vegetation	residential - define foot path, install runoff diverter, dripline; vegetation - establish YCC/Volunteers: define footpath, install runoff diverter, install dripline trench, plant native trees and shrubs	low	medium	low

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**Tax Map and Lot numbers may not be the actual location of the site.

Appendix C: Sites Documented through the Sabbathday Lake Watershed Survey - 2008

Sector & Site*	Map #	Location	Tax Map**	Tax Lot**	Land Use / Activity	Description	Recommendations	Impact	Cost of Materials	Cost of Labor
2-10	3	West Shore Road	5	14	Residential	surface erosion - severe (bank behind house); soil - bare	install runoff diverters - waterbar; dripline; vegetation - establish, no raking YCC/Volunteers: install runoff diverters and dripline trench; plant native trees and shrubs; possibly spread ECM on recreation areas / areas of bare soil	medium	medium	low
2-11	3	Outlet Rd	5	7-11	Residential	soil - winter sand; shoreline - lack of vegetation	remove winter sand; vegetation - establish YCC/Volunteers: plant native vegetative buffer; spread ECM between plantings	medium	low	low
2-12	3	Outlet Rd	5	7-10	Town Road	culvert - unstable (outlet); road shoulder erosion - slight; soil - winter sand	culvert - armor (outlet), lengthen, install plunge pool; remove sand	medium	medium	medium
2-13	3	Across from #113 Outlet Road			Beach Access	shoreline- undercut, erosion, unstable access	residential - mulch/erosion control mix, add stones under roots; vegetation - establish YCC/Volunteers: spread ECM on walkways and areas of exposed soil, add stones under roots; plant native trees and shrubs	low	low	low
2-15	3	Outlet Beach	5	7-2	Commercial	soil - bare; shoreline - undercut, lack of vegetation, erosion	residential - mulch/erosion control mix; vegetation - establish, no raking; H2O bar YCC/Volunteers: install waterbar; spread ECM on walkways and areas of exposed soil; plant native trees and shrubs	medium	low	low
2-16	3	Outlet Rd - Pine Tree pole #134 CMP pole # 10			Town Road	culvert - unstable, clogged; road shoulder erosion - moderate; soil - winter sand	culvert - armor, remove clog, replace, lengthen; remove winter sand	medium	high	high
2-17	2	Outlet Rd - stream crossing			Town Road	culvert - unstable; road erosion - moderate	culvert - armor, replace, enlarge, lengthen (ideally - but not likely)	medium	high	high
2-18	2	Outlet Rd - MP pole # 4			Town Road	ditch - moderate erosion; road shoulder erosion - moderate at top of culvert inlet; other - full check dam	clean behind check dam YCC/Volunteers: clean out check dam	low	low	low
2-19	1	Bog - crossing Quarry Rd			Town Road	culvert - unstable, clogged (undersized); road shoulder erosion - severe; surface erosion - slight	culvert - armor, enlarge, lengthen; stabilize shoulder	low	high	high

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Appendix C: Sites Documented through the Sabbathday Lake Watershed Survey - 2008

Sector & Site*	Map #	Location	Tax Map**	Tax Lot**	Land Use / Activity	Description	Recommendations	Impact	Cost of Materials	Cost of Labor
2-20	3	Outlet Road	6	2	Residential	Residential - bank erosion, moderate surface erosion on shoulder and under steps to lake; Town Road - shoulder erosion	shape and regrade shoulder to sent water into buffer; fill existing gully beneath steps with angular rock covered with clean crushed rock - hand placement YCC/Volunteers: possibly hand place angular rock and clean crushed rock under steps once shoulder has been regraded and shaped and proper permits are in place	medium	low	medium
3-01	5	Braley Rd	23	30	Private Road	surface erosion - moderate; soil - bare	roads/driveway - gravel, grade, install runoff diverters -waterbar: residential - infiltration steps down lake access YCC/Volunteers: once road / driveway has been regraded: create and install rubber razor water diverter; install infiltration steps	high	low	low
3-02	5	True's Point Rd	23	24	Private Road	surface erosion - slight; soil - bare	residential - mulch/erosion control mix; vegetation - establish on shorefront, enhance with blueberries, natives YCC/Volunteers: plant native trees and shrubs; spread ECM	low	low	low
3-03	5	True's Point Rd	23	24	Residential	shoreline - inadequate shoreline vegetation, erosion - very limited	vegetation - enhance w/ native shrubs and groundcover YCC/Volunteers: plant native trees and shrubs; spread ECM between plantings	low	low	low
3-04	5	True's Point Rd			Private Road	shoreline - inadequate shoreline vegetation	vegetation - establish small evergreens YCC/Volunteers: plant native trees and shrubs; spread ECM between plantings	low	low	low
3-05	5	True's Point Rd			Residential	runoff from deck	residential - crushed walkway/drip edge; vegetation - establish juniper/blueberry YCC/Volunteers: install dripline trench and washed crushed stone walkway; plant native shrubs along shoreline	low	low	low

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Appendix C: Sites Documented through the Sabbathday Lake Watershed Survey - 2008

Sector & Site*	Map #	Location	Tax Map**	Tax Lot**	Land Use / Activity	Description	Recommendations	Impact	Cost of Materials	Cost of Labor
3-06	5	Sabbathday Heights Development			Construction Site	poor erosion control practices; evidence of sediment movement; road shoulder erosion (level not indicated); surface erosion - moderate; soil - bare	Construction site: impact may change prior to report's printing	high	medium	medium
3-07	5	Snow Hill Rd, just before Sunset Shores Rd, CMP telephone pole #20, Pinetree #19			Town Road	road shoulder erosion - moderate; soil bare, winter sand; other - shoulder erosion into culvert into stream	road/driveways - vegetate shoulder (if possible, sandy); other ideas- need to reseed after ditch/shoulder maintenance	medium	low	low
3-08	5	Snow Hill Rd, bog under road net to Sunset Shores			Town Road	culvert - unstable (inlet); road shoulder erosion - moderate; soil - bare, winter sand	culvert - armor (inlet); roads/driveway - vegetate shoulder	medium	low	low
4-01	8	Across from Grange Hall and extending to beach area			Town Road	culvert - clogged, plunge pool needs cleaning; soil - winter sand; shoreline - lack of vegetation, inadequate vegetation (plantings did not take), unstable access	clean plunge pool; replant vegetation; remove winter sand YCC/Volunteers: clean plunge pool and replant native vegetation	medium	low	low
4-02	8	Along Sabbathday Rd from Eagle Club to Snow Hill		22-F	Town Road	culvert - clogged; soil - winter sand	culvert - remove clog; clean out ditch	low	low	medium
4-04	8	Black Point Rd	22	7	Residential	soil - bare	vegetation - establish YCC/Volunteers: plant native shrubs; possibly spread ECM between plantings	medium	low	low
4-05	8	Black Point Rd	22	7	Residential	divert the direct runoff to the lake	residential - infiltration trench, install runoff diverter, rain garden YCC/Volunteers: install runoff diverter (possibly rubber razor); possibly install infiltration trench and rain garden if feasible	low	low	low
4-06	8	Black Point Rd	22	24?	Construction Site	none indicated	need to recheck after construction complete YCC/Volunteers: possibly install native trees and shrubs along shoreline once construction is complete	low	low	low
4-07	5	Golden Rd off Sunset Shores Rd	23	1	Residential	roof runoff erosion	residential - rain garden YCC/Volunteers: possibly install native rain garden; consider installing roof dripline trench	low	low	low

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**Tax Map and Lot numbers may not be the actual location of the site.

Appendix C: Sites Documented through the Sabbathday Lake Watershed Survey - 2008

Sector & Site*	Map #	Location	Tax Map**	Tax Lot**	Land Use / Activity	Description	Recommendations	Impact	Cost of Materials	Cost of Labor
4-08	5	Golden Rd off Sunset Shores Rd	23	3	Residential	shoreline - lack of vegetation, inadequate vegetation	residential - define foot path, install drip edge; vegetation - establish YCC/Volunteers: define foot path (consider crushed stone tiers), cover areas of exposed soil with ECM, plant native trees and shrubs	low	low	low
4-09	5	Sunset Shores Rd	23	7	Residential	soil - bare; shoreline - inadequate vegetation, erosion; surface erosion - moderate	residential - mulch/erosion mix; vegetation - establish YCC/Volunteers: spread ECM along walkway and areas of bare soil; plant native trees and shrubs	medium	low	low
4-10	8	Left of Richardson's on Sunset Rd		4	Town Road	culvert - unstable (inlet); road shoulder erosion - moderate; soil - bare	culvert - armor (inlet); ditch - vegetate; other - redefine turnout, reinstall sediment basin, install sediment basin or waterbar to catch runoff from lake-side of road; roads/driveways - install runoff diverters - waterbar? YCC/Volunteers: possibly help install waterbar or sediment basin along driveway on lake-side of road	low	low	medium
6-02	4	Della Mills Rd, Util Pole 68-3			Private Road	ditch - moderate erosion	ditch - vegetate, armor with stone	low	medium	low
6-04	4	Marston Rd	20	10	Residential	surface erosion - slight; shoreline - lack of vegetation, erosion, unstable access	residential - define foot path, mulch/erosion control mix; vegetation - no raking YCC/Volunteers: define walkway; plant native trees and shrubs; cover areas of exposed soil with ECM; possibly hand place fallen stone along shoreline if granted by permits	low	low	low
6-05	7	Marston Rd	20	6	Residential	surface erosion - slight; soil - bare; roof runoff/erosion; inadequate shoreline vegetation	residential - infiltration trench/drip edge; vegetation - establish and enhance; construction site - mulch YCC/Volunteers: install dripline trench, plant native trees and shrubs; cover areas of bare soil with ECM	low	low	low

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Appendix C: Sites Documented through the Sabbathday Lake Watershed Survey - 2008

Sector & Site*	Map #	Location	Tax Map**	Tax Lot**	Land Use / Activity	Description	Recommendations	Impact	Cost of Materials	Cost of Labor
6-06	7	Marston Rd	20	6	Driveway	surface erosion - moderate; soil - bare	roads/driveway - reshape (crown), vegetate shoulder, install runoff diverters YCC/Volunteers: possibly install runoff diverter(s) once other recommendations have been completed	low	medium	medium
6-07	4	Marston Rd	20		Private Road	ditch - severe erosion; road shoulder erosion - severe; surface erosion - moderate	ditch - reshape ditch, install turnouts; roads/driveway - reshape (crown), install runoff diverters (open culvert, rubber razor, waterbar) YCC/Volunteers: possibly install runoff diverter(s)	low	medium	medium
6-08	7	Bracket Rd			Town Road	culvert - unstable; surface erosion - severe; soil - bare, delta in stream/lake	culvert - armor; road/driveways - add new surface material, reshape (crown), vegetate shoulder	high	high	high
6-09	7	Bracket Rd	20	3	Residential	surface erosion - moderate; soil - bare; dumping waste, tires, engines	road/driveways - add new surface materials, reshape (crown); vegetation	medium	medium	medium
6-10	7	Shaker Road	21	2	Construction Site	surface erosion - moderate; soil - bare	residential - install runoff diverter; vegetation: revegetate bare soils with shrubs, reduce open areas; construction site - mulch, seed/hay, silt fence/EC berms (silt fence has fallen, needs to be put back up) YCC/Volunteers: once construction has been completed: install runoff diverter; plant native trees and shrubs; define walkways and recreational areas; cover exposed soil with ECM	high	medium	medium
6-11	8	Shaker Rd - culvert by Grange Hall			Town Road	culvert - unstable (inlet); road shoulder erosion - moderate;	culvert - armor (inlet)	low	low	low
7-01	6	Stream crossing fire lane 275C Pond Rd Raymond			Town Road	road should erosion - moderate; soil - winter sand; vernal pond on opposite side looks like it over-flows in spring eroding other side of road	ditch - armor with stone (both shoulders on road)	low	low	low
7-02	6	Across from #48 Pond Rd			Town Road	culvert - unstable; road shoulder erosion - moderate; soil - winter sand	culvert - armor; armor shoulder with stone	medium	low	low
7-03	6	Pond Rd at Raymond border multiple culverts			Town Road	culvert - unstable, crushed/broken; road shoulder erosion - moderate (rills) - severe (road collapses on edge); soil winter sand	culvert - armor, replace (corroded); ditch - armor with stone, install ditch, install sediment pools; armor shoulder with stone	medium	medium	medium

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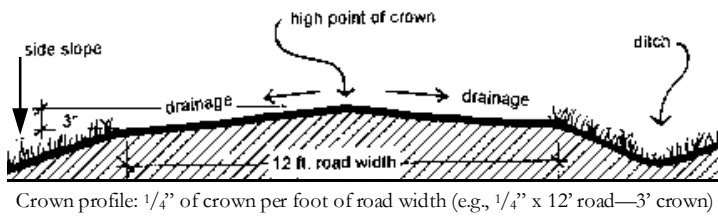
Sector & Site*	Map #	Location	Tax Map**	Tax Lot**	Land Use / Activity	Description	Recommendations	Impact	Cost of Materials	Cost of Labor
7-04	6	#231 Pond Rd			Town Road	culvert - unstable; ditch - bank failure; road shoulder erosion - moderate; soil winter sand	culvert - armor; ditch - vegetate, armor with stone; road/driveways - remove grader/plow berms	low	low	low
7-05	6	Pond Road in New Gloucester (just before house #190 heading towards Rt 26)			Town Road	unstable culvert inlet / outlet; slight road shoulder erosion	armor culvert inlet/outlet; lengthen culvert; install turnouts	low	medium	medium
7-06	6	Perwinkle Hill (large culvert crossing off of Pond Road in New Gloucester)			Private Road	moderate road shoulder erosion	armor eroded areas above culvert	low	low	low
7-07	6	Pond Road in New Gloucester (just past Perwinkle Hill heading towards Rt 26 at yellow and black stream crossing posts) Two culverts - one for overflow			Town Road	unstable culvert inlet / outlet; moderate road shoulder erosion; steep bank erosion adjacent to culvert	armor culvert inlet/outlet; lengthen culvert; install turnouts	medium	medium	medium
8-01	2	Across from Shaker Library			Town Road	road shoulder erosion - slight; soil - winter sand	ditch - armor shoulder with stone; remove winter sand and clean opening to storm drain	low	low	low
8-02	4	Old 26 and Route 26			State Road	road shoulder erosion - moderate; soil winter sand	ditch - armor with stone; roads/driveways - vegetate shoulder; remove winter sand	low	low	medium
8-03	4	Della Mills Road	36	35	Agricultural	surface erosion - moderate; culvert - crushed; soil - bare; surface erosion - slight; agriculture - manure washing off site, livestock access to waterbody?; other - drainage through pasture; landowner says state road drains onto property (state diverted ditch through pasture)	ditch - install ditch on state road to divert off pasture; vegetate current ditching; work with NRCS to develop a nutrient management plan; culvert - remove clog, armor inlet and outlet; roads/driveways - reshape (crown), vegetate shoulder; discontinue dumping waste near stream	medium	high	high
8-04	2	Route 26 behind Shaker Library			State Road	ditch - bank failure (back slope); soil - bare	ditch - armor with stone; clean out slumped ditch side	low	low	medium
8-05	2	Corner of Shaker Rd & Outlet Rd - drains to bog			Town Road	road erosion - slight; soil - bare, winter sand	roads/driveway - vegetate shoulder	low	low	low

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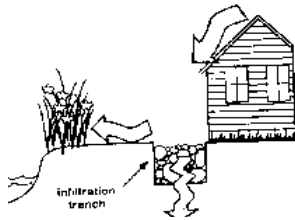
**Tax Map and Lot numbers may not be the actual location of the site.

Appendix D:

Glossary of Common Conservation Measures

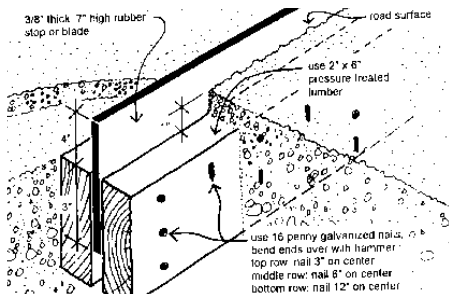
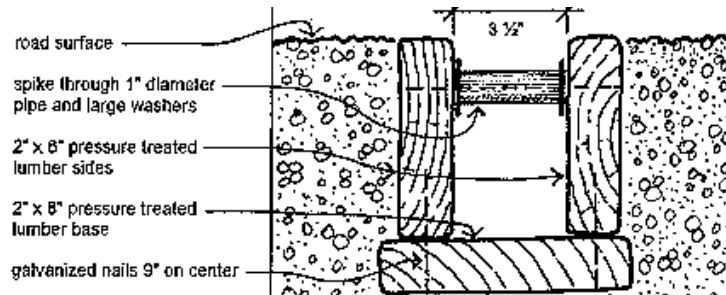


Crown—High point that runs lengthwise along the center of a road or driveway. The high point slopes gently away from the center toward the outer edge of the road, allowing water to drain off the road and preventing erosion of the road surface.



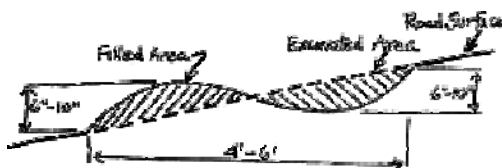
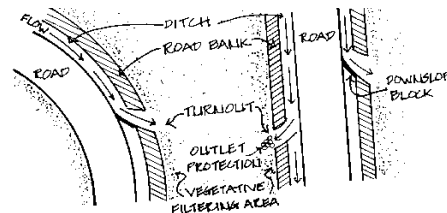
Dripline Trench—Rock-filled trench beneath the roof edge dripline that collects and stores roof runoff until it soaks into the ground. Helps control erosion and reduce wear on the house by preventing backsplash. A typical trench is 6-8" deep and 12-18" wide and filled with 3/4" stone. Can also be used along the edges of driveways to encourage infiltration of runoff.

Open Top Culvert—Box-like structure that collects and diverts road surface runoff away from a sloped driveway or camp road. They are seldom recommended for year-round roads due to the likelihood of plow damage. Install at a 30° angle to the road and direct the outlet into a stable buffer. Clean out leaves and debris periodically.



Rubber Blade—Structure that protrudes above the road surface high enough to intercept and collect water, while allowing traffic to pass over it. It is generally not used on year-round roads and driveways because of the likelihood of plow damage. Install at a 30° angle to the road and direct the outlet into a stable buffer. The rubber conveyor belts can be purchased at some hardware stores or Portland Rubber Company (774-3993).

Turnout—A conservation practice used to direct runoff from a ditch (or road ruts) into a vegetated buffer. The turnout should have a flared end section that is level and lined with rock to spread out the flow.



Waterbar—Ridge (like a speed bump) that runs diagonally across a road, driveway or path, typically at a 30° angle. Stops water from running down the road and diverts it to the side. Easy to construct and most appropriate for roads with low traffic volume. Needs to be rebuilt periodically.

Fact sheets for over 20 conservation practices, including those listed above, are available online at www.maine.gov/dep/blwq/docwatershed/materials.htm

Appendix E:

Benefits of Forming a Road Association



Before



After

Above: Road association funding paid for grading to remove a large pothole on this private gravel road.

- **Establishment or maintenance of a smooth driving surface**

A private road association has the legal authority to collect road dues. Structured funding allows for the planning of routine road maintenance and improvements providing better road conditions, thus leading to a safer road to travel on.

- **Enhanced property values**

Many banks and the secondary mortgage market deny construction and mortgage loans for properties on private roads that do not have road associations. Established road associations ensure a greater likelihood of roads being properly maintained and therefore properties on that road will be more accessible.

- **Reduced improvement costs in the future**

Routine road maintenance prevents the need of major road fixes. Simple road maintenance procedures organized and even implemented by road association members themselves can prevent the need for hiring expensive contracting services, material, and equipment once a problem has been ignored for too long.

- **Protection of lake water quality**

Un-maintained gravel roads can result in drainage problems leading to severe road erosion. This can cause sediment to wash into streams and lakes causing numerous water quality issues. A structured road association increases the road's likelihood of being maintained and monitored on a continuous basis preventing major problems from arising.

- **Additional Benefits of Forming a Road Association:**

- ◆ Helps open the lines of communication among community members
- ◆ Provides a framework for centralized decision-making
- ◆ Sets up an impartial and efficient means for managing money
- ◆ Establishes legal authority and potentially avoids personal liability

For information on forming a road association, please contact Maine DEP or Cumberland County Soil and Water Conservation District to obtain a copy of the booklet: "A Guide to Forming Road Associations". This publication can also be downloaded online at www.cumberlandswcd.org.

For More Information

Sabbathday Lake Association (SLA)

David Becker, President

Email: David_Becker@dcbecker.com

Website: www.sabbathdaylakeassoc.org

Provides outreach and advocacy within the watershed, provides educational materials, directs individuals to appropriate agencies, conducts water quality testing in conjunction with VLMP.

Town of New Gloucester

385 Intervale Road, New Gloucester, ME 04260

(207) 926-4126

Website: www.newgloucester.com

Code Enforcement Office deals with land use and zoning issues, permits, and inspection. Town Planning Office provides planning expertise and support to the Planning Board, Land Management Planning Committee, Economic Development Committee, Selectmen, and Town Manager.

Cumberland County Soil and Water Conservation District (CCSWCD)

35 Main Street, Windham, ME 04062

(207) 892-4700

Website: www.cumberlandswcd.org

Offers assistance with watershed planning and survey work, environmental education, engineering support, seminars and training sessions, and education on the use of conservation practices.

Maine Department of Environmental Protection (MDEP)

312 Canco Road, Portland, ME 04103

Toll Free (888) 769-1036 or (207) 822-6300

Website: www.MaineDEP.com

Provides permit applications and assistance, numerous reference materials, technical assistance, environmental education, project funding opportunities, and stewardship activities for lakes.

Maine Congress of Lake Associations (COLA)

1-877-254-2511

Email: info@mainecola.org

Website: www.mainecola.org

The only statewide network of individuals and lake associations devoted solely to the protection and preservation of our lakes.

Maine Volunteer Lake Monitoring Program (VLMP)

24 Maple Hill Road, Auburn, ME 04210

(207) 783-7733

Website: www.mainevolunteerlakemonitors.org

One of the oldest and largest citizen lake monitoring groups in the US that is also the largest provider of scientific lake data in Maine.



Photo credit: Paula Gauthier

Remember, the long term health of the watershed depends on you!