Crystal Lake Watershed Survey Report



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

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Acknowledgments

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

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Table of Contents

Introduction	1
Purpose of the Watershed Survey	3
Summary of Watershed Survey Findings	4
Figure 1: Crystal Lake Watershed Survey Erosion Site	Map 5
Residential	6
Driveway	7
Town Roads/Private Road	8
Boat & Beach Access	9
Soils in the Crystal Lake Watershed	10
Figure 2: Crystal Lake Erosion Sites (northern) Figure 3: Crystal Lake Erosion Sites (southern)	11 12
Where Do We Go From Here?	14
Appendix A: Permitting ABC's	15
Appendix B: Common Conservation Practices	16
Survey Result Tables	17
Where Do I Get More Information?	Inside Back Cover



Introduction

Is there a water quality problem in the Crystal Lake Watershed?

The Crystal Lake Association has tested water quality in Crystal Lake for more than 25 years. This testing has found the lake's water quality to be slightly above average based on secchi disk transparency, total phosphorus and chlorophyll-a measurements.

However, recent dissolved oxygen profiles show moderate oxygen depletion in deep areas of the lake to levels that pose a moderate risk of phosphorus recycling problems. Based on observations at other Maine lakes, these trends indicate that the lake is under stress.

As a result of development trends in the area and the water quality conditions Crystal Lake has been placed on the Maine Department of Environmental Protection (DEP) list of *Priority Watersheds*.



What is polluting Crystal Lake?

The biggest pollution culprit in Maine's lakes is **nonpoint source (NPS) pollution** found in the runoff from rain and snowmelt. During and after storms, soil, and nutrients like phosphorus and nitrogen, wash into lakes from the surrounding landscape by streams and overland flow.

NONPOINT SOURCE POLLUTION

Also called NPS or polluted runoff. Pollution that can not be traced back to a discharge from a particular direct source (e.g., an industrial outfall pipe).



One way to visualize NPS pollution is to think of rain and snow melt as a giant broom that sweeps over the watershed, moving debris and soil into the lake from the surrounding land and streams. In an undeveloped, forested watershed, storm water runoff is slowed and filtered by trees, shrubs and other vegetation. It then soaks into the uneven forest floor. In a developed watershed, storm water velocity increases on impervious surfaces like rooftops, compacted soil, gravel camp roads and pavement, and does not always receive the filtering treatment the forest once provided. Declining water quality may be a result of the concentrated development around the lake and heavily used state and town roads surrounding the lake. Wilkies Beach, the lakes' public beach and boat ramp, receives

heavy public use throughout the season and may also be a contributor.

The nutrients in storm water runoff can be bad news for lakes. **Phosphorus**, a nutrient that is common on land, 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.



Excess **phosphorus** can "fertilize" a lake and lead to nuisance **algal blooms**.

Why is it important to protect Crystal Lake's water quality?

- Once a lake has declined, it can be difficult or impossible to restore.
- Crystal Lake contains valuable habitat for fish, birds and other wildlife.
- Crystal Lake outlets during heavy periods of high water into Mill Pond via a short unnamed drainage pathway. Mill Pond, in turn, flows into Mill Brook, Collyer Brook and then into the Royal River and ultimately Casco Bay.
- 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.



Crystal Lake's water quality is directly impacted by the land uses in its surrounding watershed. The most effective way to manage lake water quality is by managing land uses within the watershed.

What is being done to protect the Crystal Lake Watershed?

The Crystal Lake Association (CLA) tests water quality in Crystal Lake as part of the Maine Volunteer Lake Monitoring Program. CLA also works with agencies and watershed residents to promote environmental stewardship.

Volunteer watershed surveys have been found to be one of the most effective ways to protect lake water quality by getting citizens involved in identifying existing and potential sources of polluted runoff. During the summer and fall of 2003, the Crystal Lake Association, Cumberland County SWCD and DEP conducted a watershed survey.

This report is specifically designed for citizens living in the Crystal Lake Watershed. It contains a summary of the survey findings and recommendations to protect the health of the lake.

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 Crystal Lake Watershed. However, the survey was also intended to:

- Raise public awareness of the connection between land use and water quality, and the impact of polluted runoff on Crystal Lake.
- Inspire people to become active stewards of the watershed.
- Use the information gathered to help develop a strategy to protect Crystal Lake including a possible Implementation Plan.
- Make general recommendations to landowners for fixing erosion problems on their properties.

Local citizen participation was essential in completing the watershed survey and will be even more important in upcoming years. Through the leadership of the Crystal Lake Association, and with assistance from groups and agencies concerned with lake water quality, the opportunities for stewardship are limitless!



Numerous lakeshore properties were observed to have little or no **vegetated buffer** at the water's edge. These sites were not included in the survey results, but it is important to note shrubs and trees do a much more effective job than bare ground or grass at keeping polluted runoff from entering lakes. The deep roots of shrubs and trees also help stabilize the shoreline.

Buffers can be installed inexpensively. You can stop mowing and raking at the water's edge and let plants grow up naturally. Or you can plant the area with native trees and shrubs.

Buffers enhance the appearance of shorefront property and attract birds and other wildlife without ruining the landowner's view.



Summary of Watershed Survey Findings

Volunteers and technical staff identified 42 sites that are currently impacting or have the potential to impact water quality in the Crystal Lake Watershed. The amount of documented sites in this survey is quite low compared to other surveys conducted in southern Maine and represents an achievable opportunity to address watershed problems. The cost to fix 40 of the 42 sites were rated to be low to medium with little technical expertise required.

A total of seven land use types were associated with the identified sites. The largest number of problems were associated with residential areas, beach and boat access, and town roads. Detailed descriptions of these sites are on the following pages.

Key Findings:

- Most of the problems were found on residential properties.
- Most of the problems can be fixed with little expense or technical expertise. Plants, mulch and other simple solutions can go a long way towards protecting the lake.
- About 2/3 of the problems may be causing significant impact to the lake.







Potential Impact of Problems

There were similar numbers of sites with low and medium impacts. None of the identified sites were rated as high impact. Attention should be paid to all of the sites, since it's the cumulative impact of **all** the sites that causes water quality to decline.

• Low- eroding site with limited transport off site, or small site with no evidence of rills or gullies

• Medium—sediment transported off site but does not reach high magnitude

Cost to Implement Recommendations for Labor and Materials

- ♦ Low—less than \$500
- Medium—\$500 to \$2,500
- High—more than \$2,500

Erosion Site Map

Residential

Of the 25 sites associated with residential areas, 19 were low impact, 6 were medium impact. Nearly all of the sites (21 of 25) can be fixed with little technical expertise and low cost.

Common Problems Identified:

- Slight or moderate surface erosion
- Bare and sparsely vegetated soil
- Lack of vegetated buffer along shoreline •
- Direct flow of runoff to lake
- Roof runoff causing erosion
- Shoreline bank erosion

Recommended Solutions:

- Place grass seed and hay or bark mulch on bare soil
- Establish or enhance vegetated buffer
- Limit foot traffic in eroding areas
- Install stone lined trench along edge of house or at gutter downspout to catch roof runoff
- Install waterbar, open-top culvert, rubber razor or other runoff diverter across paths
- Place mulch or stone on footpaths

Below is an actual example of polluted residential runoff on Crystal Lake, as well as a description of the problems and possible solutions for this site.



Problems:

- Roof runoff
- Bare soil with direct flow to lake
- Lack of vegetated buffer

Solutions:

- Stone lined trench at roof drip edge
- Seed and mulch bare areas
- Establish vegetated buffer along shoreline

Residential areas were associated with 60% of the identified sources of polluted runoff to Crystal Lake. These problems pose a significant threat to lake water quality. Fortunately, most of these sites can be corrected with easy, low cost fixes.

It's the cumulative impact of all the sites that causes water quality to decline.

Driveways

One driveway was identified and was rated at a medium impact to the lake. This site could be fixed with low to medium cost and technical expertise.

Potential Problems:

- Surface erosion (ruts, gullies)
- Poor driveway shaping
- Direct flow of sediment to lake



Below is a typical example of driveway surface erosion (not on Crystal Lake).



Driveway above shows signs of surface erosion and ruts caused by concentrated water flows.



New surface material added, proper crown established and rubber razor blade installed to divert that water off the road and into the vegetated buffer.

Recommended Solutions

- Add new hard packing surface material
- Reshape and crown driveway so water moves quickly from the surface
- Install diverters such as waterbars, open top culverts or rubber razors to get water off driveway

Although driveway erosion is not a widespread concern around Crystal Lake, proper driveway maintenance is important to prevent future problems.

Town Roads & Private Roads

Of the four road sites, three were on town roads and the one private road site on Pine Cove Road was in need of yearly maintenance. Some of the town road sites have already been addressed with some fine tuning remaining. Despite the fact that only four road sites were identified, eroded areas tend to be larger than many other sites with greater potential impact.

Common Problems Identified:

- Moderate surface erosion
- Direct flow to lake
- Lack of ditches
- Moderate ditch erosion
- Moderate shoulder erosion
- Unstable culvert inlet and outlet

Recommended Solutions:

- Reshape and vegetate shoulders to get water off road
- Install diverters such as waterbars, open top culverts or rubber razors to get water off road
- Clean, reshape and armor ditches with stone rip rap or plant grass
- Remove grader berms and winter sand to allow proper drainage off road
- Stabilize culvert inlets & outlets with riprap

Below is an actual example of town road runoff on Crystal Lake, as well as a description of the problems and possible solutions for this site.



Problems:

- Lack of ditches
- Moderate surface erosion
- Shoulder erosion
- Winter sand build-up

Solutions:

- Install proper ditching
- Reshape and vegetate shoulder
- Remove winter sand

While a one time fix may cost more up front, it will reduce lake pollution and reduce maintenance costs on your road, ditches and vehicle.

Boat & Beach Access

Ten beach sites and two boat access sites were identified. Five beach sites were low impact and five were medium impact. Both of the boat access sites were low impact. Most of the problems can be fixed with low technical expertise and low cost.

Common Problems Identified:

Recommended Solutions:

- Slight to severe surface erosion
- Seed and mulch bare areas

- Bare soil
- Direct flow of sediment to lake
- Shoreline degradation
- Unstable beach access

- Plant or enhance buffer on shoreline
- Install water bar runoff diverters to divert upland runoff from reaching beach
- Define path for foot traffic

Below are actual examples of beach erosion from runoff on Crystal Lake, as well as a description of the problems and possible solutions for this site.



Problems:

- Severe erosion
- Direct flow of sediment and winter sand into lake

Solutions:

- Establish shoreline buffer and define path for foot traffic
- Construct infiltration trench to intercept upland runoff
- Vegetate and stabilize shoulders of adjacent roads

Beach and boat access areas are inherently problematic for lake protection. Beach sands are loose and are easily moved with runoff into the lake. Boat access ways provide an direct path for soil to reach the lake.

Soils in the Crystal Lake Watershed

Understanding the soils in your watershed helps with planning erosion control measures, as well as choosing plants that will thrive. The soils in the Crystal Lake Watershed are mostly sandy gravelly loams that are very permeable with infiltration rates of greater than 6.3 inches per hour. These soils are moderately acidic.

Plant types of vegetation that can handle drought conditions and acidic soils. The following native plants are well suited to Crystal Lake properties and most of the perennials are widely available.



Phosphorus Free Fertilizer Dealers

Most soils in Maine have enough phosphorus to keep a lawn healthy. If you must fertilize, use phosphorus free fertilizer. Retailers include:

Home Depot	149 Mt. Auburn	Auburn	777-0042
Ace Cooks Hardware	P.O. Box 299	Gray	657-4204
True Value	P.O. Box 577	Raymond	655-7320
Coastal Hardware	708 U.S. Rte One	Yarmouth	846-3861

Or Call your local lawn service and request Phosphorus free fertilizer

Map of erosion sites northern end

Map of erosion site southern end

Next Steps ~ Where Do We Go From Here?

Fixing the erosion sites identified in this survey will require efforts by individuals, the Crystal Lake Association, road associations and municipal officials.

Individual Citizens

- Prevent runoff from washing sediment into the lakes. Detain runoff in depressions or divert flow to vegetated areas. Call the Cumberland County SWCD or DEP for free technical assistance.
- Minimize the amount of cleared land and road surfaces on your property.
- Stop mowing and raking, and let lawn and raked areas revert back to natural plants. Deep shrub and tree roots help stabilize the shoreline.
- Avoid exposing bare soil. Seed and mulch bare areas.
- Don't bring in sand or rebuild beaches without permits and technical assistance.
- Call DEP and the Town before cutting trees and vegetation, building or disturbing soil within 250' of the lake. See Appendix B for more information.
- Maintain septic systems properly. Pump septic tanks (every 2 to 3 years for year round residences; 4-5 years if seasonal) and upgrade marginal systems.
- Get a copy of "Camp Road Maintenance Manual A Guide for Landowners." This reference is a <u>must</u> for anyone managing a gravel road. (Call the DEP at 822-6300 to order a free copy.)

Crystal Lake Association

- Develop an active membership, help implement recommendations from the Crystal Lake Watershed Survey and provide educational materials and guidance to members of the Crystal Lake watershed community.
- Organize workshops and volunteer "work parties" to start fixing identified erosion problems and teach citizens how to fix similar problems on their own properties.
- Educate municipal officials about lake issues and work cooperatively to find solutions.
- Continue to partner with agencies, municipalities, Districts and others to jointly seek funding and implement projects to protect the lake water quality.
- Support Friends of the Royal River Youth Conservation Corps to fix identified problems

Town of Gray

- Enforce shoreland zoning ordinance to assure full protection of Crystal Lake.
- Conduct regular maintenance on town roads in the watershed.
- Participate in and support the implementation of the Crystal Lake Watershed Survey Report.
- Promote training for road crews, planning boards and conservation commissions.
- Support the Royal River Youth Conservation Corps.

Appendix A: Permitting ABC's

Protection of the Crystal Lake Watershed is ensured through the good will of residents around the lakes and through laws and ordinances created and enforced by the State and Towns.

How do you know when you need a permit?

- <u>Construction, clearing of vegetation and soil movement within 250 feet of the lake shore falls</u> <u>under the Shoreland Zoning Act</u>, which is administered by the Towns through the Code Enforcement Officer and the Planning Board.
- <u>Soil disturbance within 75 feet of waterbodies also falls</u> <u>under the Natural Resources Protection Act</u>, which is administered by the DEP.

To ensure that permits for projects that will not result in significant disturbance are processed swiftly, the DEP has established a streamlined permit process called **Permit by Rule**. These one page forms (shown below) are simple to fill out and allow the DEP to quickly review the project.

The Natural Resources Protection

Act seeks to establish reasonable

regulation in order to assure

responsible development that does

not harm Maine's precious natural

systems.

~from Protecting Maine's Natural Resources~Volume 1, DEP 1996

The project partners encourage you to contact the DEP and the Gray Code Enforcement Officer if you have any plans to construct or relocate a structure, clear vegetation, create a new path or driveway, stabilize a shoreline or otherwise disturb the soil on your property. Even if projects are planned with the intent of enhancing the environment—such as installing some of the practices mentioned in this report –contact the DEP and Town to be sure. See last page for contact information.

	PERMIT	BY RULE N	OTIFICATIO	N FORM	
	(F	or use with DEP Reg	gulation, Chapter 3	05)	
PLEASE TYPE OR PRINT	IN BLACK INK ONLY (COPIES, PLEASE BEAL	R DOWN)	1	1 1 1 1 1
Applicant:	umberland Cou	inty SWCD	Name of Owner	Norm & M	ichelle Grol
Mailing Address:	381 Main S	t. Suite3	Town/City:	Gorhan	~
State: Maine	Zip Code:	04038	Daytime Teleph (Include area co	de) 207	839-7839
Name of Wetland, Wat	ter Body or Stream:	Sabbotho	Day Lake		
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How to apply for Permit by Rule with DEP:

- Fill out a notification form. Forms are available from your town code enforcement officer or the Maine DEP offices in Portland or Augusta.
- 2. Permit by Rule requires that you follow certain standards such as installing silt fence. It is important that you obtain a copy of the standards so you will be familiar with the law's requirements.

The permit will be reviewed within 14 days. If you do not hear from DEP within 14 days, you can assume your permit is valid. If you bring the permit directly to a DEP office, you may be able to get your permit approved immediately.

Appendix B

Rubber Razor Blade: Use this structure in a sloped gravel driveway or camp road. It can be plowed over only if the plow operator is aware of its presence and lifts the plow blade slightly. Place it at a 30 degree angle to the road edge and point the outlet toward a stable buffer.



road surface	Second W KING
spike (brough 1" diameter	00 · 00 111
pipe and large washers	0.8 8
2" x 6" pressure treated	
idinuer sides	8 8 8 MM MIN 8 80
2" x 8" pressure treated	Revealed the second
lumber base	0.0.0 0 0/1/0 2
galvanized nails 9" on center —	0.0.0
	,00 0.00.00.00.0 0.0

Open Top Culvert: Use this structure in a sloped gravel driveway or camp road that does not get plowed in the winter. Place it at a 30 degree angle to the road edge and point the outlet toward a stable buffer. Remove leaves and debris annually.

Drywell: Use a drywell to collect runoff from roof gutter downspouts. Drywells can be covered with sod, or left exposed for easy access and cleanout. Drywells and infiltration trenches work best in sandy or gravelly soils.





Waterbar: Install waterbars to break up the slope and prevent water from concentrating in the pathway. Fill behind each waterbar with crushed stone to provide an area to slow runoff and help be diverted to vegetated areas and soak into the ground. Any rot-resistant type of wood, can be used, and should extend past the outside edge of both sides of the path.



Dripline Trenches: Install a rock-filled trench along the roof drip line to collect and infiltrate roof runoff, thereby controlling erosive runoff from the rooftop. The trench will collect roof runoff and store it until it soaks into the soil. These systems will also reduce wear on your house by reducing back splash.

Where Do I Get More Information?

Contacts

Cumberland County Soil and Water Conservation District

201 Main Street, Suite 6 Westbrook, Maine 04092 207-856-2777

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 Protectionwww.state.me.us/dep/blwq312 Canco Road, Portland, ME 04103Toll Free (888) 769-1036 or (207) 822-6300

17 State House Station, Augusta, ME 04333 Toll Free (800) 452-1942 or (207) 287-7688

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

Crystal Lake Association, P.O. Box ??????, Gray, Maine 04039

Town of Gray, 6 Shaker Road, Gray, Maine 04039 207-657-3339

Publications

The Buffer Handbook: A Guide to Creating Vegetated Buffers for Lakefront Properties. 20 pgs. plus inserts. Androscoggin Valley SWCD and Lake and Watershed Resources Management Associates. 1998.

Camp Road Maintenance Manual: A Guide for Landowners. 54 pgs. Kennebec County SWCD and Maine DEP. June, 2000.

www.state.me.us/dep/blwq/docwatershed/materials for websites

A Homeowner's Guide to Environmental Laws Affecting Shorefront Property in Maine's Organized Towns. DEPLW-38-B98. 28 pgs. Maine DEP. December, 1997. www.state.me.us/dep/blwq/docstand/home.pdf

Maine Shoreland Zoning—A Handbook for Shoreland Owners. DEPLW 1999-2. 34 pgs. Maine DEP. 1999.

Gardening to Conserve Maine's Native Landscape: Plants to Use and to Avoid. Bulletin #2500. June, 1999. Folded leaflet. University of Maine Cooperative Extension. www.umext.maine.edu/onlinepubs/htmpubs/2500htm.

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