



**MAINE PUBLIC DRINKING WATER
SOURCE WATER ASSESSMENT PROGRAM
LORING UTILITIES WATER SYSTEM
LITTLE MADAWASKA RIVER WATERSHED**

MARCH 2003

prepared for



**Source Water Assessment Program
Drinking Water Program
Maine Department of Human Services**

prepared by



**Drumlin Environmental, LLC
Portland, Maine**

**MAINE PUBLIC DRINKING WATER
SOURCE WATER ASSESSMENT PROGRAM
LORING UTILITIES WATER SYSTEM
LITTLE MADAWASKA RIVER WATERSHED**

MARCH 2003

prepared for

Source Water Assessment Program
Drinking Water Program
Maine Department of Human Services
11 State House Station
Augusta, Maine 04333



prepared by

Drumlin Environmental, LLC
15 Franklin Street, P. O. Box 392
Portland, Maine 04112-0392
(207) 771-5546

**MAINE PUBLIC DRINKING WATER
SOURCE WATER ASSESSMENT PROGRAM
LORING UTILITIES WATER SYSTEM
LITTLE MADAWASKA RIVER RESERVOIR WATERSHED**

TABLE OF CONTENTS

Section	Title	Page No.
	EXECUTIVE SUMMARY	ii
1.0	INTRODUCTION	1
2.0	WATER SUPPLY SOURCE	2
	2.1 Description	2
	2.2 Land Use	3
3.0	INVENTORY OF POTENTIAL WATER QUALITY CONCERNS	4
	3.1 Background	4
	3.2 Source Sensitivity to Land Use	5
4.0	ASSESSMENT OF LITTLE MADAWASKA RIVER RESERVOIR	5
	4.1 Watershed	6
	4.2 Shoreland	6
	4.3 Intake	7
5.0	SWAP RANKING AND RECOMMENDATIONS	7
	5.1 Ranking of Susceptibility	7
	5.2 Recommendations	8
	Table 1 - Little Madawaska River Reservoir Supply	2
	Table 2 - Sources of SWAP Information	5
	Table 3 - Little Madawaska River Reservoir Water Assessment	7
	Figure 1 - Public Water Supply and Surrounding Watershed	End
	Figure 2 - Land Under Protective Ownership	End
	Figure 3 - Multi-Resolution Land Characterization	End
	Figure 4 - Potential Threats to Drinking Water	End
	Figure 5 - Potential Erodible Soils	End
	Appendix A - SWAP Assessment Guidelines	End

**LORING UTILITIES WATER SYSTEM
LITTLE MADAWASKA RIVER RESERVOIR WATERSHED
EXECUTIVE SUMMARY**

The Loring Utilities Water System serves approximately 1,500 people during the day under current daily operations of Loring Commerce Centre. LUWS supplies drinking water from a reservoir located on the Little Madawaska River in the Town of Caribou, Maine. The entire watershed of the river extends to the north and west into the towns of New Sweden, Westmanland and Connor Township. The local reservoir watershed up to one mile up river is approximately 65 percent forested and 22 percent in agricultural use. Residential development locally near the reservoir and throughout the larger watershed area is sparse. Land areas bordering on the reservoir and upstream along the river are protected under LUWS and USFWS ownership. In addition, 250-foot Shoreland Zoning has been adopted by the Town of Caribou and upstream throughout the watershed. The upper portion of the reservoir and nearby upstream river segment are reportedly used for light recreational activities including fishing and boating.

The LUWS water supply source is located in a remote area with a low population density. The local watershed of the reservoir is mostly undeveloped and forested to the north and east. Limited residential development and agricultural uses are present in the western portion of the watershed. A relatively large area of land bordering the reservoir and river is under protective ownership in addition to the land use controls provided by shoreland zoning. No significant threats to the reservoir source were identified through the SWAP study. The LUWS should keep a vigilant watch for potential concerns that may arise through recreational activities on the reservoir and encroachment by more active farming on the western side of the reservoir where natural buffers are limited.

Millions of gallons of water flow down the river each day. Testing by LUWS shows good water quality conditions in the reservoir. On occasion during surface runoff events, water quality in the reservoir shows a temporary increase in color and turbidity. The increase in these parameters may be related to runoff from nearby agricultural activities. However, the high volume of daily flow down the river provides a constant flushing of the reservoir so that these conditions do not persist.

Based on the remoteness of the water supply, limited watershed development, protective ownership and zoning control of land along the river, and high flow rate of the river, the overall susceptibility of the water supply source is considered to be low.

**MAINE PUBLIC DRINKING WATER
SOURCE WATER ASSESSMENT PROGRAM
LORING UTILITIES WATER SYSTEM
LITTLE MADAWASKA RIVER RESERVOIR WATERSHED**

1.0 INTRODUCTION

The operation of public water systems in Maine is governed by the federal Safe Drinking Water Act (SDWA), which was first passed in the 1970s and later amended in 1986 and 1996. The federal government delegated authority for enforcing the SDWA to the state under the Maine Department of Human Services (DHS) Drinking Water Program (DWP). In 1998, the Source Water Protection Section was established in the DWP to implement the Maine Public Drinking Water Source Water Assessment Program (SWAP). The SWAP process is being conducted through a cooperative effort between the DWP staff, Loring Utilities Water System (LUWS) staff and Drumlin Environmental, LLC (Drumlin), the environmental consulting firm contracted through DHS to provide technical assistance for the project. The LUWS staff work for the Loring Development Authority (LDA) of Maine, an independent authority of the State established by the Legislature to redevelop Loring.

The purpose of the SWAP evaluation for the Loring Utilities Water System is to assess the susceptibility of its Little Madawaska River drinking water supply (PWSID 90915) to potential threats of contamination. The long-term goal is to protect the water supply source. To do this, the SWAP process has compiled information to assist LUWS in future planning that will help to control potential threats to the water quality of Little Madawaska River and the storage reservoir.

This Report describes the SWAP for the LUWS and is organized as follows:

- **Section 2.0** summarizes the physical characteristics of the water supply at the storage reservoir and upstream along the Little Madawaska River;
- **Section 3.0** describes the variety of conditions and activities that could pose a threat to water quality;
- **Section 4.0** provides an assessment of the threats within the Little Madawaska River watershed; and,
- **Section 5.0** ranks the susceptibility of the water quality at the storage reservoir and provides recommendations for future protection of water quality.

2.0 WATER SUPPLY SOURCE

2.0 Description

The LUWS's direct source of water is a small storage reservoir located on the Little Madawaska River approximately three miles west of the Loring Commerce Centre. Surface waters from the upstream watershed replenish the impounded source through natural runoff. The local watershed of the storage reservoir is considered in this study to extend approximately one mile upstream. However, drainage from the larger watershed area of the Little Madawaska River represents the full extent of runoff contribution to the source. According to LUWS, at typical low flow conditions in the river, the flow is approximately 6.9 million gallons per day (MGD).

The scope of the SWAP study was to focus primarily on the conditions in the storage reservoir and the local watershed located one mile upstream of the watershed. However, the larger upstream watershed area is also an important component of the water supply.

The storage reservoir and local watershed are located in the Town of Caribou and Connor Township (TWP), Maine. The larger watershed of the Little Madawaska River extends to the north and west into New Sweden and Westmanland. The components and description of the LUWS water source are provided in Table 1.

TABLE 1
LITTLE MADAWASKA RIVER RESERVOIR SUPPLY

Category	Description
Water System Name:	Loring Utilities Water System
Surface Water Source:	Little Madawaska River Storage Reservoir
Water System Type:	Non-transient, community system
Watershed Location:	Caribou and Connor TWP, Maine
Source Surface Water Area:	Reservoir - 116 Acres
Source Watershed Area:	Reservoir & One Mile Upstream - 716 Acres River - 24,018 Acres
Maximum & Average Depths	undetermined
Water Volume in Storage	undetermined
Population Served (customers):	Services: Business, commercial, industrial, institutional, recreation & residential users at the Loring Commerce Centre Population: 1,500 as day use
Type of Treatment:	Chlorination, Coagulation/Floculation & pH Control with Caustic Soda
Filtration:	Rapid sand filtration system in use
Estimated Water Use:	Daily - 100,000 GPD average

The LUWS storage reservoir and local watershed area are depicted in Figure 1.

The LUWS intake is located at the downstream, southern end of the storage reservoir. The reservoir is controlled by a 200-foot long concrete dam. The dam has a fish ladder, which is used to control reservoir outflow and thereby control the storage level in the reservoir. The LUWS facilities at the intake include a water treatment plant, treatment lagoons and pumping facilities, which have a design flow of 2.3 MGD. The site was acquired and the facilities were designed and constructed for use by Loring AFB in the late 1950s. When the base was in full operation, the typical demand for drinking water was approximately 1.4 MGD. The dam, plant infrastructure, access road easement, pipeline easement and associated land area are now owned by the LDA.

The intake is located approximately 20 feet from shore at a depth of eight feet below the water surface. Water flows by gravity from the screened intake to the coagulation/flocculation tanks and then through the rapid sand filters to a clear well prior to leaving the site. The water is chlorinated with sodium hypochlorite and pH adjusted with caustic soda to control lead and copper as the water flows to the Loring Commerce Centre via a 2.5-mile long transmission pipeline. The 16-inch diameter pipeline conducts water to a one million gallon, in-ground, storage tank located at the Centre.

A 2,000-gallon (new) underground petroleum storage tank is present at the site in a location downstream from the source intake and containment dam.

2.2 Land Use

LUWS owns a 50-acre parcel of land at the reservoir dam and treatment plant and an additional 10 acres of utility and road rights-of way. The land and facility are located in a remote area with only one public way access. An additional 556 acres of land located around the reservoir and upstream along the river, formerly owned by Loring AFB, is now protected under ownership of the U.S. Fish and Wildlife Service (USFWS). The USFWS manages the property for fishery, wildlife habitat, wetlands protection and public recreational uses. Figure 2 shows the land under permanent protection in the watershed.

An Archaeological, Historical and Cultural Resource Survey was completed in 1993-1994 for the dam and upstream shoreland along the reservoir and river. The survey identified several Native American archaeological sites located on the banks of the Little Madawaska River.

The storage reservoir watershed is mostly undeveloped with only a few residential properties located along an extension of Vermette Road in the western portion of the watershed. The land depicted in Figure 2 (owned by the USF&W and the LDA) is subject to Land Use Ordinances of the Loring Commerce Centre, including Shoreland Zoning Ordinance for the Loring Commerce Centre, which protects property along the Little Madawaska River.

Caribou and the upstream towns of New Sweden and Westmanland have adopted a 250-foot shoreland zoning ordinance along the Little Madawaska River. In Connor TWP, the 250-foot shoreland zoning also applies under LURC regulations. In addition, LURC has rules for water resource protection pertaining to wetlands greater than 10 acres, the 100-year frequency flood

plain along the river and the shoreland located 250 feet from the high water mark of Great Pond water bodies (i.e., equal to or greater than 10 acres).

Recreational activities along the river and in the reservoir are restricted somewhat. Motorboats and swimming are not allowed. Canoes may be used. Fishing is not permitted within 150 feet of the dam spillway.

The local watershed of the reservoir has approximately 65 percent cover in evergreen, deciduous and mixed forest growth. Wetlands and pastures comprise about 11 percent and row cropland represents about 22 percent of the watershed. Pasture and active cropland are located nearby to the west and east, respectively, of the reservoir. The principal row crops grown in the area include potatoes and broccoli. Further upstream in the reservoir watershed, the land is covered primarily in forest growth. The larger watershed area of the Little Madawaska River has a mix of forest and limited agricultural land uses and sparse residential development. A map of the land use classifications for the watershed and surrounding area is shown in Figure 3.

3.0 INVENTORY OF POTENTIAL WATER QUALITY CONCERNS

3.1 Background

The Source Water Assessment Program (SWAP) is intended to assist water districts and suppliers in protecting the quality of their surface water supply by identifying potential threats to water quality. Two factors have been considered in identifying and assessing the potential risk posed by a threat: (a) location in relation to the intake and (b) the nature of a potential threat.

This SWAP assessment looks for potential threats to water quality in three zones:

The intake zone within 1,000 feet of the intake;

The shoreline zone, within 250 feet of the shoreline of the surface water body; and,

The watershed zone, extending to the limits of the surface watershed.

Activities in each of these zones have a different potential effect on the quality of water in the surface supply.

Within each of the three zones, the SWAP assessment examined a variety of conditions, land uses and practices that have a potential to influence water quality. These features generally fall into one of the following categories:

Physical characteristics of the watershed, for example the presence of wetlands, steep topography or erodible soils;

General land uses and development patterns, for example the percentage of developed versus undeveloped land and controls to guide future development; and,

Specific activities that involve chemical handling or may release pathogens (e.g., fecal coliform) with the potential to degrade water quality.

The SWAP assessment also considered source water quality data as an indicator of existing conditions. Appendix A describes specific guidance used during the SWAP to inventory potential factors influencing water quality. Appendix A also lists specific activities included in the SWAP assessment. Table 2 lists general sources of information consulted during SWAP research.

TABLE 2
SOURCES OF SWAP INFORMATION

Information Type	Information Source
Watershed Characteristics	US Geological Survey (Topography, Hydrology), Soil Conservation Service (Soils), Maine Geological Survey (Geology)
Raw Water Quality	LUWS Monitoring
Potential Contamination Sources	DEP Databases and LUWS
Land Use and Zoning	LUWS and Municipal Contacts
Other Analyses	Other DEP Databases

3.2 Source Sensitivity to Land Use

The key watershed features that define the sensitivity of the water supply source to land uses are briefly described below:

- **Natural Features:** The reservoir watershed is mostly forested and undeveloped, but includes limited agricultural uses in close proximity to the source.
- **Man-made Features:** The reservoir watershed has limited residential development and few roadways.
- **Specific Activities:** Access to the reservoir is limited due to the remoteness of the area and lack of roadways. Waterfowl and other wildlife use the area as a natural preserve under the control of the USFWS. Outdoor recreational use of the area is reported to be minimal.

4.0 ASSESSMENT OF LITTLE MADAWASKA RIVER RESERVOIR

The LUWS storage reservoir is used as a filtered and chlorinated water supply source. LUWS staff conducts testing of the raw water on a daily frequency for pH, color and turbidity; and, temperature, alkalinity, hardness, sulfates, chloride and total dissolved solids on a quarterly basis. In addition, TE2 and TE3 testing are completed annually and LUWS plans to test annually for

TTHMs and THAAs. According to LUWS, the data show an increase in color and turbidity in the summer months particularly during runoff events. All other testing shows good water quality.

LUWS has also conducted occasional testing for Giardia and Cryptosporidium, a potato herbicide and potato fungus. No concerns have been identified from the results of these analyses.

4.1 Watershed

The storage reservoir is a small, relatively shallow body of water that derives runoff from the large watershed area associated with the Little Madawaska River. Even low flow conditions are reported at a significant quantity of 6.9 million gallons per day. Land use in the watershed is comprised of sparse residential development and limited agriculture. Much of the watershed is forested and roadless.

The LDA's ownership of land in the watershed is limited to the 50 acres located at the treatment plant property. Over 500 additional acres of land around the reservoir and along the river are protected and controlled by the USFWS and by the Land Use Ordinances of the Loring Commerce Centre.

Review of the DEP databases of regulated activities and observations made during a recent reconnaissance of the watershed identified one point source and a few non-point sources of potential contamination within the watershed. Specific sites identified as potential threats are shown in Figure 4. The point source located in the northern portion of the watershed is an old disposal site believed to have been a former town dump. The area is now closed, vegetated with grass cover and periodically mowed to prevent the growth of brush and trees. The non-point sites have been used for landspreading ash. The land in agricultural use that is likely to be used for landspreading is located in the southwestern portion of the watershed. Other sources that can potentially affect runoff include the active row-crop farmland areas where herbicides and pesticides may be used. A few of these active agricultural fields are located in the vicinity of the reservoir. However, none of these sites are considered to be a significant concern to the water supply source.

4.2 Shoreland

All the shoreland around the storage reservoir is undeveloped except for the area of the water treatment facility. The shoreland consists of wetlands and woodlands except for several hay fields located on the west side of the reservoir near the dam. The shoreland has low to moderate slopes with wetland vegetation. The soils on these slopes that have a moderate to high potential sensitivity to erosion are shown in Figure 5. However, no potentially erodible soils or erosion problems were identified along the shoreland areas.

4.3 Intake

The intake is not presently identified by signs; however, the only road access to the treatment plant and intake area is controlled by LUWS. The reservoir is located in a remote area which experiences limited use by outdoor recreationalists.

The LUWS monitors the intake water for inorganics, metals, pesticides and herbicides. The testing has shown good water quality. Color and turbidity have shown an increase during runoff events, however, the increase is temporary and not a cause for concern.

Surface waters normally experience an aging process known as eutrophication, which is caused by various natural and man-made influences. Phosphorus from runoff, fertilizers, sewage and other sources is a primary factor affecting eutrophication since phosphorus nourishes plant and algae growth in surface waters. The amount of algae productivity in surface water is characterized in terms of three Trophic States: (1) Oligotrophic = low, (2) Mesotrophic = moderate, and (3) Eutrophic = high. The Trophic State can be identified based on chlorophyll and phosphorus content and by secchi disk transparency data, which measures the clarity of the surface water. No trophic information is available for the storage reservoir. However, based on the high volume of flow in the river and flushing through the reservoir, little or no buildup of trophic levels in the source water is anticipated.

5.0 SWAP RANKING AND RECOMMENDATIONS

5.1 Ranking of Susceptibility

The SWAP assessment factors indicate that overall susceptibility of the water quality in the storage reservoir is low. This ranking is supported by analytical data showing good water quality, a limited threat from surrounding land use activities and large volume of flow in the river which maintains a high flushing rate through the reservoir.

Specific factors considered in assessing the overall risk are summarized in Table 3.

TABLE 3
LITTLE MADAWASKA RIVER SURFACE WATER ASSESSMENT

Zone	Measure	Findings	Risk Level
Watershed	Ambient Water Quality Existing Conditions	Attains Class A Limited agricultural uses and remote landspeading of ash residuals pose a low threat on surface runoff. High river flows provide continuous flushing through the reservoir.	Low Low
	Future Development	Future development is prohibited on land in USFWS ownership. Development pressure appears to be	Low

	Overall	low due to the remoteness of the area and limited population.	Low
Shoreland	Source Classification	Undetermined	N/A
	Soils	No identified exposures of erodible soils (Stetson).	Low
	Activities Posing a Threat	Encroachment by farming activities on the west side of the reservoir.	Low-Moderate
	Potential for Future Threats	Shoreland protection by USFWS and area remoteness minimizes threats although more active farming, cultivation and use of chemicals to the west of the reservoir would be a concern.	Low
	Overall		Low
Intake	Raw Water Quality	Undetermined; likely low trophic conditions with high flow rates in river.	Low
	Ownership/Control	LUWS ownership/control limit access by land.	Low
	Activities Posing a Threat	Access by water is not limited, but recreational use is minimal.	Low
	Potential for Future Threats	Beaver and other wildlife around the intake can affect source quality. Increased recreational use in the reservoir.	Low
	Overall		Low
Overall			Low

5.2 Recommendations

The overall ranking for the source susceptibility to potential threats is low. LUWS can provide added protection to the source water quality as follows:

- Continue to implement a thorough water quality-monitoring program.
- Place markers or signs to notify the public and keep the intake area clear from recreational activities allowed on the reservoir.
- As a stakeholder in issues related to water resource protection, maintain public awareness and good communications with the surrounding watershed communities so that future development threats on the river can be mitigated through the adoption of good land use practices and regulatory controls.

APPENDIX A

SWAP ASSESSMENT GUIDELINES

**MAINE PUBLIC DRINKING WATER
SOURCE WATER ASSESSMENT PROGRAM
LORING UTILITIES WATER SYSTEM
LITTLE MADAWASKA RIVER RESERVOIR WATERSHED**

**APPENDIX A
ASSESSMENT GUIDELINES**

Assessment Item/Threat	Low	Moderate	Significant
Physical Characteristics of the Watershed			
Watershed boundary, area	smaller	>>	larger
Area of water body	smaller	>>	larger
Tributaries	few	>>	many
Watershed topography	low	moderate	steep, rugged
Wetlands	many	>>	few
Water body depth	deep	>>	shallow
Sand and gravel aquifers	few	some	many
Soil types (erodibility and slope)	low	moderate	high
Raw Water Quality			
Secchi Disk Transparency	> 8 M	4-8 M	< 4 M
Turbidity	< 1 NTU	< 5 NTU	> 5 NTU
pH	6.5-8.5	N/A	< 6.5 or > 8.5
Phosphorus	< 10 ppb	< 20 ppb	> 30 ppb
Pesticides and herbicides	ND	N/A	detected
Color	< 5	5-15	> 15
Total Coliform and E Coli	> 29/100 ml	occasional	> 142/100 ml
Dissolved Oxygen	>7 mg/L	5-7 mg/L	< 5 mg/L
Temperature	ambient		> 10° C ambient
VOCs	absent	N/A	detected
Chlorophyll-a	< 2 ppb	2-6 ppb	> 6 ppb
Total Organic Carbon	< 4 mg/L	4-8 mg/L	> 8 mg/L
Potential Contamination Source Inventory			
UST/AST leak sites	Absent from watershed or	Present in watershed, some	Present and unmonitored
Municipal/Comm/Special Landfill	actively monitored and	operational deficiencies	and/or unremediated.
Compost sites	monitored and controlled or	and/or remediation are	
Demolition debris sites	fully remediated.	underway.	
Ash/septage storage/utilization			
Superfund site			
Sand/salt storage sites			
Petroleum spill sites			
Hazardous waste sites			
Wastewater treatment facilities			
Food residuals utilization sites			
Uncontrolled hazardous sites			
Tank farms			
Industrial complexes			

Assessment Item/Threat	Low	Moderate	Significant
Potential Contamination Source Inventory Non-point pollution sources Transfer stations Sludge utilization sites Automobile graveyards Engineered subsurface systems Woodyards Underground injection wells Surface impoundments Mining/mineral processing sites Overboard discharges to rivers Active UST sites Roadways Railroads Utility Rights-of-way Boat launches Commercial farms CAFOs Commercial forest operations Private septic systems Home heating oil tanks Airports Bathing beaches Combined sewage overflows	If present, at low density, properly installed and operated. In compliance with applicable local, state and federal regulations.	>>>>	High density, little evidence of active management, documented incidence of problems and failures.
Land Uses and Zoning Residential density Percent of watershed Owned by PWS Public lands or conservation Forested With protective zoning Agricultural Impervious cover Industrial/commercial Waterbody uses: Restricted areas Ice fishing Boating Swimming Recreational vehicles	> 2 Ac/lot total > 80% for all protected uses < 20 % total < 20 % total < 20 % total large, posted limited to absent	1-2 Ac/lot intake and shoreland protected, others developed 20-30% total 20-30% total 20-30% total intake zone moderate, well-managed	< 1 Ac/lot critical areas (intake, shoreland) unprotected or developed > 30% total of 3 > 30% total of 3 > 30% total of 3 small to none prevalent, uncontrolled
Other Analyses Trophic State Index Vulnerability Index Build-out Analysis	< 25 low fully developed	25-60 moderate >>>	> 60 high high potential for development