Brandy Pond Watershed Survey

Cumberland County Soil and Water Conservation District
Lakes Environmental Association
Maine Department of Environmental Protection
Portland Water District

September 2009

Acknowledgements

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

Survey Volunteers

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Sponsors

Cumberland County Soil and Water Conservation District
Lakes Environmental Association
Maine Department of Environmental Protection
Portland Water District
United States Environmental Protection Agency
Town of Naples

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Table of Contents

Introduction

Watershed

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

This report is specifically designed for citizens living in the Brandy Pond Watershed. It provides the results and analysis of a watershed survey conducted in response to water quality data that indicates the Pond is under stress.

The Lakes Environmental Association (LEA) has tested Brandy Pond's water quality for over 30 years. The data indicate the Pond is showing signs of stress. In particular, phosphorus and chlorophyll (algae) concentrations are moderate in the Pond, and consistently low dissolved oxygen values in the deeper waters are limiting the habitat for coldwater fish. Most years, the pond turns over relatively early, replenishing oxygen to the deeper waters. Years with a late turnover, however, can stress cold water species such as trout and salmon. Because of the limited fishery habitat and the substantial amount of development occurring within the watershed, LEA rates Brandy Pond in the "moderate to high degree of concern" category.

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 Brandy Pond and most other Maine lakes is **polluted runoff.** During and after storms and snowmelt, soil (and hitch-hiking nutrients like phosphorus and nitrogen) wash into lakes from the surrounding landscape through streams, ditches and overland flow.

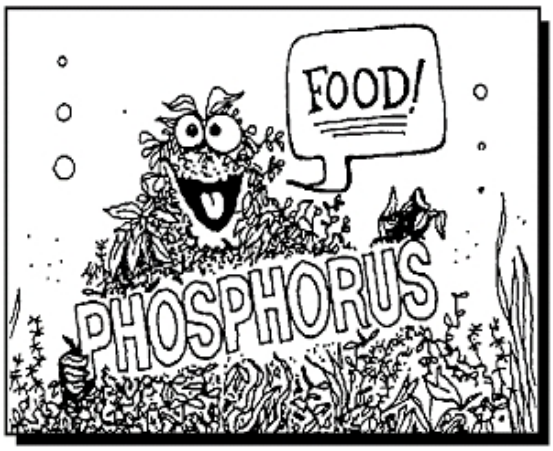
In an undeveloped, forested watershed, runoff is slowed and filtered by tree and shrub roots, grasses, leaves, and other natural debris on the forest floor. It then soaks into the uneven forest floor and filters through the soil. In a developed watershed, however, stormwater does not always receive the 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 algal 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.

The fallen leaves help slow runoff at this site, however native ground covers should be planted to stabilize the soil.

Development is threatening the health of Brandy Pond. If landowners work together with technical support provided by LEA, Cumberland County Soil & Water Conservation District (CCSWCD) and the Maine Department of Environmental Protection (MDEP) we can slow or neutralize the impact development is having on Brandy Pond. This report outlines several ways residents of Brandy Pond can reduce the impacts of polluted runoff on their properties and help maintain and improve the water quality of the Pond.

Why is Stormwater Runoff a Problem?

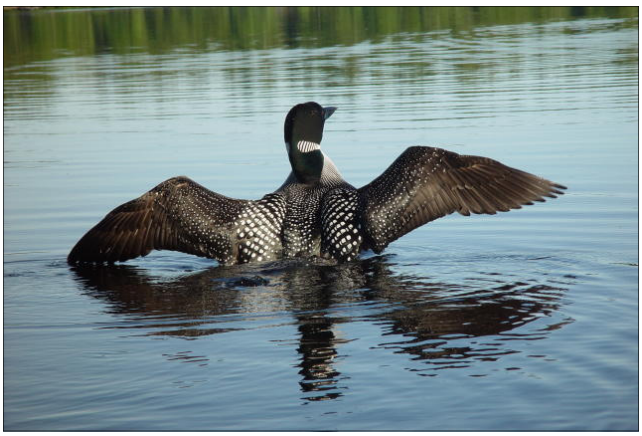
The problem is not necessarily the water itself, it's the sediment, nutrients and pollutants in the surface runoff that can be bad news. Large volumes of sediment can settle out in the lake, creating an ideal substrate for nuisance and invasive aquatic plants such as variable-leaved water milfoil. **Phosphorus**,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



*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.*

Why should we protect the Pond from polluted runoff?

- The Pond contains valuable habitat for fish, birds and other wildlife.
- Brandy Pond provides recreational opportunities to watershed residents and 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. LEA has been working to remove invasives in Brandy Pond and the Songo River since 2005.
- A 1996 University of Maine study demonstrated that lake water quality affects property values. For ever meter 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's water quality or character has declined, it can be difficult or impossible to restore.







Watershed Survey Purpose

The primary purpose of the watershed survey was to:

- Identify and prioritize existing sources of polluted runoff, particularly soil erosion sites, in the Brandy Pond Watershed.
- Raise public awareness of the connection between land use and water quality and the impact of polluted runoff.
- Inspire people to become active stewards of the watershed.
- Use the information gathered as one component of a long term lake protection strategy.
- Make general recommendations to landowners for fixing erosion problems on their properties.

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. It is our hope that through future projects we can work together with landowners to solve erosion problems on their properties, or help them learn how to find solutions on their own.

Survey Method

The survey was conducted by 19 volunteers with the help of experienced technical staff. Most of the volunteers were from the University of Southern Maine's (USM) Soil and Water Conservation Engineering class. USM students were trained on survey techniques and erosion identification during a special class lecture in April 2009, and community volunteers were trained at an informational meeting prior to the survey day.

The volunteers and technical staff spent a 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.

The data collected were entered into a database and the documented erosion sites were plotted on maps. The sites were broken into categories (driveways, roads, residential, etc.) and rated based on their impact on the Pond 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 copy of the spreadsheet that contains all collected data is located in Appendix B.

It is important to note that this survey focused on identifying soil erosion that is impacting the Pond. However, there are other sources of phosphorus that may be affecting water quality but are not as visible as soil erosion. For example, faulty septic systems can leech phosphorus into the water, and intensively maintained lawns (characterized by a high use of fertilizers and pesticides) can also add excess nutrients and other harmful chemicals to the Pond.

Summary of Watershed Survey Findings

Volunteers and technical staff identified 73 erosion sites in the Brandy Pond Watershed that are currently impacting or have the potential to impact water quality.

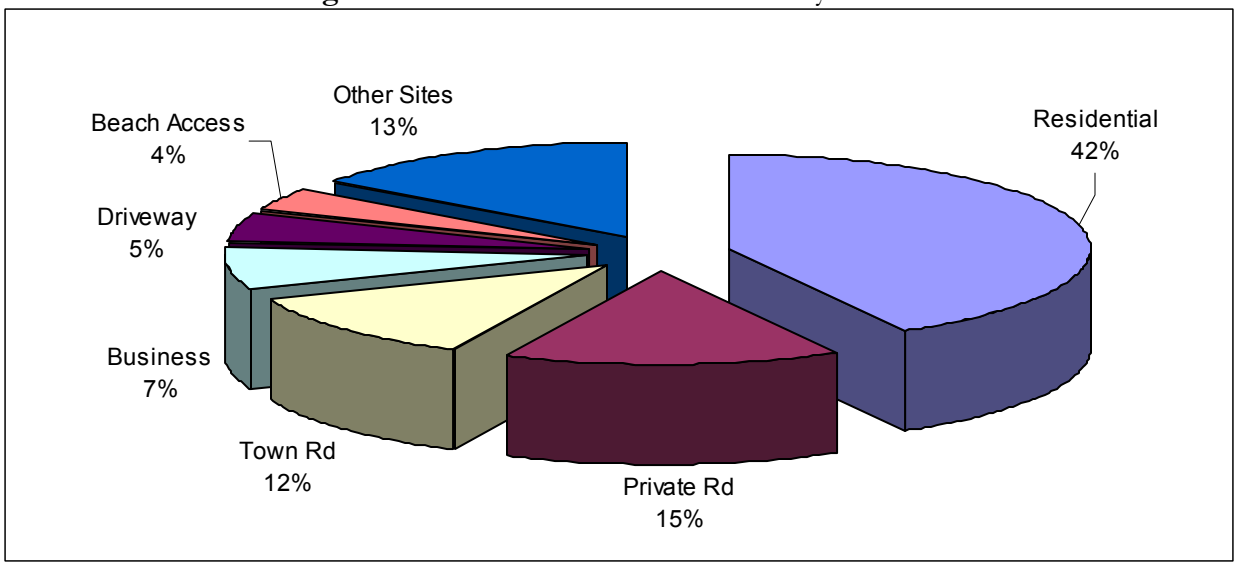
Table 1 represents all of the sites in each category as well as their impact rating. Most sites (53) were determined to have a low or medium impact on the Pond. It should also be noted that the *cumulative impact* of all sites is what can cause water quality to decline. The different levels of impact are defined in the following pages.

The pie chart in Figure 1 shows the percentage of erosion sites documented for each land use category. The majority of sites were associated with private properties such as residential sites or private roads. These areas accounted for about 57% of all sites identified in the survey.

Table 1. Summary of site categories and impacts

Land Use	High Impact	Medium Impact	Low Impact	Total
Beach Access	1	1	1	3
Boat Access	0	2	0	2
Business	1	2	2	5
Driveway	1	1	2	4
Private Rd	1	5	5	11
Residential	7	8	16	31
Right of Way	1	2	0	3
State Rd	0	3	0	3
Town Rd	0	7	2	9
Trail or Path	1	1	0	2
Total	13	32	28	73

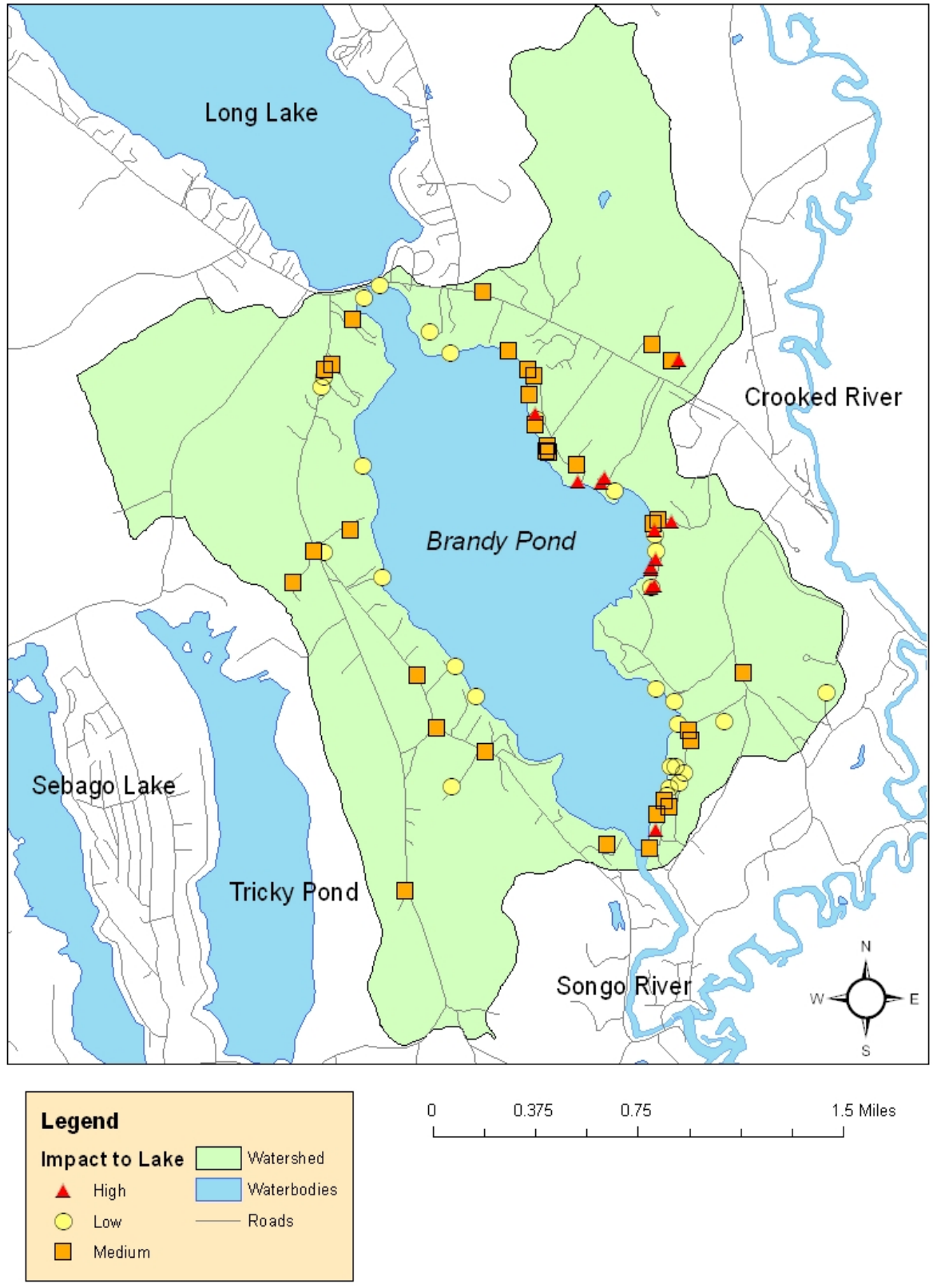
Figure 1. Breakdown of identified sites by land use.



*Other Sites include; Boat Access (2%), Right of Way (4%), Trail or Path (3%) and State Road (4%)

Brandy Pond Watershed Map

Figure 2. The Brandy Pond Watershed with points representing 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 4 and 5 depict the cost ratings.

Figure 3.

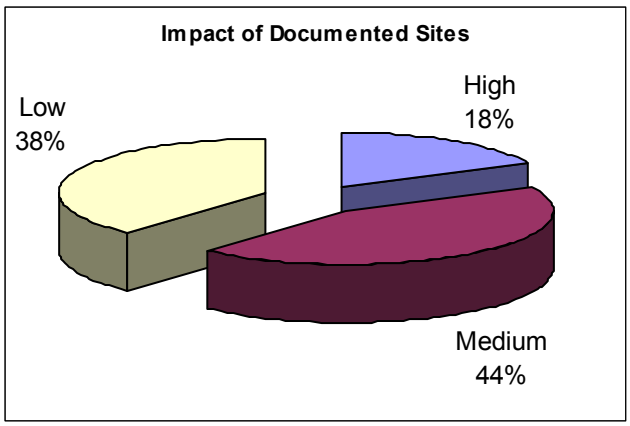


Figure 4.

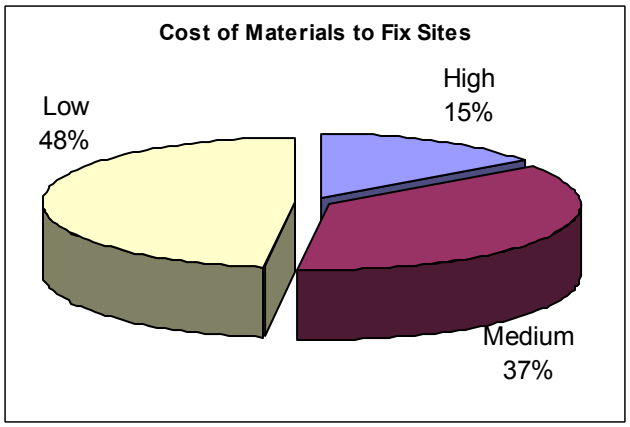
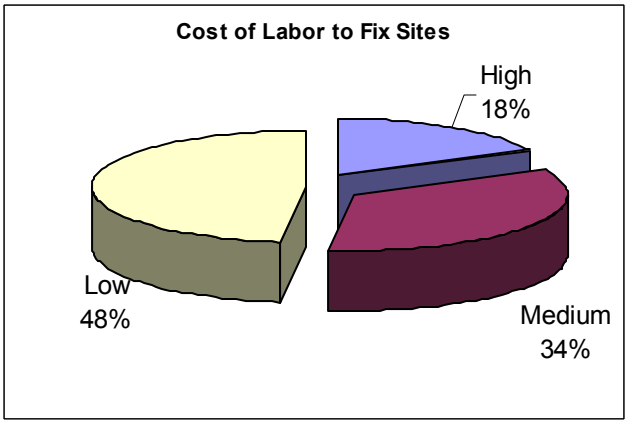


Figure 5.



Impact was based on slope, soil type, amount of soil eroding, proximity to water and the presence of a buffer.

- "Low" impact eroding sites are those with limited soil transport off-site.
- "Medium" impact sites are where 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 stream, pond or ditch.

Just over a third 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.

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.
- "Medium" cost sites are estimated between $500 and $2,500 for restoration efforts.
- "High" rated sites are estimated to cost over $2,500.

With close to 50% of the sites ranked low for the cost of both labor and materials, we are hopeful that watershed residents will take the initiative to address erosion problems on their properties.

Residential Areas

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

Of the 31 sites associated with residential areas documented through the survey, 16 were low impact, 8 were medium impact and 7 were high impact. The majority of the sites can be fixed with little technical expertise and low cost.

Common Problems Identified:

- Shoreline erosion
- Shoreline undercut
- Surface erosion
- Roof runoff erosion
- Lack of vegetation/buffer

Recommended Solutions:

- Establish or enhance shoreline vegetation
- Limit foot traffic in eroding areas and stabilize footpaths/establish path
- Vegetate and mulch bare soil
- Install dripline trench to catch roof runoff
- Install runoff diverters such as waterbars, rubber razors, open-top culvert, etc.

The erosion problems associated with the site pictured below were common on many other properties within the watershed.

Problems:

- Surface erosion
- Exposed tree roots
- Direct flow of sediment to Pond
- Shoreline erosion

Recommendations:

- Define footpath
- Vegetate with native plants
- Grade back shoreline & vegetate
- Mulch bare areas

Residential areas were identified most often as impacting or have the potential to impact Brandy Pond (42%). These problems pose a significant threat to lake water quality. Fortunately, most of these sites can be corrected with easy, low cost fixes.

Private Roads

Of the 11 private road sites documented through the survey, 5 were low impact, 5 were medium impact and 1 was high impact. These problems are slightly more expensive as most have a cost rating of medium for both the materials and labor.

Common Problems Identified:

- Slight or medium shoulder erosion
- Plow berm
- Surface erosion
- Inadequate ditch
- Winter sand
- Unstable or crushed culvert

Recommended Solutions:

- Remove grader berms
- Remove winter sand
- Clean, reshape and armor ditches
- Clean and stabilize culverts
- Crown and reshape road to redirect water
- Install water diverters such as waterbars, rubber razors, open-top culverts, etc.

The erosion problems associated with the site pictured below were common on many other properties within the watershed.

Problems:

- Road shoulder erosion
- Surface erosion
- Plow/grader berm
- Direct flow of sediment to Pond

Recommendations:

- Reshape and crown road
- Install ditch or turnouts
- Install runoff diverters
- Remove berm

Gravel roads are one of the biggest sources of pollution to Maine lakes.

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

Town Roads

Of the 9 town road sites documented through the survey, 3 were low impact, 6 were medium impact and there were no high impact sites. These problems are mostly medium or high cost to fix, with only one site having low cost solutions.

Common Problems Identified:

- Unstable culvert inlet or outlet
- Broken culvert inlet or outlet
- Moderate to severe road shoulder erosion
- Winter sand
- Ditch erosion
- Bank failure in ditch
- Roadside berm

Recommended Solutions:

- Clean out, stabilize or replace culverts
- Armor culvert inlet/outlet with stone
- Vegetate road shoulder
- Remove winter sand
- Install ditch turnouts
- Vegetate or armor ditch

The erosion problems associated with the site pictured below were common on many other properties within the watershed.

Problems:

- Winter sand
- Clogged culvert
- Unstable inlet/outlet
- Surface erosion

Recommendations:

- Remove winter sand
- Clean, enlarge or replace culvert
- Armor culvert with stone
- Establish vegetation

Remember, it's the cumulative impact of all the sites that causes water quality to decline.

Driveways

Of the 4 driveways documented in the survey, 2 were low impact, 1 was medium impact and 1 was high impact. These sites could be fixed with relatively low cost – 2 were rated as medium cost and 2 were low cost.

Common Problems Identified:

- Severe shoulder erosion
- Bare soil
- Moderate surface erosion
- Winter sand
- Unstable and clogged culvert

Recommended Solutions:

- Crown driveway to divert water
- Install water diverters such as waterbars, rubber razors, etc.
- Remove winter sand
- Unclog and armor culvert
- Vegetate shoulder

The erosion problems associated with the site pictured below were common on many other properties within the watershed.

Problems:

- Surface erosion
- Winter sand build up
- Water is starting to form channels, which will worsen erosion

Recommendations:

- Install runoff diverter/water bar
- Reshape/crown to redirect water
- Add new surface material
- Vegetate with native plants

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.

It's great for your driveway and it's great for the Pond!

Sites in Other Categories

Beach Access

Of the 3 beach access sites documented by the survey, there was one low impact site, one medium impact site and one high impact site. Two required low cost solutions and one was rated at medium cost. These sites suffered from shoreline erosion due to a lack of a vegetative buffer and/ or unstable access. Some low-cost solutions include vegetating the shoreline and bare soil and establishing a meandering path to the beach.

State Roads

The three state road sites found during the survey all had medium impact to the Pond but will require potentially high cost solutions, both in terms of materials and labor. All three sites involved unstable, clogged or crushed culverts. While some culvert issues can be fixed by armoring the inlet and outlet with rip rap, crushed culverts need to be replaced and frequently enlarged, which contributes to the cost of the project.

Business

Of the five business-owned sites documented, two required a low cost fix, two were medium cost and one was high cost. The business sites featured bare soil, ditch erosion, surface erosion and problems with current erosion control methods such as silt fence. Mulching bare soil or putting down seed and hay is a low-cost fix for some of the problems, though the higher cost problems will require the use of rip rap and installing runoff diverters.

Trails

A high impact trail site and a medium impact trail site were found during the survey, with the materials and labors costs being medium and low, respectively. Both trails had issues with surface erosion and bare soil, which can be combated with runoff diverters, mulching and establishing vegetation.

Boat Access

There were two boat access sites discovered during the survey and both of them were medium impact sites with low cost solutions. The two sites have problems with surface erosion and bare soil, one of them having unstable access to the beach as well. Small runoff diverters, vegetation and mulching will do a great deal of good on sites like these.

An example of a site identified at a business. Problems included severe ditch erosion and bank failure. While the location of this site is far from the shores of Brandy Pond, the soil flows directly to a stream, which flows into the Pond. Recommendations included stabilizing the ditch with riprap, defining a foot path and installing a runoff diverter.

Build a Better Buffer

What is a buffer?

Buffers are areas of trees, shrubs, groundcovers, and leaf litter that help prevent sediment and nutrients from reaching the Pond. It is important to maintain vegetation on all parts of properties to trap sediments, excess nutrients and other pollutants; prevent erosion; and help stabilize sloped areas and the shoreline. Vegetation can also add beauty, enhance privacy, and provide wildlife habitat.

Under local Shoreland Zoning laws, there are limits to removing vegetation within 250-feet of the water, and there are restrictions to development within the first 100-feet from the water.

Planting native trees, shrubs, and groundcovers will help stabilize the soil and reduce erosion at this property.

How do buffers work?

⇒ Leaf surfaces collect rain and allow for evaporation.

⇒ Shorter plants, groundcover, and the "duff" filter sediment and pollutants from runoff.

⇒ Root systems hold soil in place, maintain soil porosity, and take up water and nutrients.

⇒ An uneven soil surface allows rain and snowmelt to puddle and infiltrate.

Often folks feel that once a buffer is in place, they will lose control of their access to the water - both physically and visually. Not so! Traffic can be directed by the use of appropriately placed shrubs and trees, which can be pruned so that views of the water are preserved. In fact, buffers can be designed to protect against noise and enhance privacy for lakefront residents. The photo to the left shows an excellent example of a path to access the lake. The path winds through this buffer, minimizing the direct route for runoff to reach the lake.

Phosphorus Free Fertilizer Dealers

Before fertilizing, consider getting a soil test to measure nutrient levels on your property. Tests are inexpensive, and kits can be obtained through CCSWCD, LEA or the University of Maine Cooperative Extension.

Most soils in Maine have enough phosphorus to keep plants healthy. Phosphorus free fertilizer is available at the following retailers:

Paris Farmers' Union	Portland Street	Bridgton	647-2383
Hayes True Value	204 Portland Road	Bridgton	647-3342
True Value	P.O. Box 577	Raymond	655-7320
Hansen's Farm Market	74 County Road	Gorham	839-9060
O'Donal's Nurseries	6 County Road	Gorham	839-4262

Buffers aren't just areas of vegetation between your cottage and the water. Native vegetation should be maintained on all areas of your property to lessen the impacts of surface runoff coming off of all developed areas (cottages, roads, driveways, etc.).

Permitting ABC's

Protection of the Brandy Pond 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?

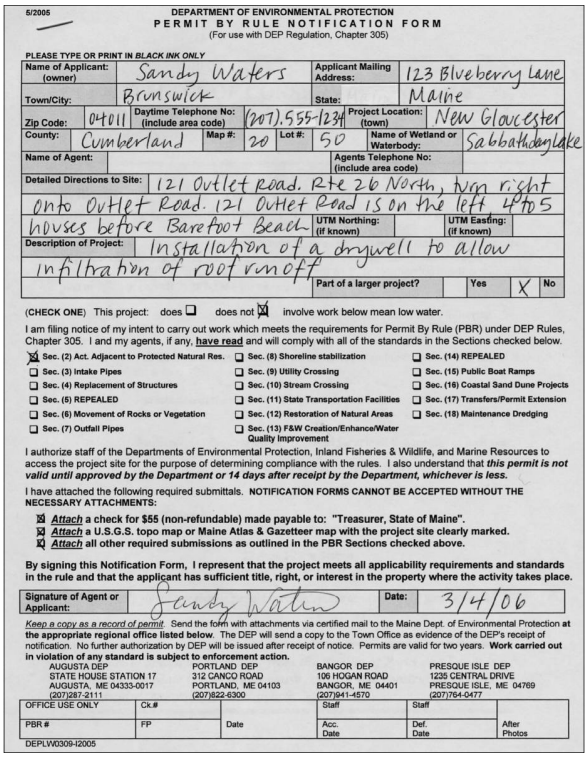
- Construction, clearing of vegetation, and soil movement within 250 feet of the lake shore falls under the Shoreland Zoning Act, which is administered by the Towns through the Code Enforcement Officer and the Planning Board.
- Soil disturbance and other activities within 75 feet of the lakeshore or stream also falls under the Natural Resources Protection Act, which is administered by the Maine DEP.

To ensure that applications for projects that will not result in significant disturbance are processed swiftly, the Maine 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, MDEP 1996

Contact the Maine DEP and Town 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 waterfront 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 Maine DEP and Town to be sure. See the last page of this report for contact information.



5/2005

DEPARTMENT OF ENVIRONMENTAL PROTECTION
PERMIT BY RULE NOTIFICATION FORM
(For use with DEP Regulation, Chapter 305)

PLEASE TYPE OR PRINT IN *BLACK INK ONLY*

Name of Applicant: (owner)	Sandy Waters	Applicant Mailing Address:	123 Blueberry Lane
Town/City:	Brunswick	State:	Maine
Zip Code: 04011	Daytime Telephone No: (include area code) (207).555-1234	Project Location: (town)	New Gloucester
County: Cumberland	Map #: 20 Lot #: 50	Name of Wetland or Waterbody:	Sabbathday Lake
Name of Agent:		Agents Telephone No: (include area code)	
Detailed Directions to Site:	121 Outlet Road. Rte 26 North, turn right onto Outlet Road. 121 Outlet Road is on the left 4th 5 houses before Barefoot Beach		
UTM Northing: (if known)		UTM Easting: (if known)	
Description of Project:	Installation of a drywell to allow infiltration of roof runoff		
		Part of a larger project?	Yes X No

(CHECK ONE) This project: does ☐ does not ☒ involve work below mean low water.

I am filing notice of my intent to carry out work which meets the requirements for Permit By Rule (PBR) under DEP Rules, Chapter 305. I and my agents, if any, have read and will comply with all of the standards in the Sections checked below.

☒ Sec. (2) Act. Adjacent to Protected Natural Res.	☐ Sec. (8) Shoreline stabilization	☐ Sec. (14) REPEALED
☐ Sec. (3) Intake Pipes	☐ Sec. (9) Utility Crossing	☐ Sec. (15) Public Boat Ramps
☐ Sec. (4) Replacement of Structures	☐ Sec. (10) Stream Crossing	☐ Sec. (16) Coastal Sand Dune Projects
☐ Sec. (5) REPEALED	☐ Sec. (11) State Transportation Facilities	☐ Sec. (17) Transfers/Permit Extension
☐ Sec. (6) Movement of Rocks or Vegetation	☐ Sec. (12) Restoration of Natural Areas	☐ Sec. (18) Maintenance Dredging
☐ Sec. (7) Outfall Pipes	☐ Sec. (13) F&W Creation/Enhance/Water Quality Improvement	

I authorize staff of the Departments of Environmental Protection, Inland Fisheries & Wildlife, and Marine Resources to access the project site for the purpose of determining compliance with the rules. I also understand that ***this permit is not valid until approved by the Department or 14 days after receipt by the Department, whichever is less.***

I have attached the following required submittals. **NOTIFICATION FORMS CANNOT BE ACCEPTED WITHOUT THE NECESSARY ATTACHMENTS:**

☒ ***Attach*** **a check for $55 (non-refundable) made payable to: "Treasurer, State of Maine".**
☒ ***Attach*** **a U.S.G.S. topo map or Maine Atlas & Gazetteer map with the project site clearly marked.**
☒ ***Attach*** **all other required submissions as outlined in the PBR Sections checked above.**

By signing this Notification Form, I represent that the project meets all applicability requirements and standards in the rule and that the applicant has sufficient title, right, or interest in the property where the activity takes place.

Signature of Agent or Applicant:	Sandy Waters	Date:	3/4/06

Keep a copy as a record of permit. Send the form with attachments via certified mail to the Maine Dept. of Environmental Protection at **the appropriate regional office listed below.** The DEP will send a copy to the Town Office as evidence of the DEP's receipt of notification. No further authorization by DEP will be issued after receipt of notice. Permits are valid for two years. **Work carried out in violation of any standard is subject to enforcement action.**

AUGUSTA DEP	PORTLAND DEP	BANGOR DEP	PRESQUE ISLE DEP
STATE HOUSE STATION 17	312 CANCO ROAD	106 HOGAN ROAD	1235 CENTRAL DRIVE
AUGUSTA, ME 04333-0017	PORTLAND, ME 04103	BANGOR, ME 04401	PRESQUE ISLE, ME 04769
(207)287-2111	(207)822-6300	(207)941-4570	(207)764-0477

OFFICE USE ONLY	Ck.#		Staff	Staff	
PBR #	FP	Date	Acc. Date	Def. Date	After Photos

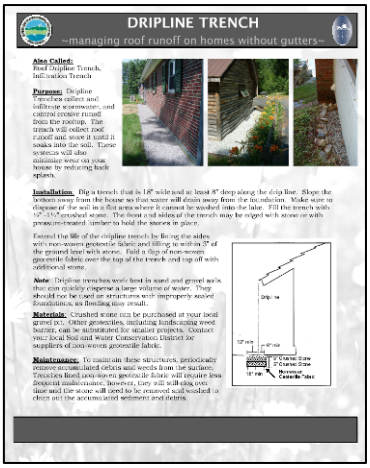
DEPLW0309-I2005

How to apply for Permit by Rule with MDEP:

1. Fill out a notification form before starting any work on the ground. Forms are available from your Town Code Enforcement Officer or the Maine DEP office in Portland, or by visiting www.maine.gov/dep/blwq/docstand/nrpa/pbrform.doc.
2. The permit will be reviewed by MDEP within 14 days. If you do not hear from MDEP within 14 days, you can assume your permit is approved and you can proceed with work on the project.
3. Follow the proper standards for keeping soil erosion to a minimum during construction. It is important that you obtain a copy of the standards so you will be familiar with the law's requirements.

Conservation Practices for Homeowners

After reading this report or having a LakeSmart evaluation, you probably have a general idea about how to make your property more lake-friendly. However, making the leap from concept to construction may be a challenge.


DRIPLINE TRENCH
~managing roof runoff on homes without gutters~

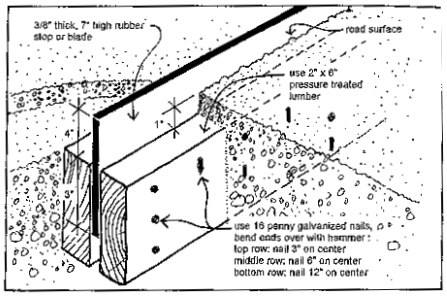
The Maine DEP and Portland Water District have developed a series of fact sheets that answer many common how-to questions. The fact sheets profile over 20 common conservation practices and include detailed instructions, diagrams and color photos about installation and maintenance. The series includes the following:

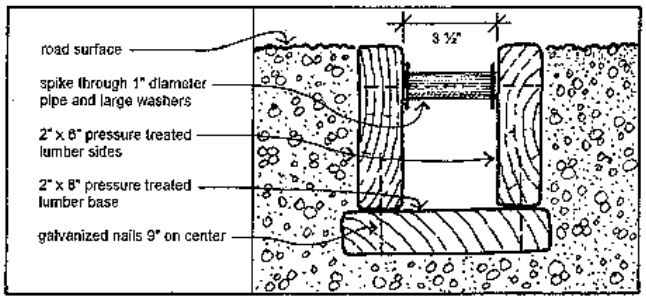
Construction BMPs	Infiltration Trench	Rain Barrels
Dripline Trench	Native Plant Lists (4)	Rain Gardens
Drywells	Open-Top Culverts	Rubber Razors
Erosion Control Mix	Paths and Walkways	Turnouts
Infiltration Steps (2)	Permitting	Waterbars

The series also includes four native plant lists. Each one is tailored to different site conditions (e.g., full sun and dry soils). The lists include plant descriptions from the DEP's *Buffer Handbook* and small color photos of each plant to make plant selection easier.

Fact sheets are available to help you install conservation practices on your property
Download at http://www.maine.gov/dep/blwq/docwatershed/materials.htm.

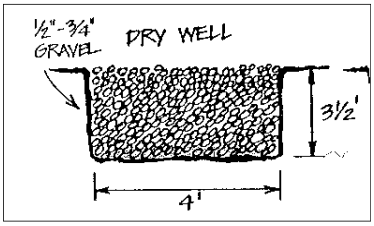
Rubber Razor Blade: Use this structure in a gravel driveway or camp road. It can be plowed over only if the plow operator is aware of its presence and lifts the plow blade slightly. Place it at a 30 degree angle to the road edge and direct the outlet toward a stable vegetated area.



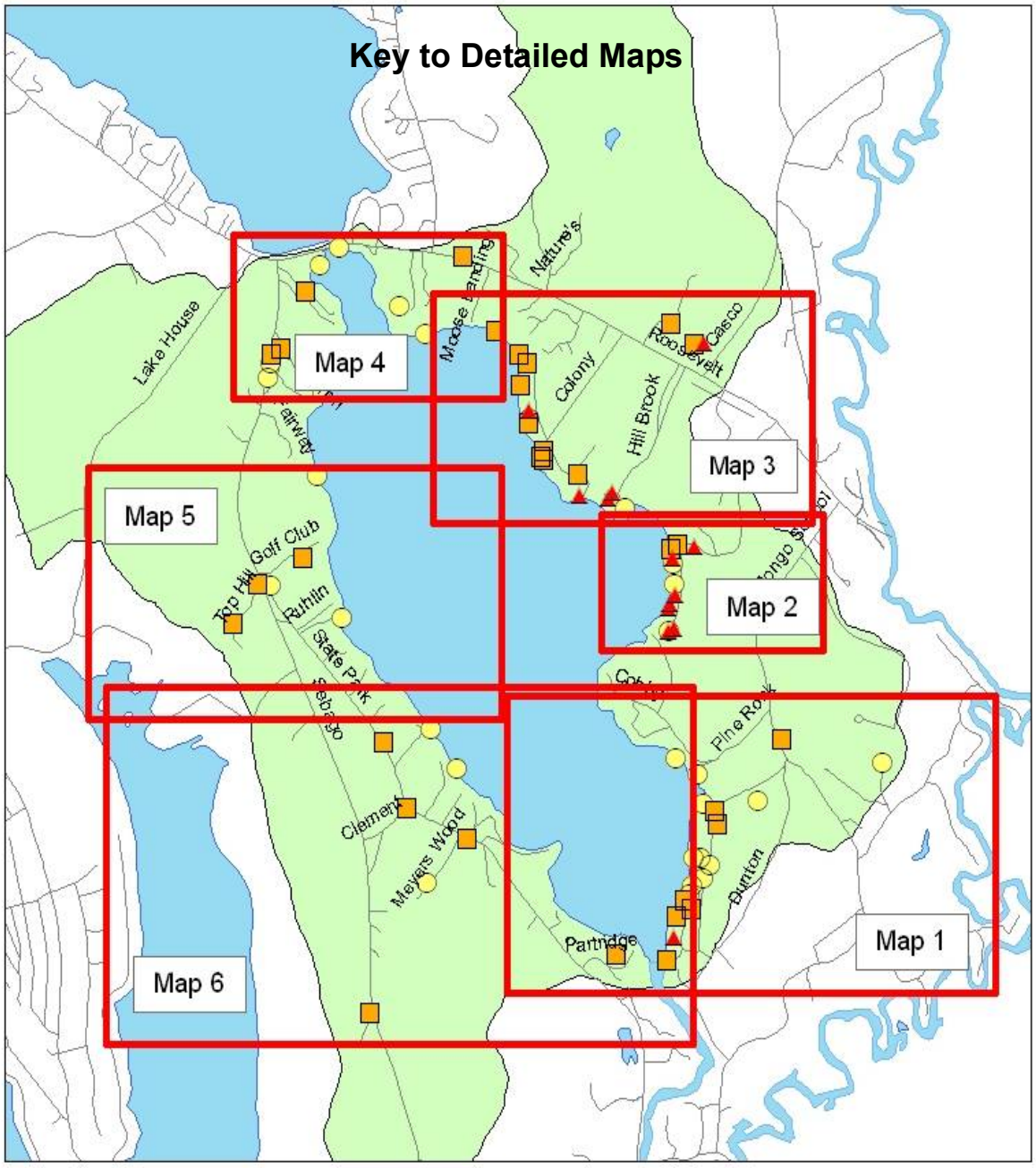


Open Top Culvert: Use this structure in a gravel driveway or camp road that does not get plowed in the winter. Place it at a 30 degree angle to the road edge and point the outlet into stable vegetation. Remove leaves and debris as needed.

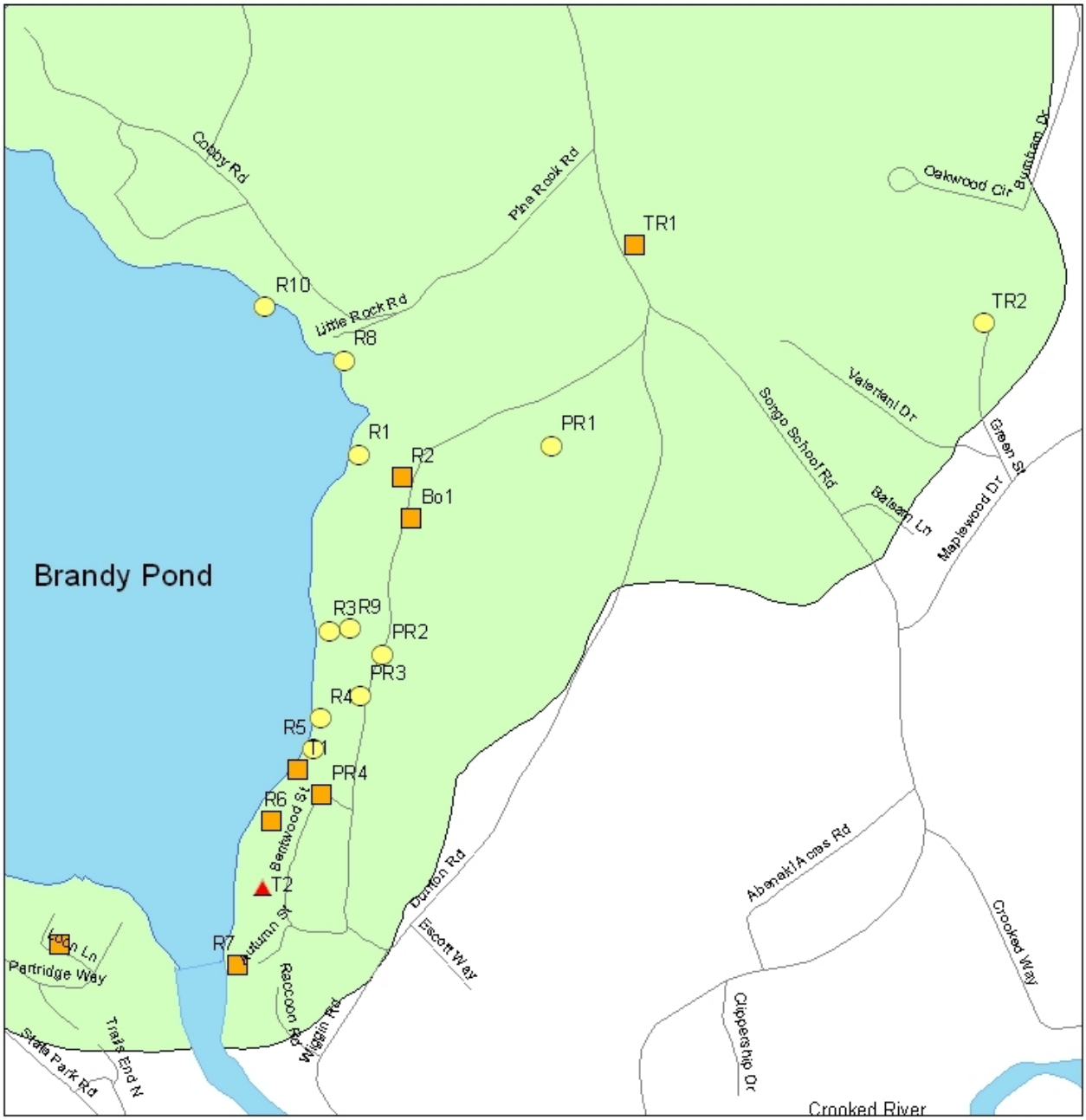
Drywell: Use a drywell to collect runoff from roof gutter downspouts. Drywells can be covered with sod, or left exposed for easy access and cleanout. Drywells and infiltration trenches work best in sandy or gravelly soils.



Appendix A: Maps of erosion sites documented



Map 1: Erosion Sites



Legend

Impact to Lakes

- High
- Low
- Medium

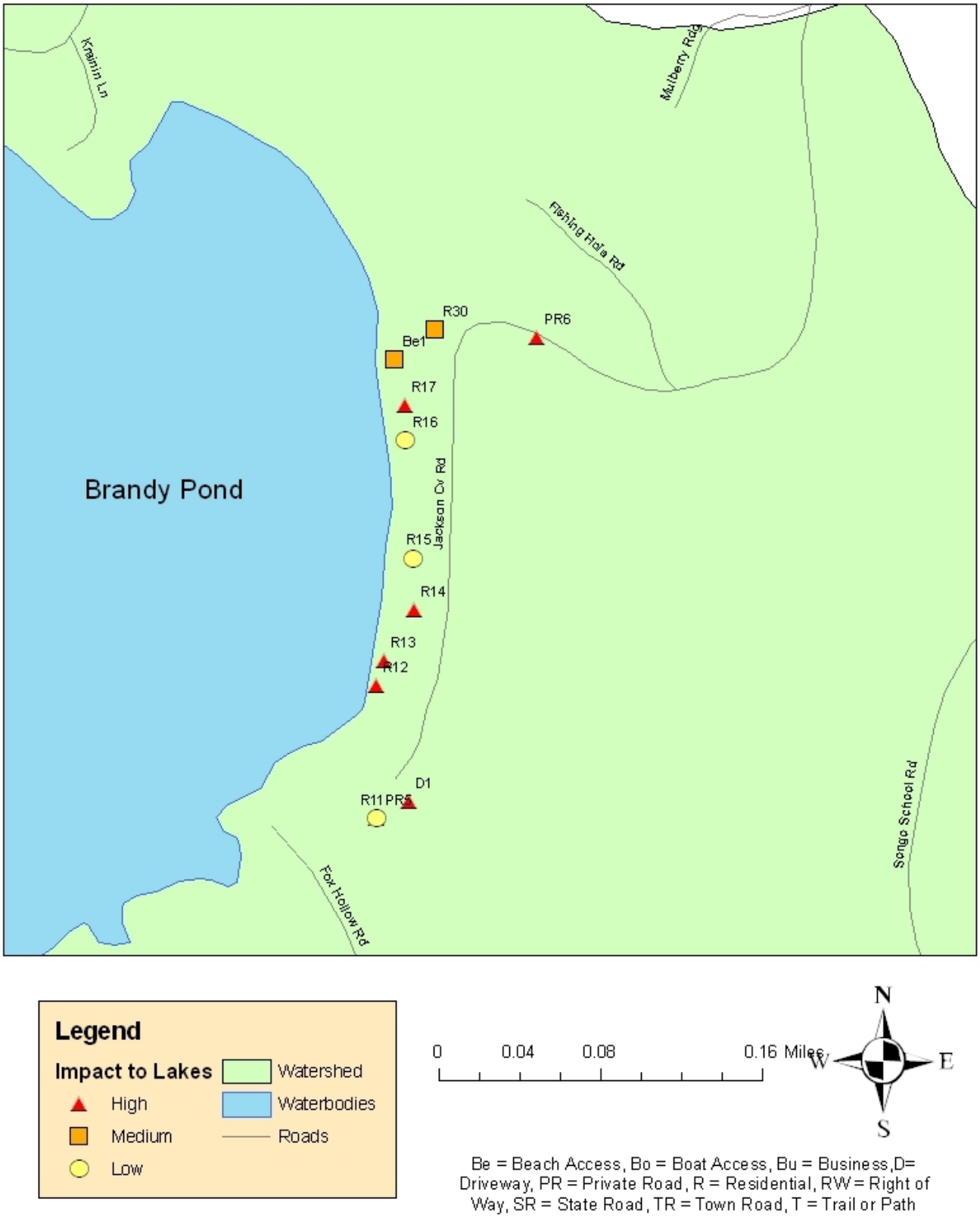
- Watershed
- Waterbodies
- Roads

0 0.5 1 2 Miles

N W E S

Be = Beach Access, Bo = Boat Access, Bu = Business, D= Driveway, PR = Private Road, R = Residential, RW = Right of Way, SR = State Road, TR = Town Road, T = Trail or Path

Map 2: Erosion Sites



Map 3: Erosion Sites

Legend

Impact to Lakes

- High
- Medium
- Low

- Watershed
- Waterbodies
- Roads

0 0.05 0.1 0.2 Miles

N W E S

Be = Beach Access, Bo = Boat Access, Bu = Business, D= Driveway, PR = Private Road, R = Residential, RW = Right of Way, SR = State Road, TR = Town Road, T = Trail or Path

Map 4: Erosion Sites

Legend

Impact to Lakes

- High
- Medium
- Low

- Watershed
- Waterbodies
- Roads

0 0.05 0.1 0.2 Miles

N W E S

Be = Beach Access, Bo = Boat Access, Bu = Business, D= Driveway, PR = Private Road, R = Residential, RW = Right of Way, SR = State Road, TR = Town Road, T = Trail or Path

Map 5: Erosion Sites

Legend

Impact to Lakes

- High
- Medium
- Low

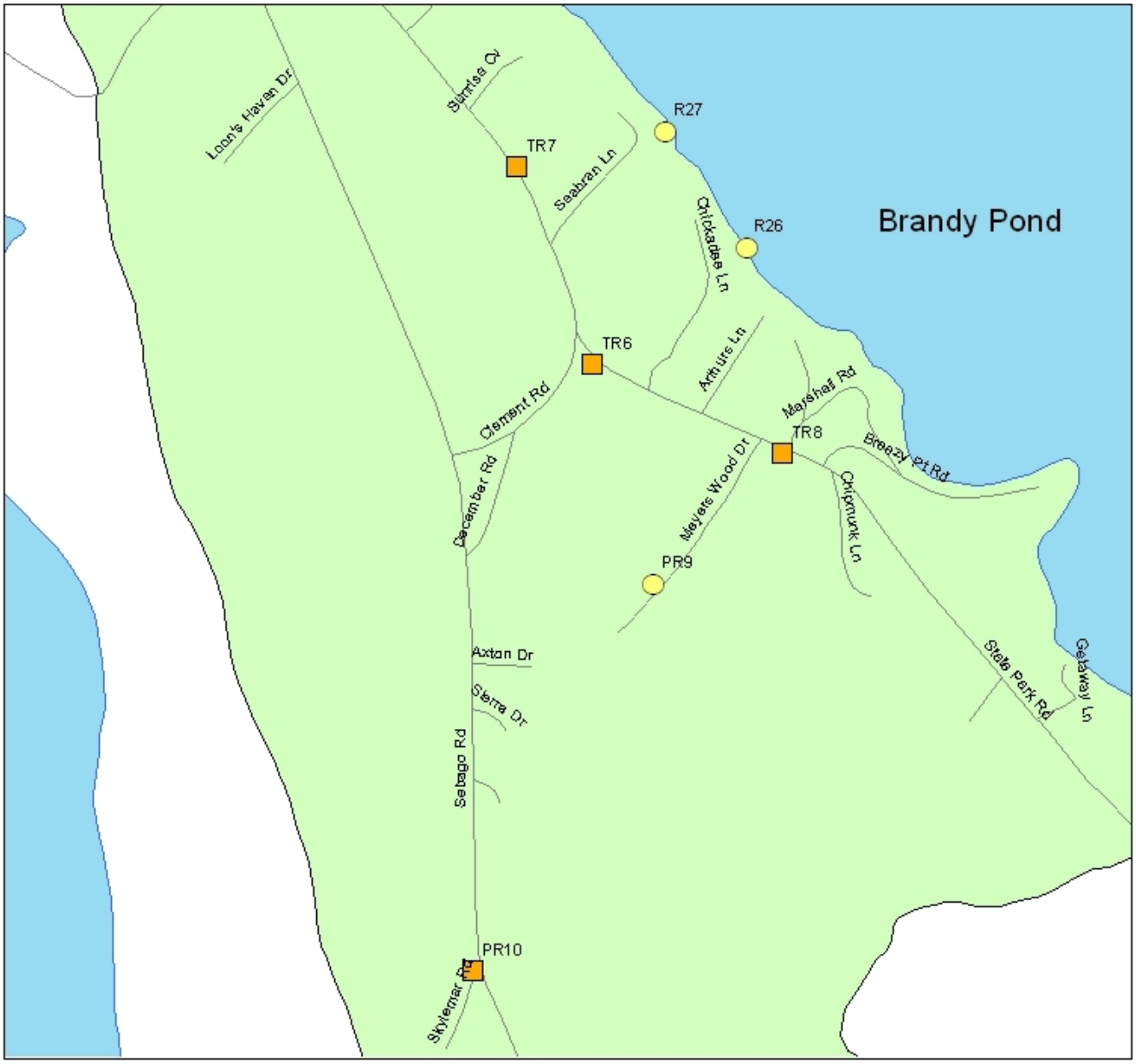
- Watershed
- Waterbodies
- Roads

0 0.1 0.2 0.4 Miles

N W E S

Be = Beach Access, Bo = Boat Access, Bu = Business, D= Driveway, PR = Private Road, R = Residential, RW = Right of Way, SR = State Road, TR = Town Road, T = Trail or Path

Map 6: Erosion Sites



Legend

Impact to Lakes

- High
- Medium
- Low

- Watershed
- Waterbodies
- Roads

0 0.1 0.2 0.4 Miles

N W E S

Be = Beach Access, Bo = Boat Access, Bu = Business, D= Driveway, PR = Private Road, R = Residential, RW = Right of Way, SR = State Road, TR = Town Road, T = Trail or Path

Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
1	PR1	U-14	22	Private Rd	Slight road shoulder erosion, Plow berm, winter sand	Remove plow berm, build up/add new material to road, reshape/crown	Low	Low	Low
1	Bo1	U-14	7	Boat Access	Slight surfce erosion, bare soil	Build up road/add gravel, reshape/crown, grade, install runoff diverters - rubber razor	Medium	Low	Low
1	R1	U-14	18	Residential	Shoreline undercut, inadequate vegetation, bank failure	Riprap, cut bank, shorefront buffer	Low	Medium	Medium
1	R2	U-14	18	Residential	Clogged culvert, Slight road shoulder erosion, bare soil	Remove clog and enlarge culvert, install ditch	Medium	Low	Low
1	PR2	U-15	39	Private Rd	Inadequate ditch, Slight road shoulder erosion, plow berm, slight surface erosion, bare soil	Install turnouts, install ditch, Remove plow berm, grade road	Low	Medium	Medium
1	R3	U-14	10	Residential	Shoreline erosion - bank failure	Enhance shoreline with vegetation and riprap	Low	Low	Low
1	PR3	U-15	40	Private Rd	Clogged culvert, bare soil, inadequate ditch, slight road shoulder erosion, plow berm, slight surface erosion	Remove clog, install plunge pool, install ditch, remove berm	Low	Low	Medium
1	R4	U-15	25	Residential	Shoreline erosion - bank failure	Enhance shoreline with vegetation and riprap	Low	Low	Low

**Although every effort was made to ensure their accuracy, tax map lot numbers reflected here may not be the actual location of the problem cited.*

Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
1	R5	U-15	24	Residential	Shoreline erosion, bank failure, undercut, inadequate vegetation	Enhance shoreline with vegetation and riprap	Low	Low	Low
1	T1	U-15	22	Trail or Path	Moderate surface erosion, bare soil, lack of shoreline vegetation, shoreline erosion	Install multiple runoff diverters, establish vegetation	Medium	Low	Low
1	PR4	U-15	22	Private Rd	Moderate shoulder erosion, moderate surface erosion, bare soil	Install turnout, install ditch, reshape/crown road	Medium	Medium	Medium
1	R6	U-15	20	Residential	Moderate surface erosion, bare soil	Install runoff diverter, establish vegetation	Medium	Low	Low
1	T2	U-15	14	Trail or path (right of way?)	Moderate surface erosion, bare soil	Install runoff diverter, create terraces	High	Medium	Medium
1	R7	U-15	8	Residential	Undercut shoreline, shoreline erosion, bank failure	Enhance shoreline with vegetation and riprap	Medium	Medium	Medium
1	TR1	U-14	1A, 1-2	Town Rd	Unstable/broken culvert outlet, severe road shoulder erosion, winter sand.	Replace or armor culvert outlet, remove winter sand	Medium	High	High
1	R8	U-14	2	Residential	Slight surface erosion, Shoreline erosion inadequate shoreline vegetation	Enhance vegetation	Low	Low	Low
1	R9			Residential	Shoreline undercut	Erosion control mat, enhance with vegetation	Low	Low	Low
1	R10	U-13	6	Residential	Shoreline slump	Repair wall	Low	Low	Low

**Although every effort was made to ensure their accuracy, tax map lot numbers reflected here may not be the actual location of the problem cited.*

Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
1	TR2	R-7	14A-7	Town Rd	Clogged crushed and broken culvert	Remove clog in culvert, remove sediment from ditch	Low	Low	Low
1	R29	U-16	0019	Residential	Construction of camp with no BMPs, bare piles of sand	Mulch, silt fence, seed or cover soil piles	Medium	Low	Low
2	D1	U-12	13	Driveway	Severe road shoulder erosion, bare soil	Build up/add new material, grade.	High	Medium	Medium
2	R11	U-12	13	Residential	Roof runoff erosion, drain from foundation, unstable shoreline access, shoreline erosion, lack of shoreline vegetation	Dripline trench, mulch, rain garden, define foot path, runoff diverter, establish buffer	High	Medium	Medium
2	PR5	U-12	10	Private Rd	Moderate ditch erosion, moderate road shoulder erosion, bare soil, winter sand	Armor ditch, reshape ditch, install turnouts	Low	Medium	Medium
2	R12	U-12	14	Residential	Roof Runoff erosion, moderate surface erosion, lack of shoreline vegetation, unstable shoreline access, shoreline erosion	Dripline trench, infiltration trench, runoff diverter, buffer at end of driveway, shoreline buffer	High	Medium	Medium
2	R13	U-12	15	Residential	Undercut shoreline, shoreline erosion, lack of shoreline vegetation, moderate surface erosion	Establish buffer, define foot path runoff diverter, erosion control mulch, rain garden	High	Medium	Medium

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Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
2	R14	U-12	16	Residential	Severe surface erosion, something - possibly septic - seeping out of ground and running into lake	Infiltration trench, erosion control mulch	High	High	High
2	R15	U-12	17	Residential	Slight surface erosion	Install runoff diverter, water retention swale	Low	Low	Low
2	R16	U-12	20	Residential	Shoreline erosion, unstable access	Stabilize deck/beach area	Low	Low	Low
2	R17	U-12	21	Residential	Lack of shoreline vegetation, shoreline erosion, unstable access	Erosion control mix, define beach area, water retention swales	High	High	High
2	Be1	U-12	29	Beach Access	Shoreline erosion, unstable access	Stabilize access with rip rap	Medium	Low	Low
2	U1	U-12	23		Severe ditch erosion	Armor ditch with stone	Medium	Medium	Medium
2	PR6	U-12	24	Private Rd	Severe road shoulder erosion	Reshape and grade road, install catch basin, install detention basin, install runoff diverters	High	Medium	High
3	R18	U-11	0006	Residential	Shoreline undercut and erosion	Enhance shoreline with native vegetation	Low	Low	Low
3	R19	U-11	0008	Residential	Severe surface erosion, lack of shoreline vegetation, beach erosion	Infiltration trench, install runoff diverter, establish vegetation	High	Medium	Low
3	U2	U-10	20-21		Moderate surface erosion, bare soil, winter sand	Install rubber razor, infiltration trench	Medium	Low	Low

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Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
3	R20	U-10	0020	Residential	Slight surface erosion, bare sand, delta in stream, undercut shoreline, lack of shoreline vegetation	Install infiltration trench, rain garden, infiltration steps, no raking	Medium	Low	Low
3	R21	U-10	0019	Residential	Moderate surface erosion, bare soil, shoreline erosion	Gutters (disconnect?)	Medium	Low	Low
3	D2	U-10	0019	Driveway	Moderate surface erosion, bare soil, winter sand, shoreline erosion	Install turnouts, reshape (crown), install rubber razor	Medium	Medium	Medium
3	R22	U-10	26	Residential	Severe surface erosion, bare soil, uncovered soil pile, winter sand, lack of shoreline vegetation, shoreline erosion, unstable access	Vegetate should, install infiltration trench, erosion control mulch, establish vegetation, seed/hay	High	Medium	Medium
3	Be2	U-11	9-1	Beach Access	Moderate ditch erosion, slight shoulder erosion, bare soil, lack of shoreline vegetation, shoreline erosion	Rubber razor, enhance diversion trench, define foot path	Medium	Medium	Medium
3	PR11			Private Road	Winter sand	Remove winter sand	Medium	Medium	Medium
3	R23	U-10	0024	Residential	Slight surface erosion, bare soil, shoreline erosion	Erosion control mulch, use gravel instead of concrete, enhance with plants	Low	Low	Low

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Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
3	U3	U-10	0025		Slight surface erosion, bare soil	Replace fill with gravel	Low	Low	Low
3	RW	U-10	30	Right of way	Bare soil, shoreline erosion, unstable access	Define foot path, enhance with plants	Medium	Medium	Medium
3	U4	U-10	0034		Slight surface erosion, bare soil, shoreline erosion	Install rubber razor, define foot path, mulch path, enhance with plants, no raking, seed/hay	Low	Low	Low
3	TR9	U-04	0010	Town Road	Crushed/broken culvert, slight ditch erosion, soil delta in stream, shoreline erosion	Replace culvert, armor inlet/outlet, build up road/add recycled asphalt, re-grade, install runoff diverter	Medium	High	High
3	Bu1	U-04	7	Business	Severe ditch erosion and bank failure, severe surface erosion, shoreline erosion	Armor ditch with stone, define foot path, install runoff diverter	High	High	High
3	Bu2	U-04	5	Business	Severe ditch erosion, severe surface erosion, bare soil, non-functioning silt fence, shoreline erosion	Fix silt fence or install better erosion control, seed/hay	High	Medium	Medium
3	Bo2	U-3	20	Boat Access	Moderate surface erosion, unstable shoreline access	Crushed stone near boat launch, build up material on road, install rubber razor	Medium	Low	Low

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Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
4	SR1	U-2	22	State Rd	Unstable culvert inlet/outlet, crushed/broken culvert, moderate-severe ditch erosion, oil slick on ditch water from parking lot	Armor culvert inlet/outlet, replace and enlarge culvert, armor and reshape ditch, vegetate shoulder, catch basin	Medium	High	High
4	Be3	U-2	Common Area	Beach Access	Moderate surface erosion, lack of shoreline vegetation	Enhance with vegetation and riprap	Low	Low	Low
4	R24	U-2	37-5	Residential	Slight ditch erosion	Vegetate ditch, install check dams	Low	Low	Low
4	Bu3	U-2	39	Business	Bare soil, uncovered pile, shoreline erosion	Relocate, stabilize, cover, or enclose debris pile, mulch, seed/hay	Low	Low	Low
4	R25	U-1	1	Residential	Slight surface erosion, bare soil, inadequate shoreline vegetation, shoreline erosion	Enhance with buffer, seed/hay	Low	Low	Low
4	PR7	U-1	3	Private Rd	Moderate road shoulder erosion, moderate surface erosion, possible road washout or intentional grading to get water off road caused erosion into lake	Build up/add new material to road, armor shoulder	Medium	Medium	Medium

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Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
4	TR5	U-1	9	Town Rd	Unstable and clogged culvert and settling basin, winter sand, undercut shoreline	Armor inlet/outlet, remove clog, clean settling basin, lengthen culvert, remove winter sand	Medium	Medium	Medium
4	SR3	U-1	11	State Rd	Unstable culvert, bare soil	Armor inlet/outlet, remove sediment	Medium	High	High
4	D3	U-1	11	Driveway	Unstable and clogged culvert	Armor inlet/outlet, remove clog	Low	Low	Low
4	D4	U-1	10	Driveway	Unstable and clogged culvert	Armor inlet/outlet	Low	Low	Low
5	PR8	U-23	2	Private Rd	Unstable/clogged/undersized culvert, severe surface erosion	Armor/replace/englarge culvert, install ditch, build up and re-shape and grade road.	Medium	High	High
5	TR3	U-23	1	Town Rd	Unstable culvert inlet/outlet, bank failure in ditch	Armor/replace/enlarge culvert	Low	Medium	High
5	SR2			State Rd	Unstable and clogged culvert, slight ditch erosion	Armor/remove clog/replace/enlarge culvert, remove winter sand.	Medium	High	High
5	TR4			Town Rd	Unstable and clogged culvert, berms on ditch, winter sand	Armor/remove clog/ replace culvert, reshape ditch, remove berms, remove winter sand, re-pave, crown.	Medium	High	High
5	R28	U-23	5	Residential	Slight surface erosion, inadequate shoreline vegetation	Infiltration trench, establish vegetation, driveway improvements	Low	Low	Low
6	R26	U-21	5	Residential	Slight surface erosion	Define foot path, install runoff diverter, use mulch or erosion control mix.	Low	Low	Low

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Appendix B: Sites Documented Through Brandy Pond Watershed Survey - 2009

Map #	Map ID	Tax Map*	Tax Lot*	Land Use	Type of Problem	Recommendations	Impact of Problems	Cost - Materials	Cost - Labor
6	TR6	U-21	3/4	Town Rd	Unstable culvert, moderate road shoulder erosion, roadside berm, winter sand	Armor inlet/outlet, armor ditch, install check dams or sediment pool, install guardrail, remove winter sand, remove berm, vegetate shoulder, install detention basin	Medium	High	High
6	R27	U-21	1A	Residential	Slight surface erosion, lack of shoreline vegetation, shoreline erosion, unstable access	Infiltration trench, establish vegetaion, water retention swales	Low	Low	Low
6	TR7	U-22	6	Town Rd	Unstable inlet/outlet, severe surface erosion, winter sand	Armor inlet/outlet, vegetate/armor/reshape ditch, remove winter sand, establish vegetation, water retention swales	Medium	Medium	Medium
6	TR8	R-7	54A	Town Rd	Clogged culvert, slight ditch erosion, slight road shoulder erosion, winter sand	Remove clog from and enlarge culvert, vegetate and reshape ditch, install sediment pool, remove winter sand	Medium	Medium	Medium
6	PR9	R-7	55-2	Private Rd	Unstable and crushed culvert, slight ditch erosion	Armor, replace, lower culvert	Low	Medium	Medium
6	PR10	R-5	28	Private Rd	Unstable inlet/outlet, moderate ditch erosion, slight road shoulder erosion, slight surface erosion, bare soil	Armor/enlarge culvert, install plunge pool, armor ditch with stone, install check dams, remove berm, grade road	Medium	Medium	Medium

**Although every effort was made to ensure their accuracy, tax map lot numbers reflected here may not be the actual location of the problem cited.*

Where do I get more information?

Contacts

Cumberland County Soil and Water Conservation District (CCSWCD)
35 Main Street, Suite 3, 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.

Lakes Environmental Association (LEA)
230 Main Street, Bridgton, ME 04009
(207) 647-8580 Website: www.mainelakes.org
Conducts water quality testing; offers assistance with lake-related issues, milfoil control, environmental education, seminars and training sessions.

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 E-mail: 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.

Publications

- *The Buffer Handbook: A Guide to Creating Vegetated Buffers for Lakefront Properties.* Androscoggin Valley SWCD and Lake and Watershed Resources Management Associates. 1998. 20 pgs. plus inserts. (www.maine.gov/dep/blwq/docwatershed/bufa.htm)
- *Camp Road Maintenance Manual: A Guide for Landowners.* Kennebec County SWCD and Maine DEP. June, 2000. 54 pgs. (www.maine.gov/dep/blwq/docwatershed/camproad.pdf)
- *A Guide to Forming Road Associations.* York County SWCD et al. July, 2004. 57 pgs. (www.maine.gov/dep/blwq/docwatershed/roadassociation.htm)
- *A Homeowner's Guide to Environmental Laws Affecting Shorefront Property in Maine's Organized Towns.* Maine DEP. April, 2003. DEPLW0320-D2003. 42 pgs. (www.maine.gov/dep/blwq/docstand/home.pdf)
- *Maine Shoreland Zoning—A Handbook for Shoreland Owners.* Maine DEP. 1999. DEPLW 1999-2. 34 pgs. (www.maine.gov/dep/blwq/docstand/sz/citizenguide.pdf)
- *Gardening to Conserve Maine's Native Landscape: Plants to Use and to Avoid.* University of Maine Cooperative Extension. Bulletin #2500. June, 1999. Folded leaflet. (www.umext.maine.edu/onlinepubs/htmpubs/2500.htm)

Report prepared by:

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