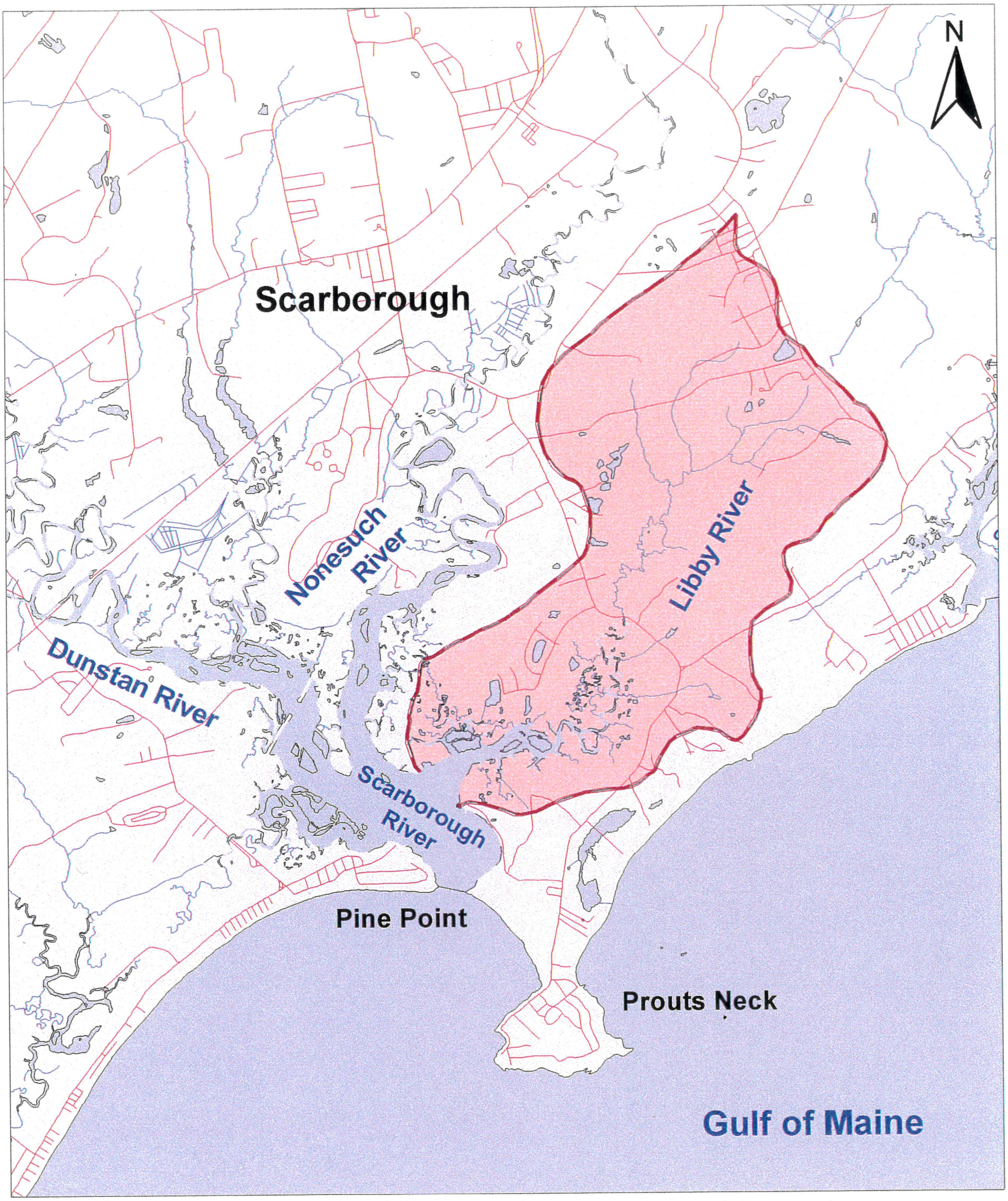
LIBBY RIVER WATERSHED SURVEY
FINAL REPORT



Prepared by:
Libby River Watershed Survey Steering Committee
Friends of Scarborough Marsh
December 2000

ACKNOWLEDGMENTS

We are very grateful to the following Libby River Watershed Survey participants, most of whom were involved in this study on a volunteer basis:

Watershed Survey Volunteers

Roger Addor
Beth Bellemere
Ann Delehanty
Robert Green
Lucy LaCasse
John Lyon
Dona Sherburne
Fred Simpson
Helen Simpson
Harvey Warren
Tracey White

Steering Committee

Ann Delehanty, *Scarborough Coastal Pollution Committee*
John Lyon, *Scarborough Shellfish Conservation Committee*
Roger Mallar, *Friends of Scarborough Marsh*
Laurene Swaney, *Scarborough Land Conservation Trust*
Tracey White, *Scarborough Conservation Commission*

Technical Staff

John MacKinnon, P.E., *Watershed Solutions, Inc.*
Don Kale, *Maine Department of Environmental Protection*

We would also like to thank the following people and organizations who generously gave of their time and expertise in support of the project:
Dave Corbeau, *Scarborough Marine Resources Officer*
Bill Giguere, *Scarborough Public Works Director*
Laura Livingston, *Maine Department of Marine Resources*
Susan Smith, *Wells National Estuarine Research Reserve*
Jim Wendel, *Scarborough Town Engineer*
Greater Portland Council of Governments

We would also like to express our gratitude to *Camp Fire Boys and Girls* who donated the use of their facility for the public meeting and volunteer training that were conducted in conjunction with the Libby River Watershed Survey.

In August, 2000, the Maine Coastal Program of the Maine State Planning Office awarded $9,828 from their Maine Shore Stewards Grant Program to the Friends of Scarborough Marsh to conduct a survey of the Libby River Watershed.

While this project was funded by a grant from the Maine State Planning Office, the contents of this document do not necessarily reflect the view and policies of the Planning Office, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

It is the policy of the Maine State Planning Office that no person shall be subjected to discrimination on the grounds of race, color, sex, handicap, age or national origin.

TABLE OF CONTENTS

INTRODUCTION

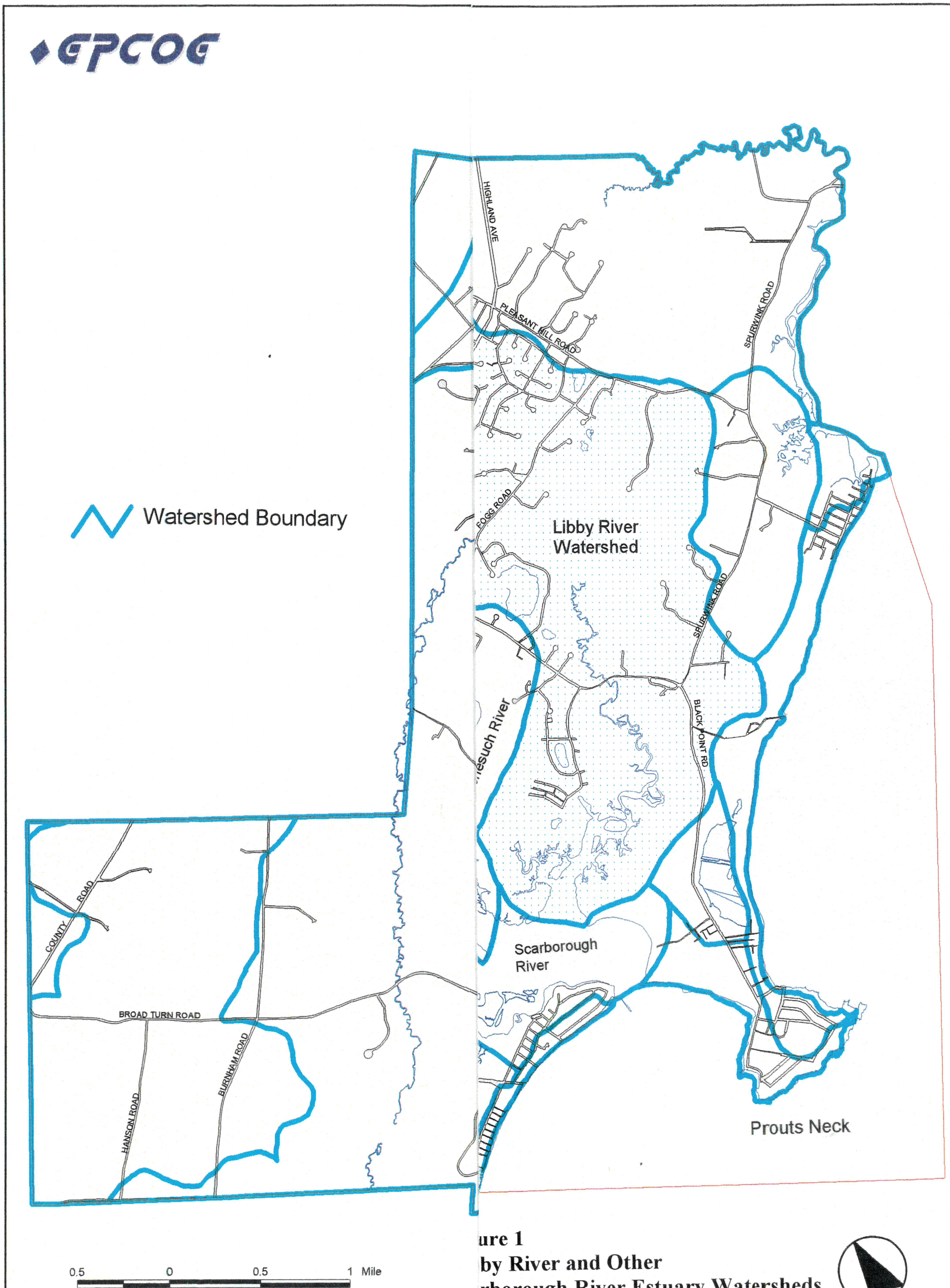
This Libby River Watershed Survey Report was prepared by the Friends of Scarborough Marsh, a coalition of private citizens and organizations pledged to conserve, protect, restore, and enhance the Scarborough Marsh Watershed. The report begins by providing background information on the Libby River and the potential origins and effects of pollutants that may be affecting water quality. The report then discusses the purposes and scope of the watershed survey, the survey findings, and the results of evaluations that are related to the survey. The report concludes with recommendations for *protecting* and *restoring* water quality in the Libby River Watershed. While the findings and recommendations contained in this report relate to the Libby River Watershed, much of the information is transferable to similar land uses in other watersheds that are connected to the Scarborough River Estuary. In particular, the recommendations presented in this report could be used as the basis for initiating watershed stewardship and planning activities in all of the estuary watersheds.

Why is protecting the Libby River so important?

The Libby River is an integral part of the Scarborough River Estuary (Figure 1). Estuaries are partially enclosed bodies of water where saltwater from the ocean mixes with freshwater from rivers and streams. Like all estuaries, the Scarborough River Estuary is a food factory for flora and fauna living in the estuary and in the adjoining marine waters. The engine that drives the food factory is "detritus", or the bits and pieces of marsh plants that provide food for organisms at the bottom of the food chain. In turn, the finfish and shellfish that are higher up in the food chain thrive on the organisms that eat detritus.

One measure of the productivity of the Scarborough River Estuary is the economic value of clams harvested by Scarborough clam diggers. For the years 1997 through 1999, Scarborough's ranking among the 92 Maine towns that reported clam landings in at least one of those years ranged from 4th to 12th place (Maine Department of Marine Resources, 2000). Assuming that the average price paid to diggers was $1.50 per pound, the 254,752 pounds of clams reportedly harvested by Scarborough diggers in 1999 earned them approximately $382,128 (Lyon, 2000). Depending on how the clams were processed and sold to consumers (e.g., steamed clams or fried clams), wholesale and retail businesses could have earned another $4 to $8 per pound!

Aside from its high productivity, the Scarborough River Estuary provides several other benefits. The marsh can be likened to a giant, natural water filter. Many types of pollutants that are flushed into coastal and inland waters attach themselves to particles suspended in the water. The suspended particles act like transport vehicles for the pollutants, and when carried into the estuary by rivers, streams, or tidal currents, they either settle or are filtered out of the water by the thick marsh vegetation. The pollutants then become entrapped by layers of sediment and vegetation. Because the broad expanses of marsh slow the incoming currents, the estuary also provides natural flood controls by moderating storm surges that may otherwise inundate low-lying areas. The thick marsh vegetation is also a buffer between open waters and the shoreline and helps to protect the shoreline against wave erosion.



ure 1
by River and Other
rborough River Estuary Watersheds

Is there anything harming the Libby River?

Overall, the Libby River appears to be healthy. Former land uses such as gravel mining and junk-yards, which once contributed to a decline in water quality and habitat, have ceased operation (Town of Scarborough, 1989). Most of the ***watershed*** is now served by public sewer which reduces the threat of pollution from failing septic systems. However, old land uses are being replaced by new land uses with a new set of problems. There has been considerable residential development in the upper portions of the Libby River watershed during the last decade. As a watershed becomes developed, the portion of rainfall and snowmelt that seeps into the ground diminishes and the amount that flows into streams from road ditches and storm sewers increases. Much of the water, or runoff, that enters ditches and storm sewers has washed over a landscape that includes lawns, driveways, and roads. Substances that have dripped, dropped, or been deposited onto lawns and pavement are flushed from these surfaces by runoff, yielding ***polluted runoff***. Polluted runoff can ultimately harm water quality in the Libby River and the Scarborough River Estuary.

> ***Watershed***
>
> A watershed encompasses all of the land that slopes down to a water body, such as the Libby River, so that rainfall and snowmelt flowing over the land eventually reaches the water body. The watershed boundary is an imaginary line along the high ground that separates neighboring watersheds.

How bad is polluted runoff?

Polluted runoff can contain a variety of pollutants, depending on the land use in the watershed. In urban watersheds, runoff typically contains the following pollutants:

- elevated levels of nutrients such as nitrogen and phosphorous
- sediment from soil erosion
- bacteria
- toxic substances such as pesticides, herbicides, petroleum products, and metals

A national study has shown that polluted runoff contributes more to coastal marine pollution in the U.S. than sewerage facilities or industrial facilities (Kennish, 1999).

<u>Nutrients</u>. Although nutrients are necessary for plant growth both on land and in the water, water bodies that are overloaded with nutrients sometimes experience ***algal booms***, which can rob the water of the dissolved oxygen that aquatic organisms need to survive. Nutrients found in polluted runoff are often associated with the overuse of fertilizers on lawns, gardens, and crops. Phosphorous is the primary nutrient of concern for freshwater bodies, while nitrogen is the primary nutrient of concern for saltwater bodies. In Maine, a 1988 algal bloom that killed shellfish in Maquoit Bay in Brunswick was likely caused by nitrogen enrichment (Casco Bay

> ***Algal Blooms***
>
> A surplus of nutrients in a water body can cause an algal bloom, or algae population explosion, that can turn clear water to a cloudy green color. In extreme cases, thick, foul smelling scum forms on the water and fish kills may occur when decomposing algae depletes the water's oxygen supply.

Estuary Project, 1996). Further from home, low concentrations of dissolved oxygen, or hypoxia, in Long Island Sound have resulted in numerous fish kills. Trawl catches in Long Island Sound have indicated that the abundance of fish is about 40 percent less in hypoxic areas as compared to areas with normal oxygen concentrations (Kennish, 1999). Nitrogen enrichment has been linked to algal blooms and oxygen depletion in the waters of Long Island Sound.

Sediment. Sediment from soil erosion not only carries attached nutrients and toxic substances into water bodies, it also can settle out and smother habitat located on the bottom. It can clog and abrade fish gills, hinder the feeding processes of some shellfish, suffocate eggs and aquatic insect larvae on the bottom, and fill in the pore space between bottom cobbles where some species of fish lay eggs.

Bacteria. Although high bacterial concentrations do not necessarily present a health hazard to humans, they do indicate the possible presence of pathogens, or disease-causing microbes. While urban wildlife and failing septic systems can be a major source of bacteria in polluted runoff, **one of the largest sources is pet waste that enters storm sewer systems**. National studies have found that polluted runoff in storm sewers contains an average ***fecal coliform bacteria*** level of 15,000 to 20,000 counts per 100 milliliters (ml) of water (Center for Watershed Protection, 1999). These numbers far surpass standards used to set safe levels for water uses such as swimming and clamming. The fecal coliform standard typically used for swimming is 200 counts per 100 ml of water and the standard typically used for shellfish beds is 14 counts per 100 ml of water.

Fecal Coliform Bacteria

Fecal coliform bacteria in water indicates the presence of fecal wastes originating from the digestive systems of warm-blooded animals. The measurement unit for fecal coliforms is counts (i.e., number of bacteria colonies counted under a microscope) per 100 milliliters of water sample.

Toxic Substances. Sources of toxic substances in polluted runoff are not just limited to industrial land uses in a watershed but include the following potential sources that can be found in residential or commercial areas:

- Oil, grease, and antifreeze leaking or washed from cars and trucks onto paved areas are ultimately flushed into storm sewers or ditches.
- "Do-it-yourselfers" that perform their own car maintenance sometimes unwittingly dispose of used automotive fluids in storm drains.
- Sump pumps and floor drains in homes and businesses connected to storm sewers can produce severe toxic effects on the receiving water body because hazardous waste is sometimes illegally disposed of in this manner.
- Pesticides and herbicides applied to lawns, gardens, and crops can eventually find their way into waterways, even if they are applied according to the manufacturer's instructions. Some herbicides and insecticides, such as diazinon, can be harmful to aquatic life even at very low levels (Center for Watershed Protection, 2000).

Many of the toxic substances found in polluted runoff are persistent in the environment, meaning that they degrade slowly and can accumulate in the food chain.

Has polluted runoff affected water quality in the Libby River?

Water quality data for the Libby River were acquired from two sources: 1) a study performed by the Town of Scarborough in 1989 and 2) bacteria test results collected by the Maine Department of Marine Resources (DMR). A summary of the water quality data is presented in the following paragraphs.

1989 Study. Limited testing of Libby River water was conducted in 1989 for the Libby River Watershed Water Quality Management Study (Town of Scarborough, 1989). In summary, test results and field observations prompted the following concerns:

- low pH (slightly acidic) and low dissolved oxygen in some of the headwater streams;
- "bad" odors, evidence of petroleum products, and high levels of lead and nickel in water samples collected from areas of dead forest that surrounded gravel pits located off of Black Point Road;
- high levels of metals in water samples that may have been associated with potential sources such as an old landfill in the northern part of the watershed, an old septage dumping area on the Larrabee farm fields, and/or an auto junk yard located near Black Point Road;
- strong sewage smell emanating from a tributary ditch that passes under Marion Jordan Road, and;
- sewage smell from a ditch downstream of a farm pond located near the junction of Spurwink Road and Black Point Road.

Land Use Changes Since 1989 Study. Land uses in the Libby River Watershed have changed significantly since the 1989 study and, although there may be lingering effects on water quality from former land uses, it is expected that they are not having the same impact as they did in 1989. The gravel pits are no longer in operation and in many cases have been converted into ponds surrounded by new homes. Other possible sources of pollutants, such as old landfills and junkyards, have either been covered or have ceased operations.

The sources of the sewage smells noted in the 1989 study were probably associated with failing septic systems. Although most homes and businesses in the watershed are now served by public sewer, some neighborhoods remain on septic systems.

1990 – 2000 DMR Test Results. DMR has been receiving and analyzing water samples collected in the Scarborough River Estuary for decades. The number of samples collected each year has varied, but in order to keep clam flats in the estuary open for harvesting, at least six samples must be collected in the area of the flats each year and analyzed for fecal coliform bacteria (Livingston, 2000).

> ***Geometric Mean***
>
> A geometric mean is a type of averaging that tends to damp out the bias that extremely high or extremely low test results normally have on an average.

The standards that DMR uses to determine whether a clam flat is open for harvesting is a ***geometric mean*** less than or equal to 14 counts per 100 ml and a ***90th percentile value*** less than or equal to 49 counts per 100 ml. DMR performs their statistical analyses on the last 30 test results in order to determine whether a clam flat is an open area (Livingston, 2000). Other standards are used to determine if a clam flat that fails to meet the open standards is approved for restricted harvesting.

> ***90^{th} Percentile Value***
>
> The 90^{th} percentile value is where 90 percent of the test results are at or below the value.

DMR test results for three sampling stations (i.e., G39, G41, and G42) on the Libby River were evaluated for this report (see Figure 2). The test results are from samples collected in January 1990 through September 2000. Factors that appeared to influence the levels of fecal coliforms in the water samples included the timing of the sampling relative to the tidal cycle, and the amount of precipitation in the days prior to the sampling. The influence that the amount of rainfall has on the levels of fecal coliforms at each sampling station is shown in the following table.

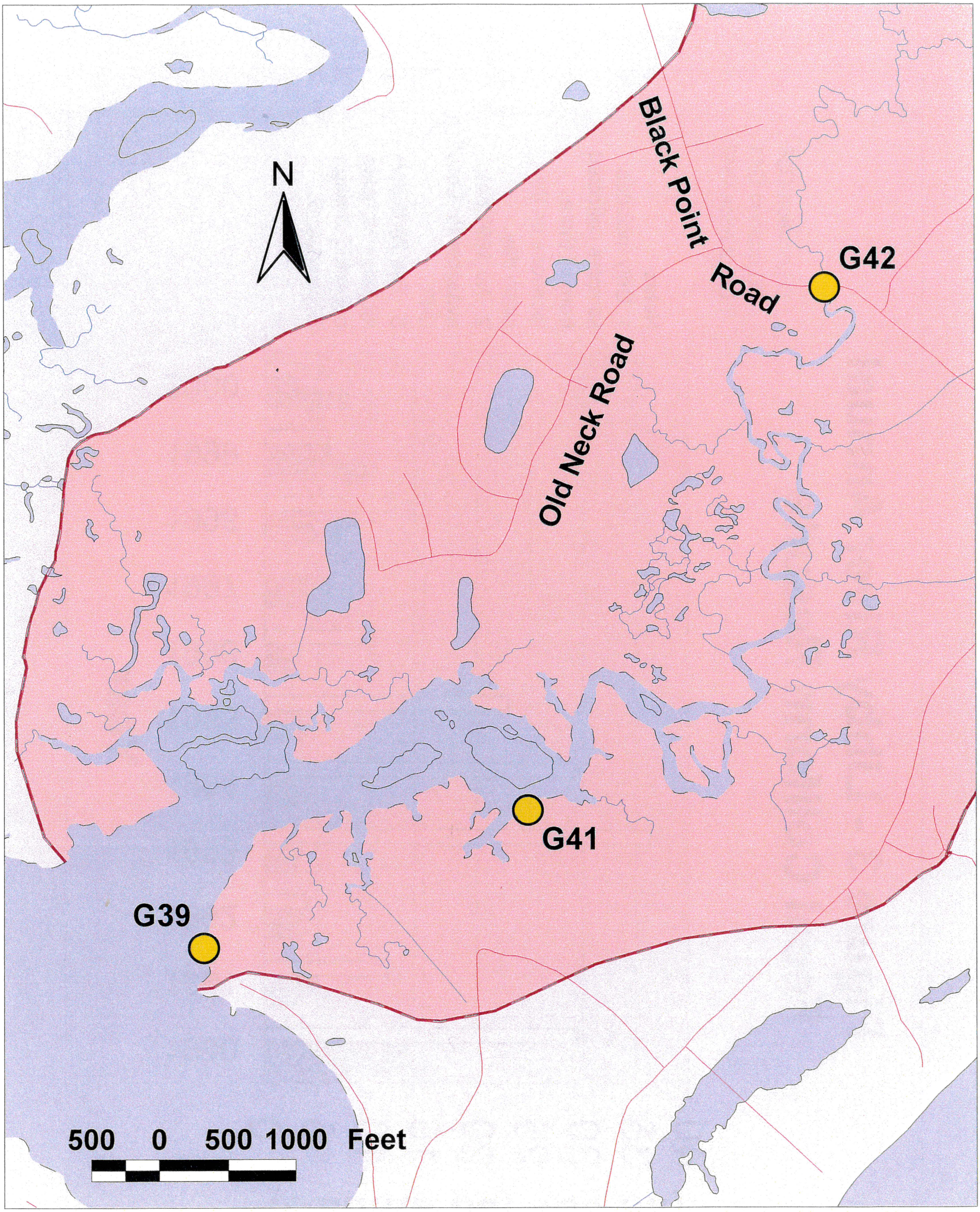
Table 1 – Effects of Rainfall on Bacteria Levels

Sampling Station	Geometric mean for Fecal Coliforms (counts per 100 ml) when rainfall during previous 72 hours is greater than or equal to 1 inch	Geometric mean for Fecal Coliforms (counts per 100 ml) when rainfall in previous 72 hours is less than 1 inch
G39	11.4	5.9
G41	8.2	6.5
G42	13.4	13.7

As seen in the table, the amount of rainfall had a significant influence on the levels of fecal coliforms near the mouth of the Libby River (i.e., Station G39) but apparently had little influence on the fecal coliforms levels at the Black Point Road crossing (i.e., Station G42). This suggests that the fecal contamination at Station G42 was associated with a source that supplies a steady stream of pollutants regardless of the weather conditions. This apparent source of dry weather fecal contamination may be a symptom of the "sewage odors" that were detected near the junction of Spurwink Road and Black Point Road during the 1989 Study.

Another evaluation of the DMR test results was performed in order to compare the levels of fecal contamination between the sampling stations. A fair comparison can be made if samples were collected from all three stations at approximately the same time, when the weather conditions and the tidal cycle were similar. Accordingly, the DMR test results were screened to include only the dates on which samples were collected from all three stations. The annual geometric means for each station were then calculated using the test results from those dates and plotted in Figure 3.

Figure 3 confirms that, until 1999, levels of fecal coliforms at Station G42 were consistently greater than the levels at the other two stations, sometimes by a wide margin. This again indicates a source of fecal contamination near Station G42. Figure 3 also explains why the area near the Black Point Road crossing has either been closed or restricted to clam digging for many years. However, since 1995, the geometric means for the Station G42 data plotted in Figure 3 have fallen below the DMR standard of 14 counts per 100 ml. Assuming this trend continues



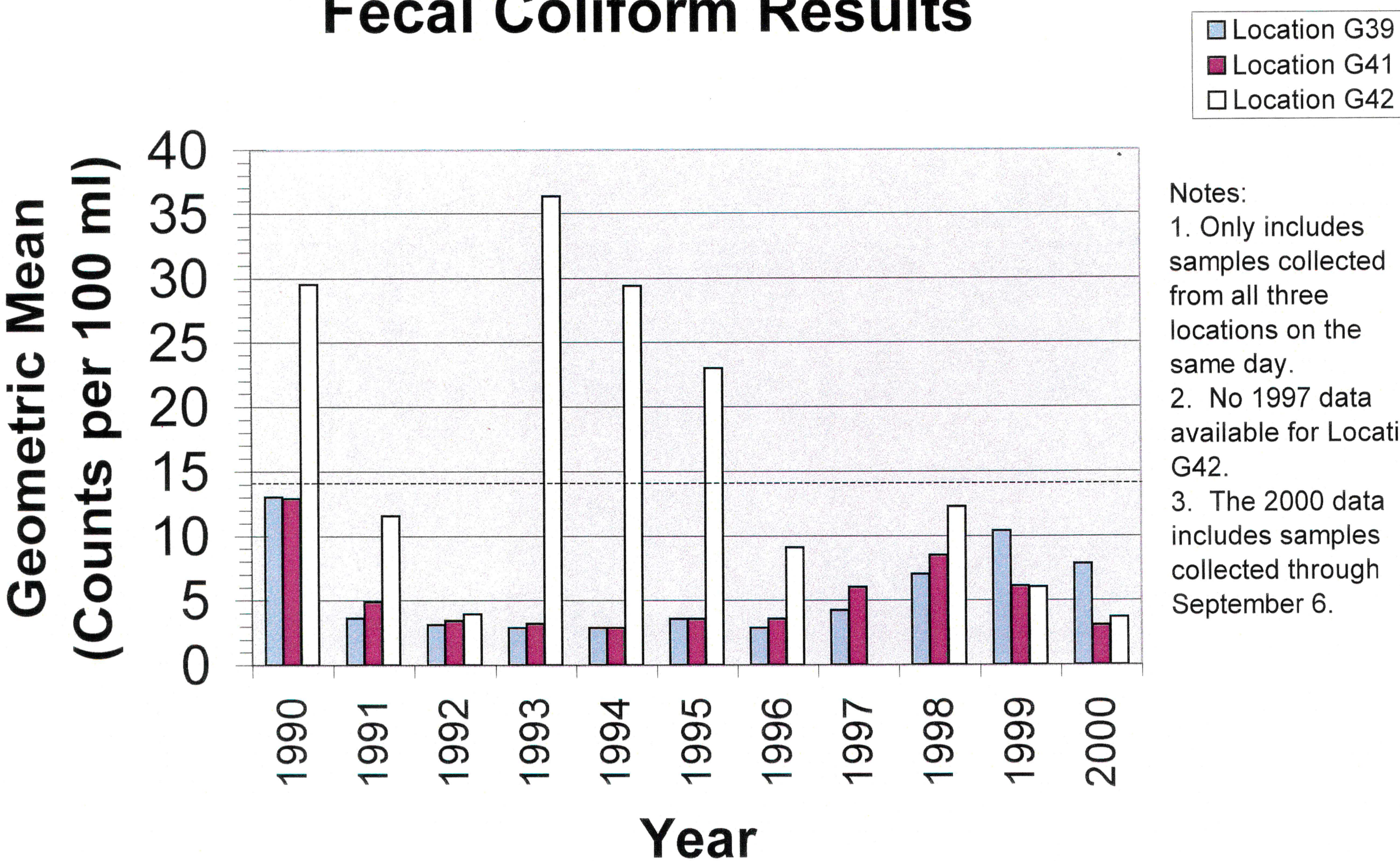
DMR Sampling Locations
Libby River Watershed
Watershed Boundary
Road

Figure 2
DMR Sampling Stations

Map produced by:
Watershed Solutions, Inc.
2000

Data Sources:
Maine Office of GIS
Maine Department of Marine Resources

Figure 3 - Libby River Annual Fecal Coliform Results



Notes:
1. Only includes samples collected from all three locations on the same day.
2. No 1997 data available for Location G42.
3. The 2000 data includes samples collected through September 6.

until there is sufficient data collected to meet DMR requirements, this area could be reopened to clam digging.

Because rainfall and the associated polluted runoff can dramatically increase the levels of fecal coliforms in the Scarborough River Estuary, DMR automatically imposes emergency closures on certain areas (i.e., "conditional rainfall areas") when more than 1 inch of rain falls in a 24-hour period. One of these areas is in the Libby River, upstream of an imaginary line located about 1,000 feet south of Black Point Road.

What is being done to protect the Libby River from polluted runoff?

Most of the salt marsh bordering the main stem of the Libby River is owned by the Maine Department of Inland Fisheries and Wildlife and there are some sections of private conservation land that extend from the salt marsh into upland areas. The State and private conservation land not only protects valuable wildlife habitat but also serves as a natural vegetated buffer that filters polluted runoff from developed upland areas before it reaches the river.

The Maine Department of Environmental Protection (DEP) has determined that the Scarborough River Estuary warrants special consideration in terms of protecting it from polluted runoff. The estuary has been listed as a "Non-Point Source Priority Watershed" in the State of Maine because its water quality is either impaired or threatened to some degree due to polluted runoff. ***Non-point source pollution*** is a widely used term for polluted runoff. Its listing as a Priority Watershed means that eligible projects designed to cleanup polluted runoff in the Scarborough River Estuary are more likely to receive federal funding than similar projects in another watershed that is not on the list.

The Scarborough River Estuary is also classified as a "Coastal Wetland Most at Risk from New Development" by the Maine DEP. Consequently, land development projects in the estuary watershed are subject to stricter standards for stormwater management under the State's stormwater rules. A developer must apply for and receive a stormwater permit (among other permits) before he can proceed with construction. The developer must demonstrate in the permit application to the Maine DEP that he will be able to meet the standards.

PURPOSES AND SCOPE OF THE WATERSHED SURVEY

This watershed survey was designed to serve two purposes:

1. Restore water quality in the Libby River Watershed by identifying existing problems associated with polluted runoff and recommending solutions.
2. Protect water quality in the Libby River Watershed from future problems associated with polluted runoff by evaluating current and future land uses.

In order to serve the purposes of this watershed survey, the following three goals were established:

1. Identify, characterize, and make general recommendations for mitigating nonpoint source pollution (i.e., polluted runoff) sites.
2. Raise public awareness about the impact that residential development and landowner activities can have on water quality.
3. Provide general information to landowners and the community on the measures they can take to protect water quality.

The first goal was accomplished by conducting a survey of the watershed for sources (sites) of polluted runoff using trained volunteers. The watershed was divided into sectors and teams of two to three volunteers were assigned a sector that they surveyed by car or on foot. When the teams found a source of polluted runoff, they documented the location, land use, type of polluted runoff, impacted resources, and recommendations to cleanup or contain the site. They also evaluated each site according to its impact on the Libby River and the difficulty and relative cost of fixing the site. A summary of their survey findings is contained in this report.

The second goal was accomplished by reaching out to the public through articles in local newspapers, in a watershed-wide mailing to landowners, during public meetings, and in the course of the watershed survey. This report will also serve to raise public awareness by identifying and evaluating the causes and effects of polluted runoff.

The third goal was accomplished by the publication and distribution of this report to interested landowners in the Libby River Watershed and to concerned members of the greater Scarborough community. This report contains the findings from the survey and the results of related evaluations including:

- estimating the amount of impervious area (e.g., paved roads) in the watershed and determining whether it has reached a threshold where there may be water quality impacts, and;
- identifying the locations of certain invasive plant species in the watershed.

SUMMARY OF WATERSHED SURVEY FINDINGS

The survey teams identified 16 sites in the Libby River Watershed that appear to be sources of polluted runoff. A few of the sites have multiple factors contributing to the problem. The surveyors recorded detailed information on the location, land use, type of polluted runoff, impacted resources, and recommendations to correct the situation. Sites were rated according to their potential *impact* on water quality in the receiving river, stream, pond or marsh, *technical skill level* needed to install the recommended solution, and the relative *cost* of the recommended solution. An explanation of the site evaluation ratings and a table containing the survey findings are presented in Appendix A. The site locations are shown in Figure 4.

Generally, the survey results indicate that the sites can be divided into the following four categories:

1. landowner practices
2. vegetated buffers
3. stormwater management systems
4. soil erosion

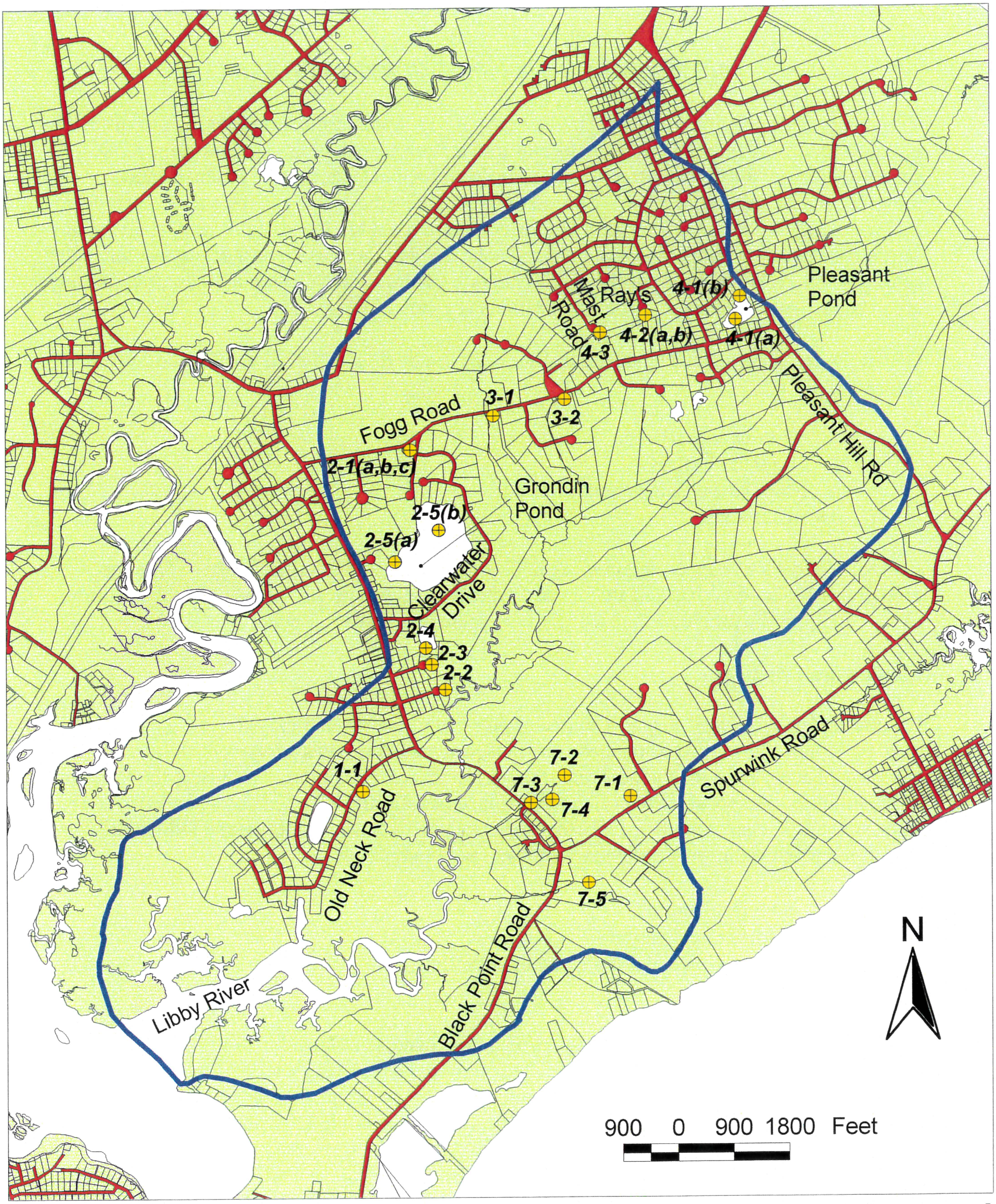
Examples of each of these categories are in Figures 5, 6, 7, and 8, respectively. Common problems associated with each category and typical solutions are also presented in the figures. More details on the problems and solutions are presented in the following paragraphs.

Landowner Practices

Landowner practices are the major source of polluted runoff in the Libby River watershed, as they are in most developed watersheds. Because watershed surveys are not able to identify the practices of every individual landowner, the survey findings do not truly represent the magnitude of the problem. However, based on the prevalence of well-manicured lawns and a suburban landscape that is characteristic of much of the watershed, it is apparent that the following landowner practices may be common sources of polluted runoff:

- lawn fertilization
- pesticide application
- dog walking and not picking up after the dog
- car washing

Lawn Fertilization. As indicated in the introduction, overuse of lawn fertilizers can result in nutrient enrichment and dissolved oxygen depletion in the receiving waters. Unlike farmers, suburban landowners typically adopt a lawn fertilization program without the benefit of knowing what their lawn needs. Soil testing is the only way of determining lawn needs. Landowners can have their soil tested by the Maine Soil Testing Service at the University of Maine. Soil containers and information forms can be obtained by contacting the Testing Service at 581-2934 or by contacting the University of Maine Cooperative Extension office in Cumberland County at 287-1471. Having your soil tested and using the recommendations of the Testing Service may



Site Location

Watershed Boundary

Road

Water

Map produced by:
Watershed Solutions, Inc.
2000

Data Source:
Wells National Estuarine Research Reserve

Figure 4
Watershed Survey Site Locations

FIGURE 5
LANDOWNER PRACTICES

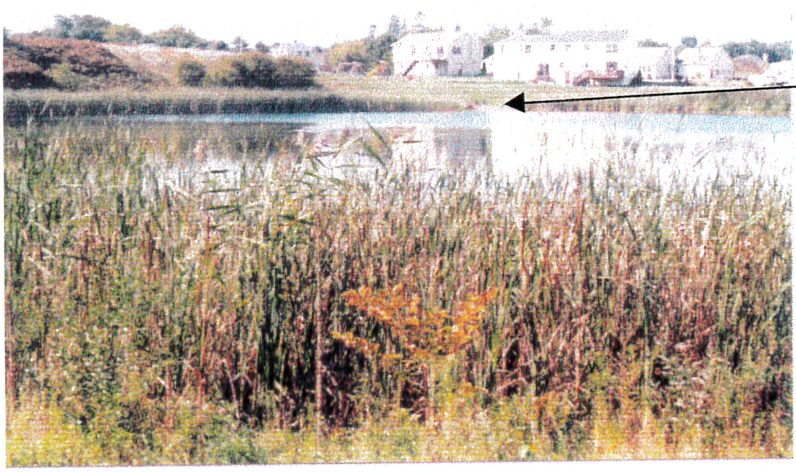
Common Problems	Overuse/misuse of lawn fertilizers	Unnecessary pesticide application	Not picking up after dogs	Do-it yourself car care	Failed septic systems	Hazardous waste disposal
Possible Solutions	• Conduct soil tests • Keep clippings on lawn • Use organic rather than chemical fertilizers • Reduce lawn area • Use hardy native plants	• Know contents of lawn care products • Don't cut grass too short • Use hardy native plants	• Dispose of dog waste in trash can, toilet or compost pile • Have dogs use areas separated from waterways by buffers • Do not dispose of dog waste in a storm drain inlet	• Use commercial car washes • Wash cars less frequently • Buy "green" car care products • Properly recycle or dispose of used oil and antifreeze	• Have system inspected and pumped every 3 to 5 years • Leach fields over 20 years old should be closely monitored for "break-outs"	• Hazardous (i.e., ignitable, reactive, corrosive, or toxic) waste should be brought to community collection centers

Problem:
- Polluted runoff from lawns, driveways, and streets flows into storm drain inlets
- Storm sewer outfall dumps polluted runoff directly into Scarborough Marsh

Solution:
- Landowners take responsibility for preventing polluted runoff from entering storm sewers

FIGURE 6
VEGETATED BUFFERS

Common Problems	Trampled vegetation along the shore	Lawns adjacent to ponds and streams	Livestock pastures adjacent to ponds and streams
Possible Solutions	• Build steps to direct foot traffic over bank* • Restrict foot traffic to a small area that is protected against erosion* • Restore vegetated buffer	• Dedicate a strip of yard nearest the water for a vegetated buffer. • Depending on personal preferences, develop a planting plan that considers appearance, maintenance, and cost	• Move fences back from the shore • Allow livestock access to water only through a gated passage • Develop alternative water supplies



Problem:

- Lawn runoff potentially containing fertilizer and pesticides flows unimpeded into pond
- Absence of buffers can result in a buildup of silt along shoreline
- Limited wildlife habitat without shoreline vegetation

Solution:

- Allow vegetation to grow in naturally or plant a buffer strip along the shoreline
- Keep pond access to a minimum and in an area that is not subject to erosion
- Shoreline vegetation provides excellent wildlife habitat

* Most soil disturbance and construction activities near water bodies and wetlands are subject to Federal, State, and Local regulations or ordinances. Be sure to contact the Town's Code Enforcement Officer before you start work to determine whether a permit is required.

FIGURE 7
STORMWATER MANAGEMENT SYSTEMS

Common Problems	No stormwater treatment in older neighborhoods	Control structures requiring repair or maintenance	No stormwater master plan for the Libby River Watershed
Possible Solutions	• Install control structures where there is available space • Retrofit catch basins with water quality inlets or other pollutant removal devices • Landowners take responsibility for preventing polluted runoff from entering storm sewers	• Identify the organization responsible for control structure repair and maintenance • Repair control structures so that they are functioning as designed • Follow control structure inspection and maintenance schedules	• Prepare a stormwater master plan that considers and plans for the combined effects of stormwater runoff from existing and future development in the watershed

Problem:
- Oil sheen on water discharged from stormwater outfall
- Black sediment indicating possible hydrocarbon contamination
- Lush, green grass indicating nutrient-rich stormwater

Possible Solution:
- Construct sediment basin designed to capture sediment exiting the outfall

Problem:
- Stormwater detention pond outlet pipe blocked by rocks
- Blocked pipe will result in slower release of detained stormwater and the possible premature over-topping of the pond dike
- Blocked pipe indicates that there may be no routine control structure inspection and maintenance

Possible Solution:
- Develop and follow a control structure inspection and maintenance schedule

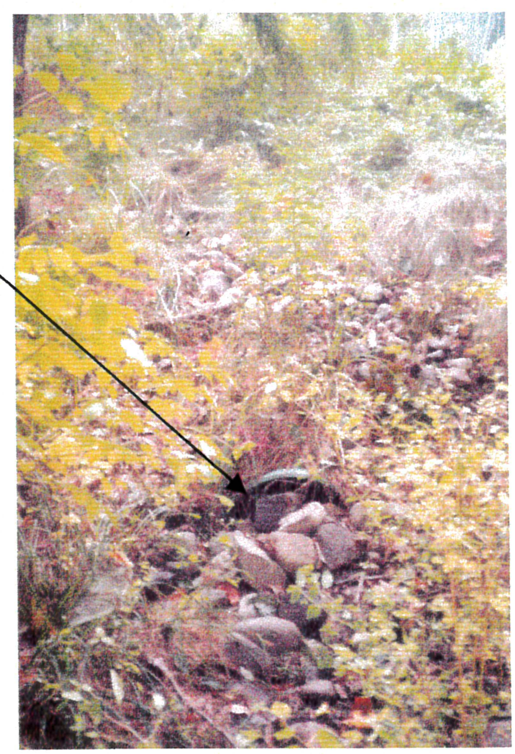
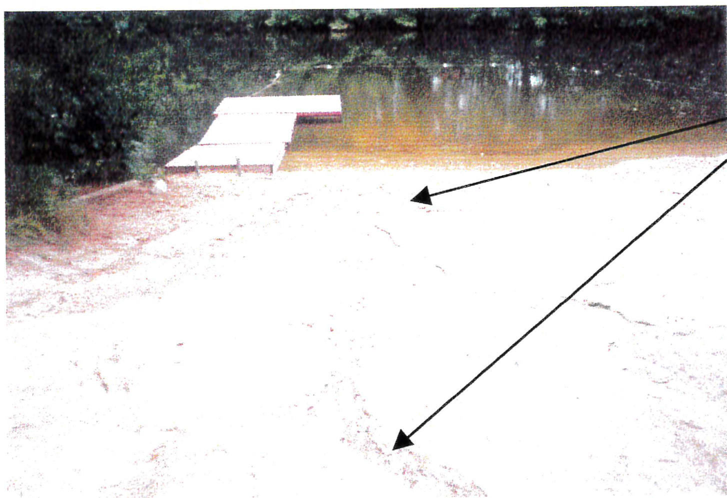


FIGURE 8
SOIL EROSION

Common Problems	Beach erosion	Ditch erosion	Footpath erosion
Possible Solutions	• Divert runoff around the top of the beach and into a vegetated buffer • Build terraces across beach using timbers or other degradable materials • Reduce beach area by planting a vegetated buffer	• Broaden the ditch, if possible, to spread out the flow • Use stone check dams on steep ditches • Armor the ditch with rip rap or line the ditch with erosion control blankets to help protect against scouring	• Install timbers across path to divert runoff into a vegetated buffer • Place crushed stone or bark mulch on the path • Rebuild the path to include meanders across the slope rather than straight down the slope

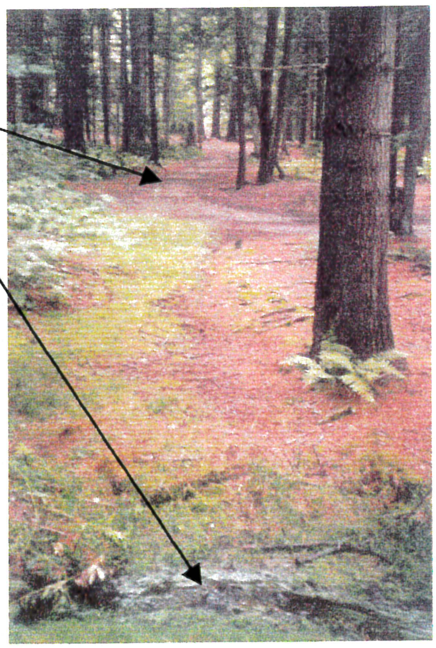


Problem:
- Water flowing down the beach is washing sand into the pond
- Beach requires periodic restoration by pulling sand back up the slope or by importing sand to fill in rills and gullies
- Pond may become nutrient-enriched from eroded sand

Possible Solutions:
- Divert runoff around the top of the beach and into a buffer
- Terrace the beach to interrupt and slow runoff

Problem:
- Water flowing down path washes eroded soil into stream
- Stream fills with sediment and may become nutrient-enriched

Possible Solutions:
- Install timbers across the path at appropriate locations to divert runoff into forested buffer
- Place bark mulch on the path
- Block path runoff where it is creating channels directly to stream



not only benefit water quality in the Libby River Watershed but may also save money that is otherwise spent on unnecessary fertilization.

Other methods of reducing or eliminating fertilizer use include:

- keep grass clippings on the lawn (i.e., recycle the nutrients in clippings)
- use organic rather than chemical fertilizers
- reduce the lawn area
- use native plant species rather than high-maintenance exotic species

Phosphorous-free fertilizer is available from certain retail outlets. Request that your lawn and garden center carry this product. For information, contact Eco-cycle at 622-7800.

Pesticide Application. As discussed in the introduction, some pesticides can be harmful to aquatic life even at very low levels. The use of "weed and feed" lawn care products is probably a significant component of pesticide use in the Libby River Watershed. Many people are not aware that these products contain herbicides. People that employ lawn care companies may also not be aware of the pesticides being applied to their lawns and gardens. In terms of protecting water quality, the following recommendations regarding pesticide application are provided:

- Don't stress your lawn by cutting the grass too short; grass that is longer is generally healthier and better able to compete with weeds.
- Be aware of pesticides in the products that you or your lawn care company uses.
- Use hardy native plant species that are better able to compete with pests.
- Apply pesticides only as a last resort, or not at all.

Dog Walking and Not Picking Up After the Dog. As indicated in the introduction, dogs have been found to be a major source of fecal coliforms and pathogens in many urban watersheds (Center for Watershed Protection, 1999). The reasons that they have this dubious distinction are due to their high populations in residential neighborhoods and their daily defecation and bacteria/pathogen production rates, both of which are high considering the average size and weight of a dog. Dog owners will be performing their part for the protection of water quality and the appearance of their neighborhood by picking up after their dog and disposing of dog waste in a trash can, toilet, or compost pile. A potential alternative to picking up after dogs is to train them to use areas that are not next to gutters, ditches, streams, or ponds. Dog waste should not be disposed of in a storm drain inlet.

Car Washing. Outdoor car washing is another common practice that often causes landowners to unknowingly contribute to polluted runoff. The car wash detergent, combined with the grease and grime washed off of cars, can result in high loads of nutrients, metals, and oil entering ditches or storm sewer systems. To reduce or eliminate the amount of polluted runoff associated with car washing, car owners should consider the following alternatives:

- use commercial car washes
- wash cars less frequently
- buy phosphorous-free and non-toxic cleaners

Besides those described above, other landowner practices that can be altered to reduce the potential for polluted runoff include:

- Septic system inspection and routine clean out should typically be conducted every three to five years, depending on the number of people in the household.
- "Backyard mechanics" should properly recycle or dispose of used oil and antifreeze.
- Dispose of household hazardous waste on community collection days that are periodically arranged by Regional Waste Systems.

Vegetated Buffers

Vegetated buffers are a natural feature of an undisturbed forest. They are composed of trees, shrubs, groundcovers, and a "duff" layer that is the accumulation of decaying leaves, pine needles, and other plant material that falls to the ground. A mature vegetated buffer both slows and filters runoff before it enters a water body. Because development can strip upland areas of most of its vegetation, buffers that remain on the shoreline are the last line of defense against polluted runoff. The watershed survey found that vegetated buffers along drainageways and ponds have been replaced by lawns and beaches in some neighborhoods. In the absence of buffers, runoff carrying potential pollutants such as chemical fertilizers and pet waste from lawns have a relatively unimpeded path to drainageways and ponds. In addition, beaches that have been constructed in place of vegetated buffers on ponds are prone to erosion and eroded soil entering a pond adds potentially harmful sediment and nutrients.

Landowners interested in re-establishing vegetated buffers on their property have choices about the appearance and functions of their buffer. Those choices can be divided into three general categories (Hardesty and Kuhns, 1998):

- natural buffer
- enhanced buffer
- landscaped buffer

Natural buffers are the product of not mowing a strip of land that is adjacent to a water body. Plants that are adapted to the area will establish themselves naturally with no investment in time, money, or energy required on the part of the landowner. The drawbacks of a natural buffer for some people are that it may take a number of years for mature vegetation to become established and the landowner has limited control over the type of plants growing in the buffer.

Enhanced buffers are appropriate for landowners who want to supplement existing buffer vegetation or who want to influence the composition of their buffer. Although there may be a moderate investment in the purchase and placement of plants, the landowner will have a buffer that better suits their personal preferences and that matures within a shorter period of time.

Landscaped buffers require considerably more planning in the layout and selection of plants than do the other buffer categories. The landowner should visualize how they want the buffer to appear as it matures and should consider the maintenance needs required to control competition between the plants and to prevent the invasion of unwanted indigenous plants. Although the cost and effort may be relatively high, the landowner has complete control over the buffer design.

Depending on the buffer category that a landowner selects, there are several factors that should be considered in buffer design:

- Hardiness zone, available sunlight, soil moisture, soil permeability, wind, and maintenance should be considered for any new plantings.
- An ideal buffer includes a diverse plant community, from groundcover to trees. However, landowners who want to preserve views should plan ahead and select small shrubs and groundcovers rather than trees.
- A buffer width of at least 75 feet is preferable, although any buffer is better than no buffer.
- An uneven soil surface that allows rain and snowmelt to puddle and infiltrate is best.
- For a buffer to be effective, runoff must enter a buffer as sheet flow, meaning that it must be thinly distributed over the surface of the ground. There are various techniques available for converting channelized flow in ditches into sheet flow. Contact Cumberland County Soil and Water Conservation District at 839-7839 for more information.

Stormwater Management Systems

New residential and commercial development is subject to Maine Stormwater Rules, which regulate the quantity and quality of stormwater leaving a project. Although all stormwater is not polluted, the use of the term "stormwater" is synonymous with "polluted runoff" for purposes of this report. Because the Stormwater Rules went into effect in 1997, much of the development in the Libby River Watershed that pre-dated the Stormwater Rules was not constructed in accordance with the strict standards that are in effect today. Typically, stormwater from new developments is not discharged into a water body until it passes through a control structure, such as a detention pond, that prevents downstream flooding and provides treatment. Stormwater from older developments normally discharges directly into a water body. If properly designed, constructed, and maintained, the stormwater that discharges from control structures is relatively free of sediment and other pollutants as compared to stormwater that is discharged directly into a water body. The Stormwater Rules are designed to protect water bodies from stormwater associated with individual projects, however, there currently is no stormwater master plan for protecting the Libby River and its tributaries from the cumulative effects of stormwater runoff from existing and future development in the watershed.

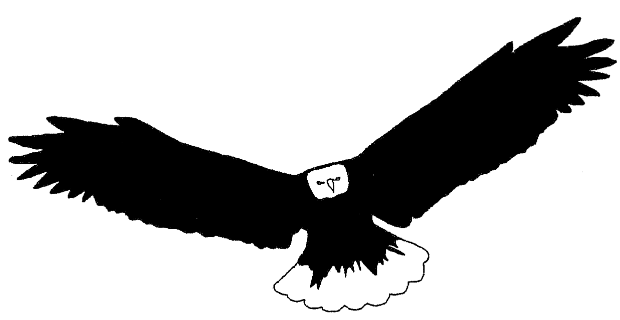
The watershed survey documented visual observations at stormwater outfalls (i.e., discharge pipes from storm sewer systems) such as discolored sediment or an oily sheen on the water. These types of observations were noted at a few outfalls and are an indication that polluted runoff has entered the storm sewer systems from the neighborhoods that they serve. These observations reinforce the importance of landowners adopting practices that are protective of water quality. This is true of new developments with control structures, as well as older developments, because control structures do not have 100 percent pollutant removal efficiency.

Stormwater control structures that were encountered during the watershed survey were inspected for deficiencies that might compromise their effectiveness. Most of the control structures had some type of problem that resulted from the lack of maintenance or repair. These problems likely result in a reduced effectiveness at controlling the amount of stormwater and stormwater pollutants that are discharged into the headwater streams of the Libby River. Unfortunately, maintenance of stormwater control structures is overlooked in many municipalities partly because it is often unclear as to what individual or organization is responsible for their upkeep and there is little follow-up by the regulating authority. Transfer of maintenance responsibilities from a developer to a municipality or a landowner association must be approved by the Maine DEP and that organization must comply with all terms and conditions of the permit to discharge stormwater.

Soil Erosion

Soil erosion does not appear to be as serious a problem in the Libby River Watershed as it is in some other developed watersheds. Soil erosion is often a product of poorly designed and/or maintained gravel roads, driveways, ditches, trampled ground on footpaths and woods roads, and construction sites. These types of land uses were not widely observed during the watershed survey but the watershed is still under periodic development and soil erosion from construction sites will remain a concern. By law, it is the responsibility of the construction contractor to install and maintain erosion and sediment controls at a construction site.

The most practical and cost-effective method to prevent sediment from entering water bodies is to prevent soil erosion from occurring in the first place. This can be accomplished by vegetating, mulching, or covering bare soil with erosion control blankets. The erosion control market has evolved to the point where there is now a product for almost any type of soil erosion challenge.



IMPERVIOUS SURFACE EVALUATION

> ***Impervious Surfaces***
>
> Impervious surfaces are relatively waterproof surfaces in that they shed rainfall and snowmelt rather than letting it seep into the ground.

Numerous studies in different regions of the country have found that there is a relationship between the amount of urbanization in watersheds and the quality of the water and aquatic habitat in streams, lakes, estuaries, and aquifers. This relationship is largely the result of the conversion of farmland, forests, wetlands, and meadows to relatively ***impervious surfaces*** such as rooftops, roads, driveways, parking lots, and sidewalks. Where impervious surfaces have replaced undisturbed vegetation and soil, the rainfall and snowmelt flows across the surface as runoff rather than seeping into the ground. Even lawns and playing fields, which have underlying soils that have been compacted by construction equipment, foot traffic, and yard maintenance equipment, are relatively impermeable compared to the forest floor. The increased amount of runoff results in larger flows in streams and rivers. Stream and river channels that are enlarged by the erosive effects of the larger flows experience a decline in water quality and habitat.

The Libby River Watershed is an urbanizing watershed and, as the amount of impervious area increases in the watershed, it is expected that water quality and habitat in the streams, river, and estuary will decline. Research conducted in other urbanizing watersheds indicates that there are thresholds for impervious area which, if exceeded, results in an observable decline in water quality and habitat. Therefore, in conjunction with the watershed survey, the Friends considered it appropriate to determine whether the amount of impervious area in the headwater stream subwatersheds and the overall Libby River watershed exceed these thresholds.

A model has been developed to estimate stream quality based on the percentage of impervious area in stream watersheds (Center for Watershed Protection, 1998). The model classifies streams into three categories; sensitive, impacted, and non-supporting. A description and the ranges of percent impervious area for each category are presented in the following table:

Table 2 – Stream Categories

Category	Description	Percent Impervious Area (%)
Sensitive	Sensitive streams are typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects.	0 to 10
Impacted	Impacted streams are clearly affected by greater storm flows that result in channel enlargement, a decline in the physical habitat, shifts in water quality into the fair/good category, and a stream biodiversity that declines to fair levels, with the most sensitive fish and aquatic insects disappearing from the stream.	11 to 25

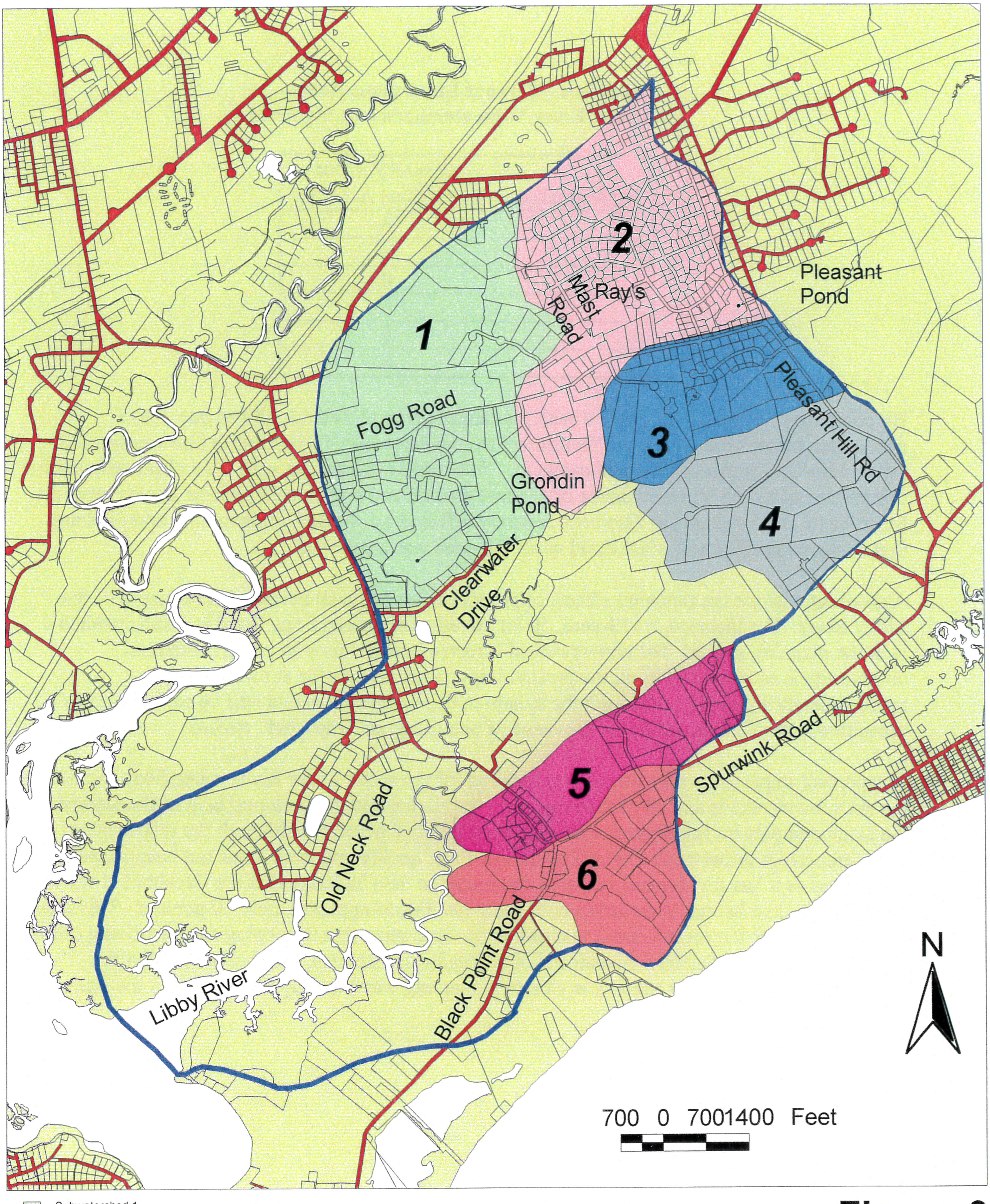
Category	Description	Percent Impervious Area (%)
Non-Supporting	Non-supporting streams have reaches that experience severe channel enlargement, the physical habitat is practically eliminated, water quality is fair to poor with a marked increase in nutrient loads, and an aquatic community that is dominated by pollution tolerant insects and fish.	greater than 25

The percent impervious area can be calculated by adding up the area covered by impervious surfaces, dividing the impervious area by the total watershed area, and multiplying the result by 100. Fortunately, there are accepted values for percent impervious area for various land uses, so it is only necessary to determine the areas occupied by each land use in a watershed and combine them to develop an overall estimate of the percent impervious area in a watershed (Center for Watershed Protection, 1998). The following table presents the percent impervious area for the land uses that are characteristic of the Libby River Watershed:

Table 3 – Percent Impervious Area for Various Land Uses

Land Use	Density (dwelling units/acre)	Percent Impervious (%)
Multifamily Townhouse	greater than 7	40
Medium Density Residential	3	30
Medium Density Residential	2	20
Low Density Residential	1	15
Low Density Residential	0.5	10
Low Density Residential	less than 0.5	6
Farms and Forest	--	1

Percent impervious area was calculated for six subwatersheds within the Libby River watershed. Based on the topography and layout of the storm sewer systems in various neighborhoods, subwatershed boundaries for the headwater streams were approximated as shown in Figure 9. Using Geographic Information System (GIS) software, the area of every land use within a subwatershed was calculated and multiplied by the percent impervious area according to the information contained in Table 3. The products of the area of land use and percent impervious area were added together, divided by subwatershed area, and multiplied by 100 to obtain an overall percent impervious area for the subwatershed. The overall percent impervious area for each of the Libby River subwatersheds is presented in Table 4.



- Subwatershed 1
- Subwatershed 2
- Subwatershed 3
- Subwatershed 4
- Subwatershed 5
- Subwatershed 6
- Watershed Boundary
- Road
- Water

Figure 9
Libby River Subwatersheds

Map produced by:
Watershed Solutions, Inc.
2000

Data Source:
Wells National Estuarine Research Reserve

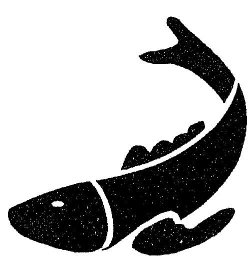
Table 4 – Percent Impervious Area for Libby River Subwatersheds (see Figure 9)

Subwatershed	Overall Percent Impervious Area (%)
1	6
2	18
3	8
4	6
5	7
6	6

By comparing the results in Table 4 with the ranges given in Table 2, all but one of the headwater streams fall within the "sensitive" stream category. The stream in Subwatershed 2 falls within the "impacted" stream category. This result is consistent with field observations of this stream as it does show evidence of channel erosion and stream enlargement downstream of Mast Road. This stream has also been severely affected by channel straightening and ditching that occurred upstream of Mast Road when this area was developed.

Also of interest are the potential effects of proposed development in the subwatersheds of the Libby River. For instance, a 113-acre, 50 lot development along Fogg Road in Subwatershed 1 is in the planning stages. The conversion of forested land in this area into a residential community is estimated to bring the percent impervious surface for Subwatershed 1 to approximately 9 percent. Although the stream in this watershed would still be categorized as a "sensitive stream", it would be on the verge of becoming an "impacted" stream.

The percent impervious area was also calculated for the entire Libby River watershed. Including the six subwatersheds and all of the remaining developed and undeveloped land in the watershed, the estimated percent impervious area is approximately 6 percent. Although the relationship between percent impervious area and estuarine water quality and habitat has not been as well researched as it has for streams, research conducted to date indicates that the threshold at which water quality and habitat in estuaries noticeably declines is approximately 10 percent. This may be good news for the estuary but it is important to recognize that the ecological well-being of the estuary is directly linked to the condition of its headwater streams, and that preventing the deterioration of headwater streams is vital to preserving water quality and habitat in the estuary.



VEGETATION EVALUATION

Changes in the composition of marsh vegetation can be an indication that the hydrology of the marsh is changing. Increases in the amount of impervious surface in an urbanizing estuary watershed will cause an increase in freshwater runoff into the estuary. In addition, tidal restrictions such as road crossings on the seaward side of a salt marsh will reduce the amount of salt water carried into the marsh by tidal flows. The combined effects of these two processes include a decrease in the salinity of the salt marsh and the creation of a growing environment that is more favorable to plants that inhabit brackish wetlands (Bryan, 1999).

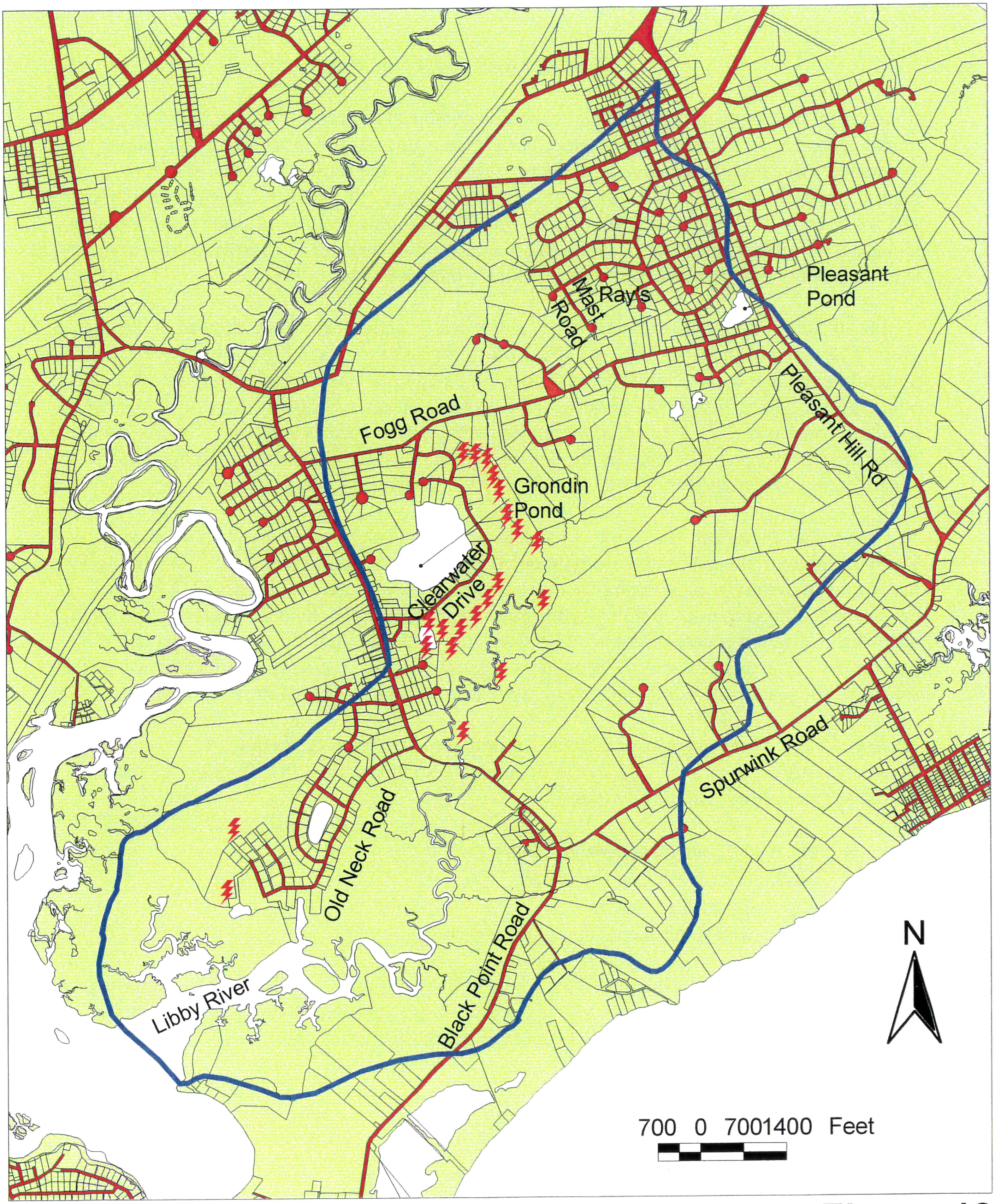
Among the more opportunistic plant species that can spread into a marsh affected by decreasing salinity levels is an invasive form of *Phragmites*. *Phragmites* is a tall (5-15 feet) plant that has a plume-like top and habit of growing in dense, single-species stands. Characteristic of invasive plant species, *Phragmites* will crowd out native marsh plants and cause a significant change in the plant community. It is especially common in brackish wetlands and is able to quickly colonize areas of bare, wet soil that has been stripped of existing vegetation (Bryan, 1999). Accordingly, it is often seen in roadway ditches and drainage systems.

The threat that decreasing salinity and the associated proliferation of *Phragmites* poses to Scarborough Marsh has been well-documented in previous studies (Linnell, 1994) (Bryan, 1999). In an effort to continue monitoring the spread of *Phragmites* in the Libby River Watershed, the Friends determined that it would be appropriate to note the locations of *Phragmites* that were observed during the course of the watershed survey. Although it is far from being a complete assessment of the distribution of *Phragmites* in the watershed, it does give an indication of the areas that the plant is invading and can be used as a starting point for future monitoring.

Phragmites was observed in the areas shown in Figure 10 during the course of the survey. Most of the areas are on the inland side of the Black Point Road crossing. The following types of habitat are associated with these areas:

- salt marsh bordering upland fields
- dead forests bordering the marsh
- edges of gravel pit ponds
- ditches and small ponds dug to drain gravel pit ponds

The above list of habitats indicates that the spread of *Phragmites* is influenced by activities that have disturbed soil and/or vegetation. This is entirely consistent with this plant's history of exploiting environments where development has altered the landscape.



Phragmites
Watershed Boundary
Road
Water

Map produced by:
Watershed Solutions, Inc.
2000

Data Source:
Wells National Estuarine Research Reserve

Figure 10
Phragmites Stands Observed During Survey

RECOMMENDATIONS

The Friends of Scarborough Marsh intend to use the results of the Libby River Watershed Survey as the basis for the *protection* and *restoration* of water quality in the Libby River and the Scarborough River Estuary. According to the survey findings and the results of related evaluations presented in this report, the following measures should be taken to correct existing problems associated with polluted runoff and to guard against future problems:

1. Landowners should adopt practices in the care of their house, lawn, septic systems, cars, and pets that reduce the amount of pollutants that can be washed into nearby water bodies.
2. Landowners should establish vegetated buffers along nearby water bodies to capture pollutants that wash off of developed areas.
3. Landowners or organizations that are responsible for the repair and maintenance of stormwater control structures should inspect their structures for deficiencies, perform needed repairs or maintenance, and follow an inspection and maintenance schedule.
4. Private landowners and the Town of Scarborough should evaluate storm sewers and other drainage networks that discharge untreated stormwater in order to determine the feasibility of installing control structures or other pollutant removal devices or systems.
5. The watershed community should consider the development and implementation of a stormwater master plan that addresses the cumulative effects of stormwater runoff from existing and future development.
6. Private landowners and the Town of Scarborough should use available techniques and materials to prevent soil erosion and the associated sedimentation in nearby water bodies.

All of these recommendations could be combined into a comprehensive watershed management plan that outlines a strategy for meeting water quality *protection* and *restoration* goals. The management plan would detail how the "tools" of watershed protection would be used to meet the goals. The following tools are being used in other communities for watershed protection (Center for Watershed Protection, 1998):

- **Land Conservation** – involves choices about the types of land that should be conserved to protect a watershed
- **Vegetated Buffers** – involves choices on how to maintain the integrity of buffers along streams, ponds, rivers, and wetlands, and provide protection from disturbance
- **Better Site Design** – seeks to design individual development projects with less impervious area which will reduce runoff into local streams
- **Erosion and Sediment Control** – addresses the clearing and grading stage in the development cycle when runoff can carry high quantities of sediment into water bodies
- **Stormwater Best Management Practices** – involves choices about how, when, and where to build stormwater control structures in a watershed, and which combination of structures can best meet water quality goals

- **Domestic Discharges** – involves choices on how to control discharges from septic systems, illicit sanitary sewer connections to stormwater systems, and reducing pollution from household and industrial products
- **Watershed Stewardship Programs** – involves careful choices about how to promote private and public stewardship to sustain watershed management

How these tools might be used in the Libby River Watershed depends on factors such as the status of the headwater streams (i.e., sensitive, impacted, or non-supporting), the estuary (i.e., automatic closures of certain clam flats after a heavy rain), and the amount of land that is available for development. For example, if there is a considerable amount of land available for development in the subwatershed of a headwater stream that falls into the "sensitive" category, then the "land conservation" and "better site design" tools might have added importance for that subwatershed.

The success of watershed management plans and watershed protection tools has been well-documented in estuaries elsewhere in the country (Center for Watershed Protection, 1998). Implementation of a watershed management plan in Buttermilk Bay (northern end of Buzzards Bay in southern coastal Massachusetts) has resulted in the turnaround of water quality and the opening of clam flats in that estuary. This was accomplished, in large part, by directing the discharge from storm drains into a system that infiltrates stormwater into the ground rather dumping it directly into the bay.

The success of any watershed management plan depends on the support and involvement of the watershed community. Accordingly, individual landowners, neighborhood associations, developers, municipal officials, local businesses, and the commercial shellfish industry should all be participants in the creation and implementation of the plan. Although there may be some Federal and State funds available to kick-start a plan or to design and construct projects that demonstrate techniques for preventing or treating polluted runoff, the financial burden for sustaining the plan would rest with the community.

The value of the Libby River and the Scarborough River Estuary is threatened by polluted runoff, especially as the town continues to grow. Polluted runoff can greatly impair water quality and restrict the commercial and recreational uses of the estuary as well as harm wildlife habitat. The problem may only get worse if water quality awareness, management, and protection are not promoted. The good news is that each of us can participate in the process to *protect* and *restore* water quality.

GLOSSARY

This glossary provides non-technical definitions of technical terms that are used in this report.

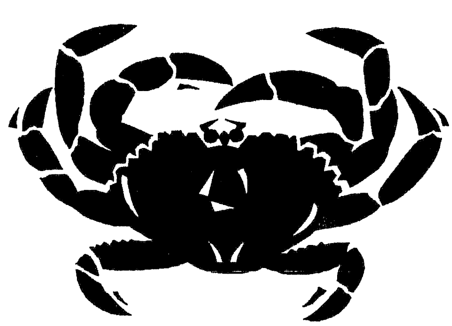
algal blooms	An algae population explosion that can turn clear water to a cloudy green color. In extreme cases, thick, foul smelling scum forms on the water and fish kills may occur when decomposing algae depletes the water's oxygen supply.
duff layer	The accumulation of decaying leaves, pine needles, and other plant material that falls to the ground.
estuary	Partially enclosed bodies of water where saltwater from the ocean mixes with freshwater from rivers and streams.
fecal coliform bacteria	Bacteria found in fecal wastes originating from the digestive systems of warm-blooded animals. The measurement unit for fecal coliforms is counts (i.e., number of colonies counted under a microscope) per 100 milliliters of water sample.
geometric mean	Type of averaging that tends to damp out the bias that extremely high or extremely low test results normally have on an average.
impervious surfaces	Relatively waterproof surfaces such as pavement that shed rainfall and snowmelt rather than letting it seep into the ground.
polluted runoff	Rainfall and snowmelt that washes over a developed landscape and picks up pollutants that have dripped, dropped, or been deposited onto the ground. *Nonpoint source pollution* is another term for polluted runoff.
sediment forebay	Small basin built to capture coarse sediment from stormwater runoff before it is discharged into a stormwater control structure.
storm sewer	Underground pipes that drain rainfall and snowmelt that collects in developed, typically paved, areas into water bodies.
stormwater	Rainfall and snowmelt that washes over the landscape. Stormwater that washes over developed land meets the same definition as polluted runoff.
subwatershed	The land area that drains rainfall and snowmelt into a tributary contained within the larger watershed.
vegetated buffer	A strip of land along a water body that is composed of trees, shrubs, groundcovers, and a "duff" layer. A mature vegetated buffer both slows and filters runoff before it enters a water body.

water body A natural or manmade feature in the landscape that holds flowing or standing water.

watershed All of the land that slopes down to a water body, such as the Libby River, so that rainfall and snowmelt flowing over the land eventually reaches the water body.

watershed survey A search, or survey, of a watershed for sources of polluted runoff.

90th percentile value A statistical term for the value in a group of numbers where 90 percent of the numbers are equal to or below the value.



APPENDIX A

WATERSHED SURVEY SITE INFORMATION AND RATINGS

REFERENCES

Bryan, R., 1999. *Scarborough Marsh: Historical Impacts, Current Conditions, and Restoration Potential.* Maine Audubon Society, Falmouth, ME.

Casco Bay Estuary Project, 1996. *Casco Bay Plan.* Portland, ME.

Center for Watershed Protection, 1998. *Rapid Watershed Planning Handbook.* Ellicott City, MD.

Center for Watershed Protection, 1999. *Watershed Protection Techniques "Bacteria Issue", Volume 3, Number 1 – April 1999.* Ellicott City, MD.

Center for Watershed Protection, 2000. *Watershed Protection Techniques "Watershed Education Issue", Volume 3, Number 3 – March 2000.* Ellicott City, MD.

Hardesty, P., and C. Kuhns, 1998. *The Buffer Handbook.* Androscoggin Valley Soil & Water Conservation District, Lewiston, ME and Lake & Watershed Resource Management Associates, Turner, ME.

Linnell, S., 1994. *A Survey of Impounded Salt Marshes in Southern Maine.* Masters Thesis, Antioch University.

Livingston, L., 2000. Phone conversation held on October 11, 2000, between John MacKinnon, Watershed Solutions, Inc., and Laura Livingston, Maine Department of Marine Resources, Water Quality Program, West Boothbay Harbor, ME.

Kennish, M., 1999. *Estuary Restoration and Maintenance, The National Estuary Program.* CRC Press, Boca Raton, FL.

Lyon, J., 2000. E-mail from John Lyon, Scarborough Shellfish Conservation Committee, sent to John MacKinnon, Watershed Solutions, Inc., on December 9, 2000.

Maine Department of Marine Resources, 2000. Table presenting "A Comparison of Soft Shell Clam Landings for the State by Town and County for 1997, 1998, and 1999 (Table is based on information received as of 4/21/2000)".

Town of Scarborough, 1989. *Libby River Watershed Water Quality Management Study.* Scarborough, ME.

EXPLANATION OF SITE EVALUATION RATINGS

Impact of Site

High:	Direct discharge into the Marsh or a water body with obvious signs of pollution.
Medium:	Direct discharge into the Marsh or a water body with no obvious signs of pollution, or discharge into a buffer with obvious signs of pollution.
Low:	Discharges into a buffer with no obvious signs of pollution.
None:	No apparent discharge from the site.

Technical Level to Install

High:	Requires an engineered design to correct the situation, such as would be required for a stormwater treatment system.
Medium:	Requires a construction contractor with the necessary expertise and equipment to correct the situation, such as would be required for installing rip rap.
Low:	Landowner would be capable of correcting the situation using their own design and equipment, such as could be done by planting vegetated buffers.
None:	Does not require any technical expertise to correct a situation, such as picking up after dogs.

Cost

High:	Applies to projects requiring engineered designs and considerable earthmoving and installation of structures.
Medium:	Applies to projects with relatively limited earthmoving required, such as for reshaping ditches.
Low:	Applies to projects that could be conducted with hand labor, such as planting buffers.
None:	Applies to situations where an activity or ceasing an activity will have no added cost.

Watershed Survey Site Information and Ratings

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem(s)	Potential Pollutant(s)	Recommendation(s)	Impact of Site	Technical Level to Install	Cost
1--1	residential	R090022	Old Neck Road	storm sewer discharge	toxics, bacteria, nutrients, sediment	educate homeowners about pollution prevention and preventing pollutants from entering storm drains	High	Low	Low
2--1(a, b, c)	residential	R081821	Fogg Road	a) stormwater detention pond design and maintenance b) runoff from lawns c) ditch erosion	a) potentially inadequate treatment of stormwater pollutants b) toxics and nutrients c) nutrients and sediment	a) review pond sizing and outlet structure for better pollutant removal and perform regular pond maintenance to remove accumulated sediment b) educate homeowners about reduced use of fertilizers and pesticides and promote planting of buffers c) reshape and vegetate or rip rap ditch	a) Medium b) Medium c) Medium	a) High b) None c) Medium	a) High b) None c) Medium
2--2	residential	R092002A	Woodrock Drive	storm sewer discharge	toxics, bacteria, nutrients, sediment	educate homeowners about pollution prevention and preventing pollutants from entering storm drains	Medium	None	None
2--3	residential	R092002A	Val Terrace	storm sewer discharge	toxics, bacteria, nutrients, and sediment	educate homeowners about pollution prevention and preventing pollutants from entering storm drains	Medium	None	None
2--4	residential	U015009	Val Terrace	runoff from lawns	toxics and nutrients	educate homeowners about reduced use of fertilizers and pesticides and promote planting of buffers	Low	None	None
2--5(a, b)	residential	a) R092002 b) R081 and R092 lots	Clearwater Drive	a) storm sewer discharge b) runoff from lawns	a) toxics, bacteria, nutrients, and sediment b) toxics and nutrients	a) educate homeowners about pollution prevention and preventing pollutants from entering storm drains b) educate homeowners about reduced use of fertilizers and pesticides and promote planting of buffers	a) Medium b) Medium	a) None b) Low	a) None b) Low
3--1	town road	R081004A	Fogg Road	ditch erosion	nutrients and sediment	reshape and vegetate ditch	High	Medium	Medium
3--2	town road	R093024	Fogg Road	ditch erosion	nutrients and sediment	vegetate ditch	Medium	Low	Low
4--1(a,b)	residential	a) U003 lots b) U003005	Pleasant Road and Fogg Road	a) beach erosion and runoff from lawns b) storm sewer discharge	a) toxics, nutrients, and sediment b) toxics, bacteria, nutrients, and sediment	a) educate homeowners about reduced use of fertilizers and pesticides and promote planting of buffers b) educate homeowners about pollution prevention and preventing pollutants from entering storm drains, consider construction of a "sediment forebay" below the storm sewer outfall in pond	a) Medium b) High	a) Low b) Low for homeowner education and High for sediment forebay	a) Low b) Low for home owner education and High for sediment forebay
4--2(a,b)	residential	a) R0931213 b) R0931212	Ray's Circle	a) breached stormwater detention pond embankment b) storm sewer discharge	a) inadequate treatment of stormwater pollutants b) toxics, bacteria, nutrients, and sediment	a) repair pond embankment and include outlet structure for better pollutant removal, perform regular pond maintenance to remove accumulated sediment b) educate homeowners about pollution prevention and preventing pollutants from entering storm drains	a) High b) High	a) High b) None	a) High b) None
4--3	residential	R093031	Mast Road	storm sewer discharge	toxics, bacteria, nutrients, and sediment	educate homeowners about pollution prevention and preventing pollutants from entering storm drains	Medium	None	None
7--1	commercial	R091006	Spurwink Road	horse manure pile	bacteria and nutrients	plan for regular removal of manure to keep the pile small and maintain a vegetated buffer between the pile and any drainageways	Low	Low	Low
7--2	commercial	R091006	Spurwink Road	footpath erosion and runoff into stream	nutrients and sediment	install water bars across path to divert runoff into buffer on west side of stream, mulch bare soil on east side of stream	Medium	Low	Medium
7--3	commercial	R091006	Black Point Road	iron leaching into stream from base of dam	toxics and sediment	repair leaks in base of dam	High	High	High

Watershed Survey Site Information and Ratings

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem(s)	Potential Pollutant(s)	Recommendation(s)	Impact of Site	Technical Level to Install	Cost
7--4	commercial	R091006	Black Point Road	beach erosion caused by runoff from swimming pool deck	nutrients and sediment	divert runoff from pool deck around the beach and into a buffer	High	Medium	Medium
7--5	agricultural	R102008	Black Point Road and Spurwink Road	cow pasture draining into a ditch and pond	bacteria, nutrients, and sediment	fence cows out of the ditch and move fence back from pond to allow wider buffer to grow between the pond and pasture	Medium	Low	Low

APPENDIX B

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION PERMITTING PROCEDURES

PERMITTING ABC's

In some cases, landowners and neighborhood associations will need to obtain local, state, or federal permits prior to implementing some of the conservation practices suggested in this report. In addition to the local permits needed for working within Scarborough's Shoreland Zone, a Natural Resource Protection Act (NRPA) permit is required from the Maine Department of Environmental Protection (DEP) when soil is disturbed within 100 feet of the following protected natural resources:

- natural lakes or ponds greater than 10 acres and artificially formed lakes or ponds greater than 30 acres;
- rivers, streams, or brooks that flow year-round or continuously for at least three months per year;
- freshwater wetlands, and;
- coastal wetlands that are influenced by the highest spring tides.

The following are general guidelines for determining the need for a Maine DEP permit. The permit applications, as well as Maine DEP staff, have much more specific and discerning information on the need for these permits. If you have any doubt, call the Maine DEP Field Services at 822-6300. Staff will promptly answer your questions or possibly visit your property.

Activities requiring permits:

- excavating, tilling, and bulldozing
- dredging
- adding soil to establish vegetation
- filling
- draining/dewatering

Activities that do not require a permit:

- planting a few shrubs or creating minor soil disturbances associated with reseeding and;
- activities carried out in an area with existing barriers (e.g., ice berms, existing retaining walls) or site conditions (e.g., negative slopes) such that material could not wash into a protected natural resource.

How to apply for Permit-by-Rule with the Maine DEP:

1. Fill out a notification form. Forms are available from the Scarborough Code Enforcement Officer or the Maine DEP office on Canco Road in Portland (822-6300).
2. Permit-by-Rule requires that you follow performance-based standards. It is important that you obtain, understand and follow these standards so that you comply with the law.
3. A Permit-by-Rule application will be reviewed by the Maine DEP within 14 days. If you do not hear from the Maine DEP within 14 days, you can assume your permit is valid. In fact, if you "walk in" to the Maine DEP, they have the ability to waive the 14 day processing period, provided that the permit and its requirements, photographs, map, and fee are complete.

Where Do I Get More Information?

Friends of Scarborough Marsh
Ann Delehanty
126 Fogg Road
Scarborough, ME 04074
(207) 883-9614

Scarborough Conservation Commission
Tracey White
113 Ash Swamp Road
Scarborough, ME 04074
(207) 885-5167

Scarborough Land Conservation Trust

Laurene Swaney
10 Joss Hill Road
Scarborough, ME 04074
(207) 883-4909

Beth Bellemere
P.O. Box 832
Scarborough, ME 04070-0832
(207) 883-5430

Scarborough Shellfish Conservation Committee
John Lyon
269 Pine Point Road
Scarborough, ME 04074
(207) 885-9032

Scarborough Code Enforcement Officer
Dave Trysk
P.O. Box 360
Scarborough, ME 04070-0360
(207) 883-4301

Maine Department of Environmental Protection
Don Kale
312 Canco Road
Portland, ME 04103
(207) 822-6319

Cumberland County Soil and Water Conservation District
Betty McInnes
381 Main Street
Gorham, ME 04038
(207) 839-7839

Maine Soil Testing Service
University of Maine
5722 Deering Hall
Orono, ME 04469-5722
(207) 581-2934

University of Maine Cooperative Extension
P.O. Box 9300
Portland, ME 04104-9300
1-800-287-1471 (in Maine) or (207) 780-4205