

# Lebanon, New Hampshire

## Source Water Protection Riparian Buffer Plan

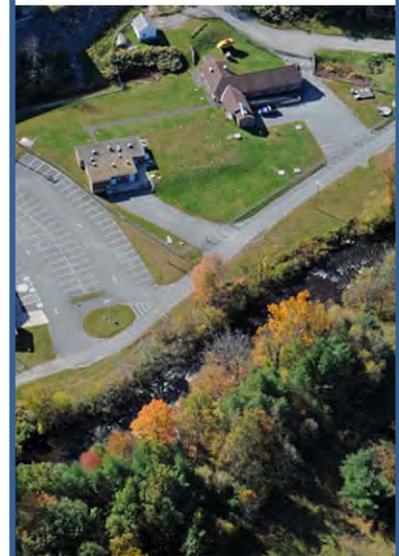
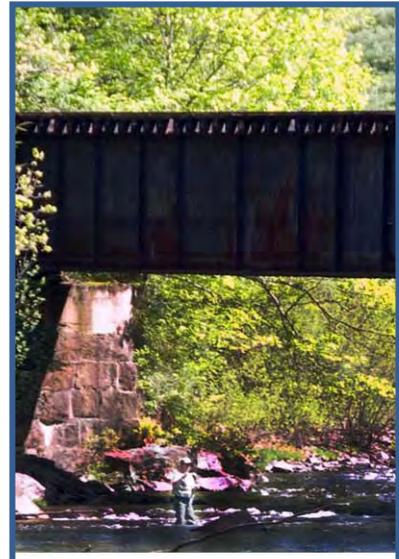
December 30, 2011

Prepared By:

Lebanon Source Water Protection Committee

Upper Valley Lake Sunapee  
Regional Planning Commission

NHDES Drinking Water Source Protection



# Table of Contents

Executive Summary .....	1
I. Introduction .....	2
Project Overview .....	2
Source Water Protection Committee.....	3
Overview of Lebanon’s Water Source.....	4
II. Parcel-Based Buffer Analysis .....	6
Extent and Composition of Riparian Focus Area .....	6
Potential Threats to Water Quality .....	8
III. Water Quality Threat Analysis .....	11
Water Quality Threats .....	11
Existing Regulatory and Enforcement Tools to Protect Water Quality.....	14
The Cost of Clean Water.....	15
IV. Property Owner Survey .....	17
Purpose.....	17
Methodology.....	17
Overview of Survey Responses .....	18
V. Summary Findings and Recommendations.....	21
Principal Water Quality Threats .....	21
Approaches for Effective Water Source Protection.....	21
Recommendations for Water Source Protection and Riparian Areas .....	22

APPENDIX A – Parcel-Based Riparian Analysis  
APPENDIX B – Community Attitude Survey  
APPENDIX C – Project Reference Materials

## EXECUTIVE SUMMARY

Riparian buffers act as "living filters" protecting water quality and helping to preserve our state's high quality lakes and rivers. In New Hampshire, land conservation and a patchwork of state and local land use controls seek to protect riparian areas with mixed results. Riparian areas reduce the impacts of nonpoint pollutants (e.g., phosphorous, nitrogen, etc) and maintain surface water quality. In 2009, DES's Drinking Water Source Protection Program completed the "Buffer Gap Analysis" to evaluate and estimate the spatial extent and level of protection afforded to riparian areas based on riparian land conservation as well as state and local regulations. Building upon DES's Buffer Gap Analysis, the Lebanon Source Water Protection Project Riparian Buffer Plan has begun to identify where and what type of opportunities there are for riparian protection.

Lebanon relies on the Mascoma River and upstream tributaries as the source water for its municipal water supply. The water supply is vulnerable to a range of point source and nonpoint source contamination; each of which could have significant impacts on the City's water treatment plant operations and public water supply.

This study of riparian areas, as part of the broader Lebanon Source Water Protection Program, combined the following components to develop a riparian buffer plan:

- A spatial analysis and ranking system that evaluates both natural sensitivity (e.g., soils, slope) and gaps in state and local regulations within riparian areas.
- Supplemental analyses identifying specific water quality issues and threats in the City including emergency response procedures and known and potential contamination sources.
- A survey of owners of properties in the riparian buffer study area. The survey responses provided important guidance about attitudes toward water quality and opportunities for developing a riparian buffer improvement program.

The Source Water Protection Committee directed the Upper Valley Lake Sunapee Regional Planning Commission in the development of short and long-term actions to maintain and improve water quality in the Mascoma River, particularly with regard to riparian areas. Recommended actions include:

- Evaluate the City Code and land use regulations to address gaps in riparian buffer protections.
- Identify priority lands and buffer areas for conservation through ownership or easement.
- Engage the public through outreach and education, particularly riparian lands property owners.
- Develop partnerships and funding for watershed planning for water quality protection.
- Become active participants in the Mascoma River Watershed Plan.

# I. INTRODUCTION

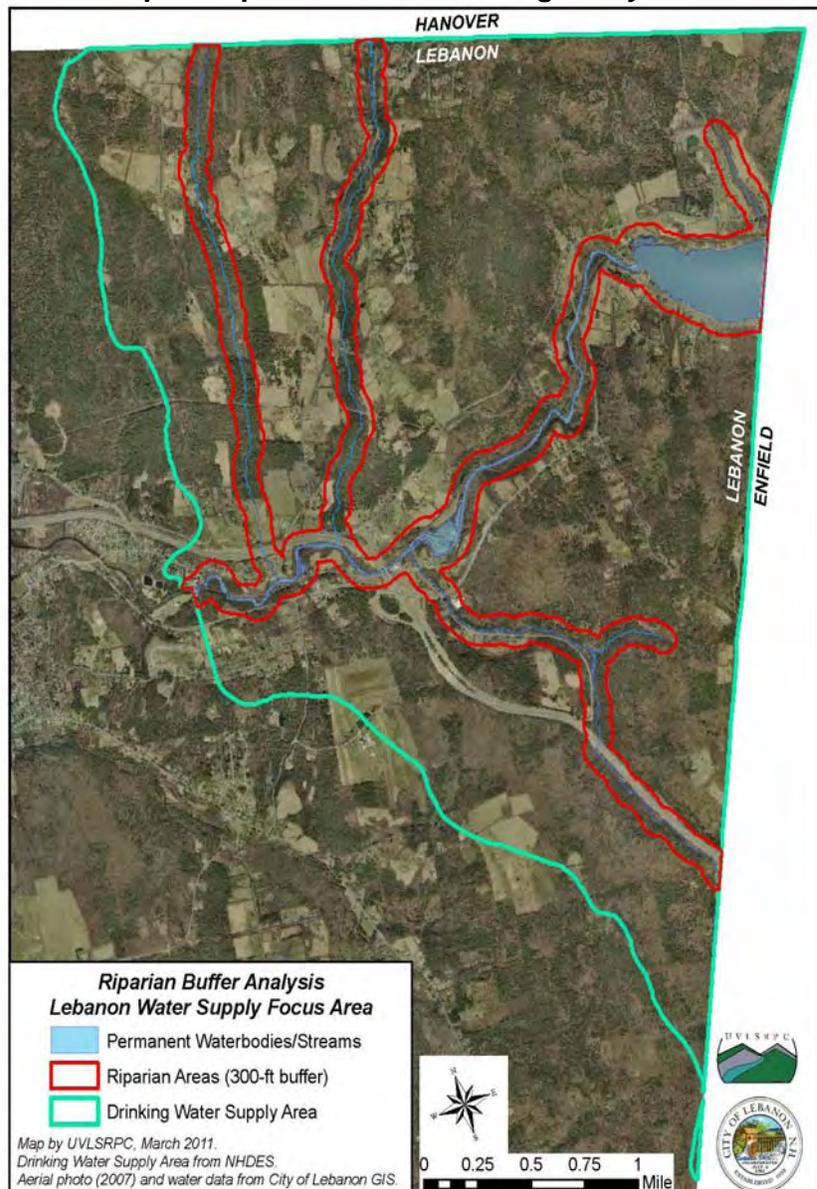
## Project Overview

Since 1997, the New Hampshire Department of Environmental Services (NHDES) Drinking Water Source Protection Program has made small grants to water suppliers, municipalities, and other local organizations for the purpose of protecting drinking water sources. The Source Water Protection projects funded through this program have included delineation of wellhead protection areas, inventorying potential contamination sources, development of local protection ordinances, groundwater reclassification, shoreline surveys, drinking water education and outreach activities, and controlling access to sources.

In 2010 the City and the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC) received funds from NHDES to initiate a planning study to promote protection for the City's water supply by addressing riparian buffers including building upon the Buffer Gap Analysis. Riparian buffers act as 'living filters' to absorb, treat, and mitigate against nonpoint source pollutants and can be developed to aid the City in ensuring a safe reliable drinking water source.

Lebanon residents are among the sixty percent (60%) of New Hampshire residents reliant upon surface water as a source of drinking water. According to the U.S. Environmental Protection Agency the leading cause of surface water quality degradation in the United States is nonpoint source pollution. While point sources of pollution – from pipes, canals, municipal wastewater treatment plants, or industrial facilities – have been closely monitored and regulated since the 1970s, the management of nonpoint pollution sources has only become a priority in the last 20 years.

**Map 1: Riparian Buffer Planning Study Area**



In 2009, NHDES's Drinking Water Source Protection Program completed the "Buffer Gap Analysis" to evaluate and estimate the spatial extent and level of protection afforded to riparian areas based on riparian land conservation as well as state and local regulations.

This planning project focused on riparian buffer areas along rivers and streams in the portion of the City that feeds water to the Water Treatment Plant intake on the Mascoma River, as illustrated in Map 1, otherwise known as the water source catchment area. The Phases of work in this planning effort included:



Mascoma Lake feeds the Mascoma River into Lebanon

- A parcel-based analysis and ranking system that evaluates both natural sensitivity (e.g., soils, slope) and gaps in state and local regulations within the riparian buffers.
- Assessment of specific water quality issues and threats in the City including emergency response procedures and known and potential contamination sources.
- A riparian property owner survey providing important guidance about attitudes toward water quality and opportunities for engaging the community on the importance of source water protection.

The City, with the assistance of the UVLSRPC and NHDES, will be using the results of this work in the development a long-term drinking water protection plan. This report summarizes how the City and the UVLSRPC integrated spatial analyses with social marketing techniques to promote public understanding and action to protect and improve riparian buffers and the public water supply.

### **Source Water Protection Committee**

The Source Water Protection Committee (SWPC) was convened by City Staff to meet regularly in an advisory role to review project progress and direct the City and ULSRPC Staff. The following City Staff and citizen volunteers participated as members of the SWPC:

Antonio Palazzo  
*Resident*

Paul Palumbo  
*Resident*

Jean Moffitt-Inman  
*Resident*

Fal Mehta  
*Resident*

Judy McNab  
*Chair, Conservation Commission*

Jim Angers  
*Department of Public Works*

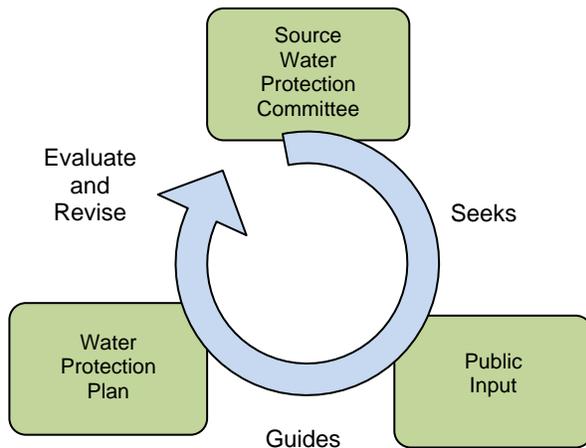
Earl Labonte  
*Department of Public Works*

Andrew Gast-Bray  
*Planning Department*

Mark Goodwin  
*Planning Department*

Paul Coats  
*Recreation Department*

Planning Process



Lebanon presently has a Source Water Protection Plan focused on potential and known contamination sources and public education regarding water source protection. This project expands the source water protection planning to address management and protection of riparian buffer areas.

The SWPC provided valuable insight and direction throughout the Riparian Buffer Plan process. The function of the SWPC to focus on source water protection issues and topics will be critical to ensure the recommendations from this plan are considered and, where appropriate, implemented. Maintaining the SWPC will also enable the City to have a representative body for future public for education and outreach efforts.

**Overview of Lebanon’s Water Source**

Geography of the Water Source

Lebanon’s surface water comes from the Greater Mascoma River Watershed, which encompasses 195 square miles to include nine communities and major regional water bodies including Mascoma Lake, Goose Pond, and Crystal Lake (see Map 2).

Water Treatment Operations

The Lebanon Water Treatment Plant draws directly from the Mascoma River and pumps treated water to approximately 15,000 customers (both residential and non-residential), as well as commercial and industrial customers. In 2010 the Lebanon water works processed 599.66 million gallons of water with an average daily production of 1.64 million gallons. This is a 1.54% over 2009 production numbers. Lebanon’s water treatment process utilizes a series of treatment steps to remove or reduce contaminants (both natural and man-made) that are – or may be – present in the source water.

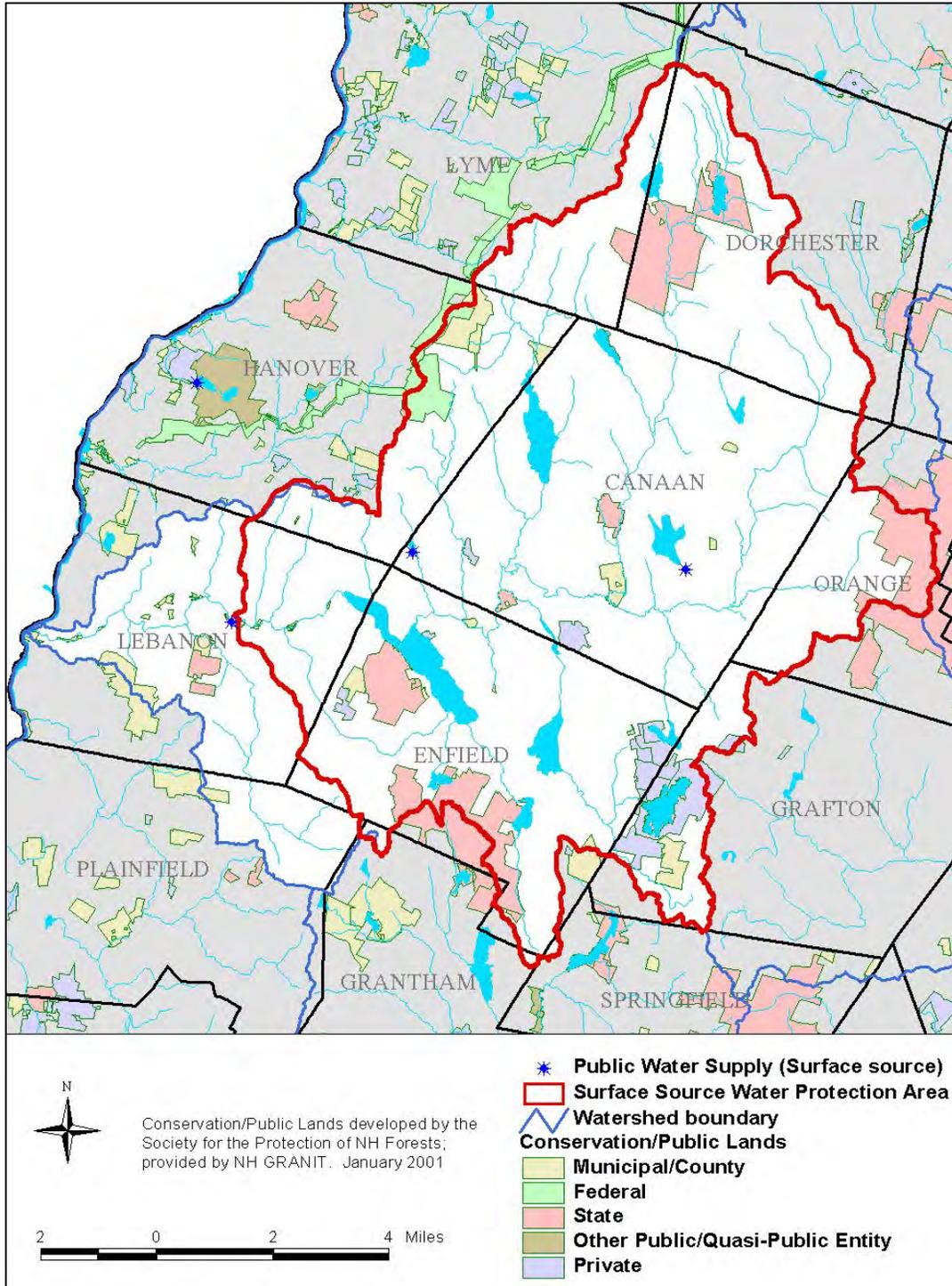


Lebanon Water Treatment Plant and Municipal Pool

The protection of the source water is a very important objective and is integral to the City’s water supply operations. Presently, the goals of the Source Water Protection Program are to protect public health by preventing episodes of drinking water contamination, and to maintain and improve water quality in order to reduce treatment costs. Components of the program

include delineation and mapping of the watershed, inventory and inspection of potential contamination sources, educational activities, and mailings. The Source Water Protection Program has been successful and the City's water treatment plant has benefitted through reduced frequency of monitoring by regulatory agencies.

**Map 2: Greater Mascoma River Watershed**



## II. PARCEL-BASED BUFFER ANALYSIS

The following buffer analysis utilized a computer-based mapping and geographic analysis tools, otherwise known as a Geographic Information System (GIS). The benefit of utilizing GIS is the capability to evaluate and map information to help inform planning efforts. This analysis helps identify a broad range of potential threats to the surface water quality and rank individual parcels of land by threat level with an emphasis on identifying nonpoint source pollution threats. A technical report of the GIS analysis and detailed maps are included in Appendix A of this report.

The effectiveness and reliability of the GIS analyses depend on the quality and level of detail provided in the source data. The body of data for this project was very good due to the level of effort NHDES, the City, and other state and federal agencies commit to generating accurate information.

### Extent and Composition of Riparian Focus Area

The entire Drinking Water Supply Area (see Map 1) covers approximately 6,013 acres in the northeast quadrant of Lebanon, or 37% of the City's total area. The Riparian Focus Area (RFA) cover 1,016 acres in total and consists of:

- 730 acres of land parcels (293 parcels wholly or partially in the RFA);
- 160 acres of public right-of-way;
- 130 acres of surface waters, including the Mascoma River and islands within the river.

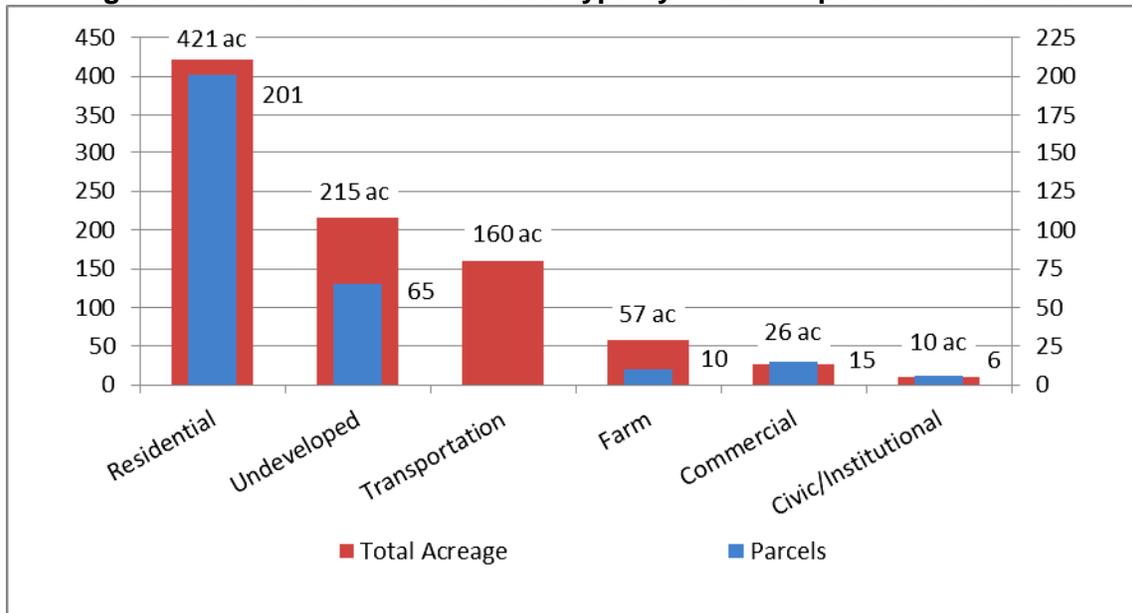
According to the parcel-based land use information, residential and undeveloped parcels account for approximately 71% of the total RFA. Lands used for transportation, including roads and adjacent rights of way, account for 18% of the total land area though there are no specific 'parcels' associated with the land use. Figure 1 illustrates the composition of land uses in the analysis.



Much of the source water catchment is forested with low-density residential use.

Land cover data developed by the City of Lebanon from 2007 aerial photography enables further investigation on landscape and land use patterns. As summarized in Table 1, roughly half of the Riparian Focus Area is forested (534.6 acres) with an additional 218.3 acres of undeveloped brush or cleared land. Land cover associated with development patterns – including paved road surfaces – cover roughly 10% of the RFA. The zoning in the RFA reinforces the current patterns of development, with two small areas zoned commercial and the majority of the area zoned residential or rural residential.

**Figure 1: Distribution of Land Use Type by Area in Riparian Focus Area**

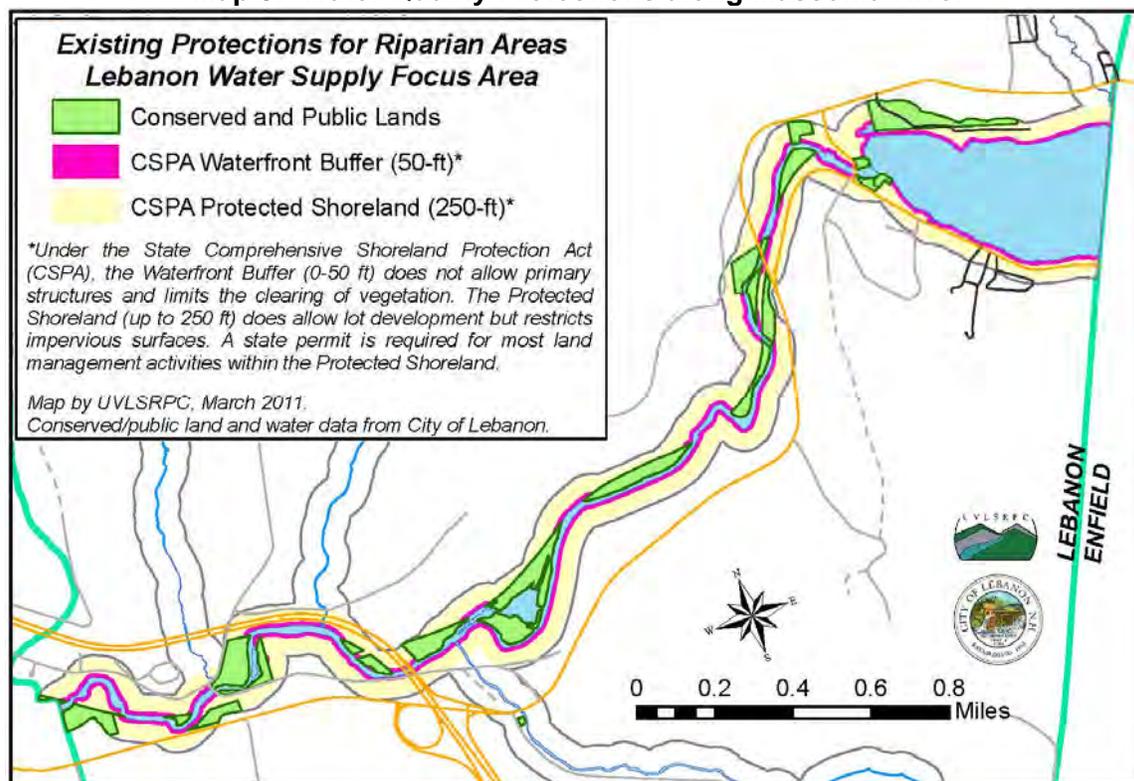


Existing Protections for Water Quality

Conserved and public lands cover 61 acres, which are generally located on or near the shoreline of the Mascoma River and Mascoma Lake. The Shoreland Water Quality Protection Act (formerly known as the Comprehensive Shoreland Protection Act) protects the shoreline along Mascoma Lake and Mascoma River (Map 3). The Shoreland law applies to 267.4 acres; 59 acres of this shoreline is already developed, based on the 2007 land cover classification. There are no conserved parcels within the riparian buffer areas along the tributaries, nor are there any regulatory protections.

**Table 1: Land Cover Analysis Results in Riparian Focus Area**

Land Cover Type	Acreage	Percent
Forest	534.6	53%
Surface Water	130.0	13%
Brush/Transitional	112.1	11%
Cleared Land	106.2	10%
Urban Built-Up	86.4	9%
Right-of-Way - Unpaved	36.5	4%
Right-of-Way - Paved	10.1	1%
Total	1,016	100%

**Map 3: Water Quality Protections along Mascoma River**

### Potential Threats to Water Quality

The analysis results provide an overview of non-point source pollution threats to the City's municipal water source. The following summaries address the different facets of the analysis.

#### *Soils, Topography, and Land Cover*

An earlier study of threats to the City's drinking water supply developed a water quality threat matrix utilizing soils data, land cover data, and proximity to surface waters. Effectively, this analysis identified vulnerabilities on parcels that could result in contamination of the adjacent surface waters. The present analysis built upon the earlier study and found:

- Poorly and very poorly drained soils cover 103.1 acres in the RFA. These soils have limited or no capacity to absorb stormwater run-off to mitigate potential erosion or prevent deposition of contaminants into the nearby surfacewaters.
- Soils that are susceptible to erosion cover 182.1 acres in the RFA.
- As of 2007, the base year of the City's digital topographic model, there were 143.9 acres of steep slopes (> 15% slope) in the RFA.
- Developed land covers 133 acres, which includes paved and unpaved rights of way.

As illustrated by Map 7 in Appendix A, most of these areas are evenly distributed throughout the RFA. Many developed parcels and roads are located near Mascoma Lake and Mascoma River and some roads follow the thread of a number of tributaries to the river. These developed areas are more likely to introduce contaminants to surface waters.

*On-Site Wastewater Treatment Systems*

It is important to recognize the potential contamination a failed or failing on-site wastewater treatment system (a.k.a. septic systems) can cause to water resources. This study identifies developed parcels not connected to the municipal sewer collection system as sites with septic systems. The exact location and condition of these systems is unknown, but the potential for contamination has been incorporated as a risk factor for this geographic analysis. There are 87 parcels in the RFA with buildings and likely septic systems that present the highest potential threat to water quality. There are 119 parcels that use on-site septic systems, but the buildings, and presumably the septic systems, are not within the riparian area. The municipal sewer system serves 57 parcels in the RFA and 30 parcels are vacant or have no waste disposal system.

*Parcel-Based Water Quality Threat Matrix*

The threat matrix analysis ranked parcels in the RFA based on the inherent water quality protections and vulnerabilities discussed above. Table 2, ranks all parcels based on the combination of vulnerability and threat and each parcel received a score of 1 (Low Threat and High Protection) to 5 (High Threat and Low Protection). Map 4 illustrates the geographic distribution of the parcels and their individual ranking in the matrix.

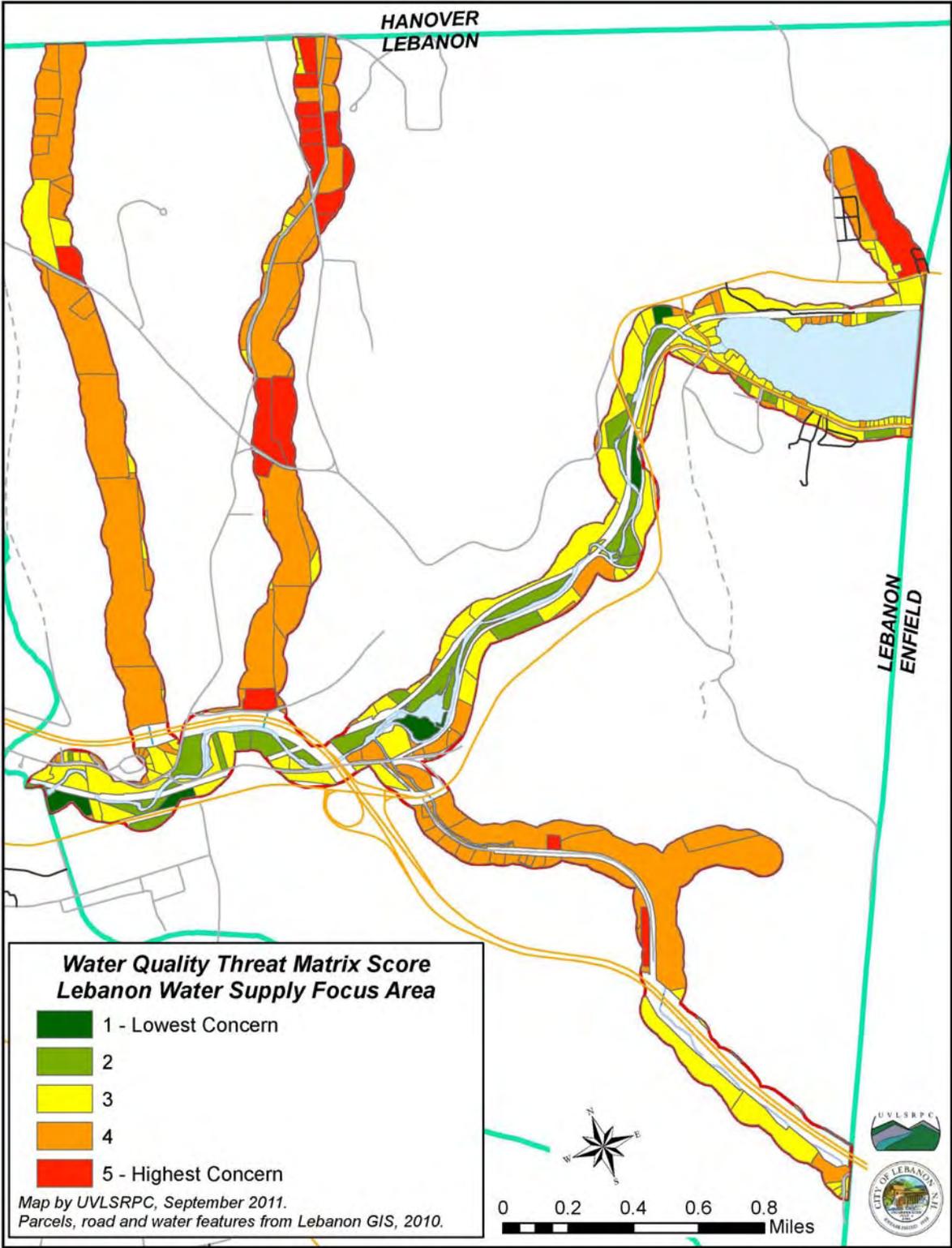
**Table 2: Threat Matrix of Parcels within Riparian Focus Area**

Threat Matrix		Protection		
		High	Medium	Low
Vulnerability	High	<b>SCORE: 3</b> 1 parcel 8.9 acres	<b>SCORE: 4</b> 18 parcels 19.2 acres	<b>SCORE: 5</b> 17 parcels 76.6 acres
	Medium	<b>SCORE: 2</b> 8 parcels 13.6 acres	<b>SCORE: 3</b> 78 parcels 119.3 acres	<b>SCORE: 4</b> 97 parcels 371.8 acres
	Low	<b>SCORE: 1</b> 14 parcels 36.6 acres	<b>SCORE: 2</b> 21 parcels 26.1 acres	<b>SCORE: 3</b> 45 parcels 59.7 acres

Out of 297 parcels in the riparian area (excluding transportation rights of way) 23 are protected through conservation easement or public ownership, 117 are protected through the SWQPA, and 157 have no existing protections. Thirty-six parcels were ranked High Vulnerability, with 181 as Medium, and 80 as Low. Parcels along the tributaries tend to have higher threat matrix scores than those along the Mascoma River or Mascoma Lake; this is due primarily to the low protection status along the tributaries. Along the Mascoma River and Mascoma Lake, higher matrix scores are primarily associated with steep terrain, vulnerable soils types, and land development.

Overall, 17 parcels have been identified as possessing qualities demonstrating High Vulnerability and Low Protection. These parcels are located on the tributaries. These parcels are all single-family residential, with the exception of a manufactured home park on Route 4 on the Enfield town line.

Map 4: Water Quality Threat Matrix in Study Area



### III. WATER QUALITY THREAT ANALYSIS

The City of Lebanon's municipal water supply is susceptible to a variety of contamination risks from human activities. The following analysis builds upon the GIS-based threat matrix and examines specific threats identified by the the SWPC. This evaluation allowed the SWPC to delve into details about known and potential contamination sources.

#### Water Quality Threats

##### NHDES Source Water Assessment Report

The NHDES issues periodic Source Water Assessment Reports (SWAR) to public water supply districts and municipal planning boards to share information on drinking water source susceptibility to contamination within a specific area immediately upstream of the water treatment plant intake. These reports are issued, in part, to encourage communities to develop source protection programs. A copy of the May 6, 2002, SWAR to the City of Lebanon is included in Appendix C.

The SWAR for the Lebanon's water source, the Mascoma River, evaluated 12 different susceptibility factors. The results of the assessment are as follows: for the Mascoma River, (4) susceptibility factors were rated as high, (4) were rated medium, and (4) were rated low:

##### High Susceptibility:

- Water quality tests detected man-made contaminants in the source water ;
- Potential Contamination Sources (PCS) were identified adjacent to the water source;
- Both a major state highway and an interstate highway pass through the study area;
- More than 10% of land within the study area is used for agriculture.



Interstate, and commercial development in the RFA.

##### Medium Susceptibility:

- Known contamination sources exist within the study area, but are more than 1,000 ft from the intake;
- There is a low density of on-site wastewater treatment systems (a.k.a. septic systems);
- Agricultural operations with livestock are in the source watershed;
- Municipal wastewater treatment plant(s) exist within the source watershed.

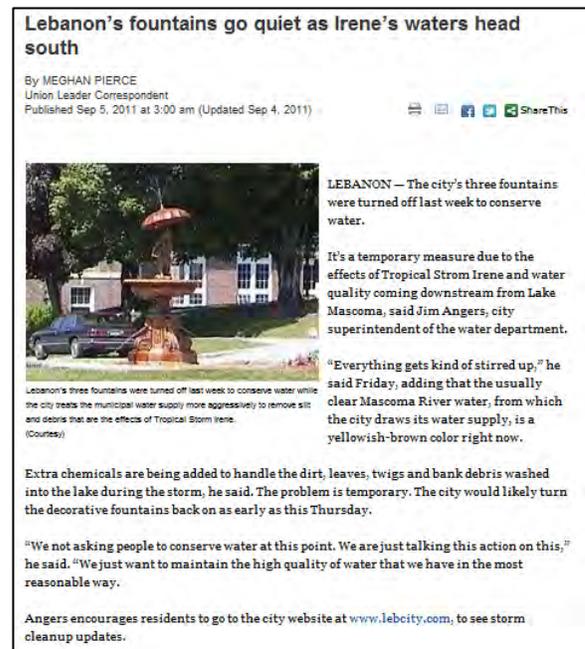
##### Low Susceptibility:

- Source water intake is in good condition;
- No documented sites within the study area regularly use pesticides;
- Low proportion of urban-style land cover in the study area;
- No observed dry weather storm sewer discharges (untreated sewage).

Past Water Quality Incident Reports

The Lebanon Water Treatment Plant Superintendent reviewed operational records to identify contamination events that warranted action due to impacts to source water quality. The following list is a brief summary of the incidents recorded from 2002 to 2011.

- Truck in the River at the Riverside Grill: First responders initiated containment as necessary, Operator on call notified, Superintendent contacted, visual monitoring of river.
- Car Overturned in Stony Brook: First responders initiated containment as necessary, Operator on call notified, Superintendent contacted, visual monitoring of river.
- Tractor Trailer Crash on 1-89, East of Whaleback in Enfield: Possible fuel spill Stony Brook, quick action by first responders to contain spill prevented diesel entering brook. Operator on call notified, Superintendent contacted, visual brook and river monitoring.
- Abandoned Motorcycle on Mill Road: Gas cap missing (no spill), Operator on call notified and visited site, no fuel in motorcycle, Superintendent notified.
- Silt Fence Down in the Hardy Hill Area: Silt fence down on new home construction site, Operator on call notified contacted homeowner/builder, fence replaired.
- Silt Fence Down at Whaleback Ski Area: Silt fence down during rain event on construction site caused high turbidity in Brook and River. Received email from Enfield DPW director, Superintendent drove to ski area contacted workers fence was repaired.
- Sewer Line Leak – Sewer main along river in vicinity of I-89 bridge. Failed segment of pipe was repaired.
- Stormwater Diversion Caused Washout: Washout of Mill Road (streambank along river) due to stormwater from Route 4. NHDOT responded and repaired washout and installed erosion controls.
- Erosion Runoff from Construcion Site: City identified erosion from placement of fill on property adjacent to river causing turbidity in river. NHDES intervened with notification to property owner to correct erosion and restore affected wetlands adjacent to river.
- Tropical Storm Irene: Treatment plant operations modified anticipation of heavy rains and resulting turbidity in river. Reservoirs in the city water supply network fully charged prior to arrival of tropical storm, plant intake closed during period of high turbidity, moderate water conservation measures taken and conservation advisory notice issued to public for the days following the tropical storm.



SWPC Source Water Threat Assessment

Upon review of the NHDES report and the water quality incident reports by City Staff, the SWPC developed its own list of priority water source susceptibility issues. The following issues are listed in no particular order:

### *Contamination along Tributaries*

As the GIS analysis indicates the tributary streams in the RFA have few, if any protections from man-made threats to water quality (e.g.: contaminant releases from agriculture, accidental chemical spills, run-off from development, etc.). Additionally, there are many areas that are vulnerable to erosion and other naturally occurring contaminants. While these tributaries appear to be remote contaminants can travel along the stream and river channels and arrive at the water treatment plant intake within hours, which makes effective response by City Staff to mitigate an event difficult.



Quality and type of riparian buffers along tributaries vary.

### *On-Site Wastewater Systems*

The majority of properties in the RFA rely on private on-site wastewater treatment systems with only a handful connected to the municipal sewer collection network. It is unclear the number, age, location, or condition of existing on-site systems. Further, it is likely new development in the study area will utilize on-site wastewater treatment systems. Such systems present a clear threat as potential nonpoint pollution sources.

### *Enfield to Lebanon Sewer Main*

Downtown Enfield and properties along Route 4A are connected to a gravity-fed sewer main that runs more or less parallel to the Mascoma River from Mascoma Lake the Lebanon Wastewater Treatment Plant. As one incident report indicates above there is potential for corrosion or a break along the sewer main, which could then spill directly into the river and have immediate impact on the source water intake.

The City monitors incoming source water for indicators of untreated sewage and can respond quickly to such an event. Regardless, the SWPC felt this sewer main should be ranked as an important concern for potential contamination not sufficiently addressed in the NHDES SWAR.

### *Major Roads and Highways*

The SWPC agrees that the state highways and interstate highway that pass through the RFA present a high potential risk for contamination. In 1951 a truck carrying 4,000 gallons of kerosene overturned and spilled the bulk of its product directly into the river. The spill resulted in a months-long remediation program at the water treatment plant and extensive commitment of resources at the local, state and regional levels. Given the increasing traffic volumes and goods traveling along local highways today, particularly along state and interstate highways, this type of incident will very likely happen again.

*New Construction and Related Earthmoving Operations*

Over the summer of 2011 the City and NHDES were engaged in monitoring and enforcing remediation due to substantial release of sediments from a property adjacent to the Mascoma River. Review of the incident revealed that the property owner was placing fill material on a property with substantial slopes pitched toward the river and insufficient erosion controls. This



event threatened the City’s water source, but the City had no regulatory or enforcement powers to intervene. Instead, the City referred the situation to the NHDES to address the issue.

As development continues to intensify in Lebanon there will likely be increasing demands to develop the largely forested and undeveloped lands in the RFA along the river and the tributary streams. The SWPC perceives this as a significant threat to water quality if no action is taken to address the issue.

Increasing development activity in the study area.

*Potential and Known Contamination Sources*

The City surveys and monitors activities on properties with potential or known contamination sources as part of the current Source Water Protection Program. Regardless, the SWPC recognizes the high potential for harm to the public water supply if contaminants – principally manmade – are released from these sites. Residential properties may also possess harmful contaminants contained in common household chemicals, though in smaller quantities than those likely stored on commercial properties.

**Existing Regulatory and Enforcement Tools to Protect Water Quality**

*Shoreland Water Quality Protection Act*

NH State Statute RSA 483-B enables NHDES to regulate and enforce the Shoreland Water Quality Protection Act (SWQPA), which applies to protected shorelands along lakes, ponds and impoundments greater than 10 acres and rivers and streams that meet specific criteria. The segment of the Mascoma River in Lebanon meets the criteria so that the shorelands along the river are protected under SWQPA. Under these regulations development activities, including construction or renovation existing structures, earthmoving, and removal of vegetation, within 250 feet of the edge of water are subject to permitting and design requirements. There are three principal zones with different levels of regulation:



- Waterfront Buffer: Areas between the edge of ordinary high water (a.k.a. the reference line) and 50

Tight shoreland development along Mascoma Lake.

feet receive the greatest level of protection. No new primary buildings are permitted in this buffer and strict vegetation standards are in force.

- Natural Woodland Buffer: This next area is from the 50-foot mark where the Waterfront Buffer ends and extends inland to 150 feet from the reference line. This area has a minimum requirement that 25% of the total area remain in an unaltered state, or generally permitted to grow naturally. (Requirements of the Protected Shoreland also apply to this area.)
- Protected Shoreland: The area effectively beginning at the inland edge of the Natural Woodland Buffer and extending up to 250 feet inland from the reference line. This area has less stringent development restrictions with maximum limits to area disturbance, but does regulate stormwater management and impervious cover.

Summary information has been included in Appendix C of this report. More detailed information on the SWQPA is available online at the NHDES web site or calling NHDES by phone.

### Municipal Regulations and Ordinances

#### *Land Use Regulations*

At the time of this study the City of Lebanon does not have land use regulations or zoning districts associated with riparian buffer areas or riparian buffer protections.

It is important to note UVLSRPC assisted the Lebanon Planning Department with recommended amendments to the City Zoning Ordinance to address surface water and ground water quality as part of another project. The proposed amendments focused on Section 400, Overlay Districts, and included proposed language for Wetland Buffer Areas, an Aquifer Protection District, and a Riverbank Protection District. No action has been taken on these proposed amendments. Copies of the proposed language are included in Appendix C.

### **The Cost of Clean Water**

In February 1951 a truck carrying an estimated 4,000 gallons of kerosene overturned next to the Mascoma River. Nearly all the product the truck was carrying entered the river 3 ½ miles upstream from the City's water treatment plant intake. The next week included extensive work and coordination among local, state, and regional officials to mitigate the sudden and irreversible contamination of the City's drinking water supply. Countless manhours and



Route 4 and I-89 encroach upon riparian areas immediately upstream of the municipal water source intake.

resources – many of them donated by local industries and neighboring towns – were spent assembling materials, notifying the public, monitoring water quality, and developing stopgap treatment processes. Ongoing treatment to address the contamination continued into the spring. Such an event today would be a significant drain on the City's manpower and financial resources.

Each municipality with a public drinking water supply deals with unique circumstances and issues to ensure a clean, reliable water supply. Water

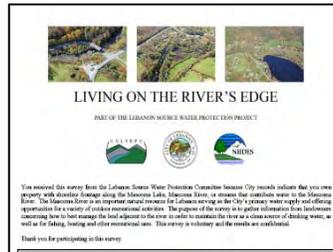
treatment plant operators do what they can to manage costs and ensure that there are sufficient levels of protection to the public water supply. Additional challenges that affect operational costs within water treatment plants include the emergence of new contaminants in the water supply, changing standards and regulations to address known contaminants, and increasing treatment and operational costs over time.

Lebanon's source water protection planning effort recognizes the importance of controlling operational costs. The study seeks to look for solutions to managing water treatment costs by addressing water quality before it enters the water treatment plant, particularly for a system that relies on surface water quality. Therefore, land use and riparian buffers become areas of opportunity to control long-term operational costs at the water treatment plant. Further, the watershed from which the drinking water flows, and how it develops over time, will likely become a critical component in the City's public water supply operations. For example, in 2002 the Trust for Public Land and the American Water Works Association surveyed water supply districts nationwide and found, on average, for every 10 percent increase in forest cover in the source watershed, treatment and chemical costs decreased approximately 20 percent.

The complexities of water treatment plant operations, forecasting future treatment costs, and the potential impact future land development may have on these costs are not addressed in this report. The topic may serve as an important discussion point to focus attention on source water quality in the Mascoma River and associated benefits to municipal water treatment plant operational costs.

# IV. PROPERTY OWNER SURVEY

The SWPC directed the UVLSRPC to prepare and distribute a 10-question survey for property owners of parcels that encroach upon the Riparian Focus Area. UVLSRPC prepared and mailed copies of the survey to 103 individual property owners. At the end of the survey period 32 survey responses were received, or a 31% response rate, which is sufficient to give the SWPC confidence that the survey responses can provide good guidance for expanding upon the current Source Water Protection Plan.



**1. How do you use your property?**

Property is used for residential purposes

Property is used for commercial purposes

Property is used for both residential and commercial purposes

**2. How long have you owned this property?**

Less than 1 year

1-5 years

6-10 years

More than 10 years

**3. Please check all that apply or maintain the checklist including the area around (a building down to the river) (Please check all that apply):**

My lawn extends to the water's edge

I have a walking access to the water

I maintain a vehicle access to the water

I like and love my property

I do not use or maintain the shoreline (within a 100 ft) or the shoreline

**4. In the last year have you or a member of your household done any of the following activities?**

Activity	Never	Occasionally	Often	Very Often	Not Applicable
Used fertilizers in residential activities	<input type="checkbox"/>				
Applied fertilizers to your lawn or garden	<input type="checkbox"/>				
Applied pesticides to lawns or to your lawn or garden	<input type="checkbox"/>				
Used herbicides in landscaping or lawn care maintenance activities	<input type="checkbox"/>				
Used pesticides in landscaping or lawn care maintenance activities	<input type="checkbox"/>				
Used herbicides on your shrubs and trees (not a professional landscaper)	<input type="checkbox"/>				
Used pesticides on your shrubs and trees (not a professional landscaper)	<input type="checkbox"/>				
Used herbicides on or around water bodies	<input type="checkbox"/>				
Used pesticides on or around water bodies	<input type="checkbox"/>				
Used herbicides on or around water bodies	<input type="checkbox"/>				
Used pesticides on or around water bodies	<input type="checkbox"/>				
Used herbicides on or around water bodies	<input type="checkbox"/>				
Used pesticides on or around water bodies	<input type="checkbox"/>				

**5. On a scale of 1 to 5 (1 = "Little or No Impact" and 5 = "Significant Impact") rank each of the following POTENTIAL NEGATIVE IMPACTS according to how much of a problem you think they are on the Mascoma River:**

Potential Negative Impact	1	2	3	4	5	Don't Know
Leaving pet waste outside	<input type="checkbox"/>					
Improper disposal of lawn mow and garden trim	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					
Improper disposal of lawn mowers and trimmers	<input type="checkbox"/>					

**6. On a scale of 1 to 5 (1 = "Little or No Impact" and 5 = "Significant Impact") rank each of the following POTENTIAL POSITIVE IMPACTS according to how much of a problem you think they are on the Mascoma River:**

Potential Positive Impact	1	2	3	4	5	Don't Know
More riparian habitat and streambank areas	<input type="checkbox"/>					
Less riparian habitat and streambank areas	<input type="checkbox"/>					
More riparian habitat and streambank areas	<input type="checkbox"/>					
Less riparian habitat and streambank areas	<input type="checkbox"/>					
More riparian habitat and streambank areas	<input type="checkbox"/>					
Less riparian habitat and streambank areas	<input type="checkbox"/>					
More riparian habitat and streambank areas	<input type="checkbox"/>					
Less riparian habitat and streambank areas	<input type="checkbox"/>					
More riparian habitat and streambank areas	<input type="checkbox"/>					
Less riparian habitat and streambank areas	<input type="checkbox"/>					

**7. Who should be most responsible for protecting the river to ensure it continues to be clean and available for use as a community water supply and for recreational activities in Lebanon?**

City Government

State Agencies

Federal Agencies

Individual property owners

Volunteer groups

Don't know

**8. Which of the following educational opportunities would you most likely take advantage of? (Select three)**

Read more about how to select certain plants and landscape your property to protect the river

Visit one of Lebanon's other landscaping along the river's riparian focus area property and educational demonstration farm

Watch a video online of how to landscape my property along the river

Take a one day landscaping course offered by the City, NH Cooperative Extension or other organization

Volunteer to show others how you manage your property to protect the river

Do the kind of opening, fence, maintenance, or workdays related to landscaping and river management

**9. What do you think you would be willing to do to improve your property to help protect the river?**

Item	Yes	No	Don't Know
Remove fertilizers on your lawn or garden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Change pet waste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Install a small streambank device on the property	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plant native trees and shrubs along a creek or streambank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Remove grass and other lawn care products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Remove streambank vegetation for soil conservation purposes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Take measures to control further development on your property	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Change how you handle, store, or dispose of household	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Join a community group to improve water quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**10. Is there space to the right, describe any other action or activity you do or would be willing to do to better protect the Mascoma River.**

**11. Please take the opportunity to share any comments or thoughts about local effects that are present the Mascoma River that we are not mentioned in the survey.**

## Purpose

After SWPC reviewed project technical analyses, the group reached consensus that it would be important to understand the interests and values of the property owners of the riparian areas being studied. A property owner survey would give SWPC insight about how property owners use their land, what they think about water quality, and what they would be willing to do to maintain and improve water quality in the Mascoma River watershed. The overall intent was to give the SWPC and the City much needed public input on how to proceed with implementing recommendations from this Riparian Buffer Plan.

## Methodology

In the interest of receiving the maximum response rate the survey had the following qualities:

- Short survey length.
- Simple, easy to understand language (no jargon or technical terms).
- Focus on respondent opinions on water quality topics and personal interest in protecting water quality.

Survey recipients were identified through using a GIS analysis of City of Lebanon Tax Map parcel data. All privately owned property that was fully or partially within the Riparian Focus Area (RFA) received mailings. UVLSRPC mailed 103 surveys to property owners (excluding duplicate listings). Each survey was designed so the respondent could fill-out the survey, fold and mail it back (the response booklet was complete return address and postage). Three weeks after the initial mailing, reminder postcards were sent to all property owners. The postcard thanked those who already responded and encouraged non-respondents to participate. An online version of the survey was also made available to respondents.

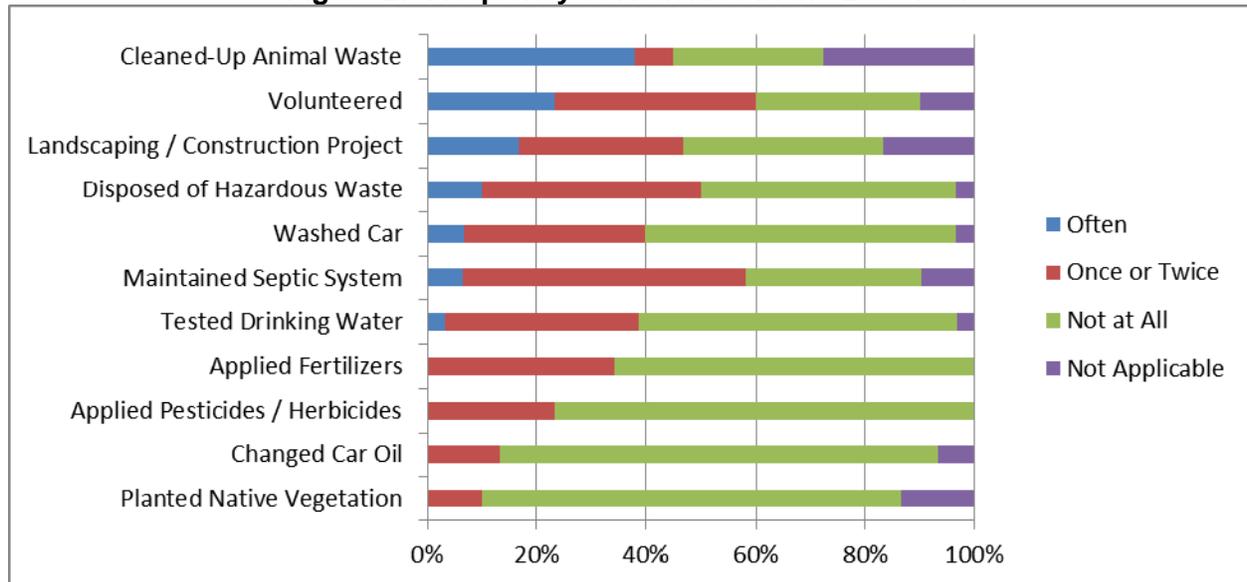
## Overview of Survey Responses

### Respondent Characteristics and Practices

The majority of survey respondents identified their property as residential (91%) with only a couple of respondents listing their property either as commercial or mixed use. Over two-thirds of respondents reported owning their property more than 5 years, 56% owned their property longer than 10 years. When asked about how they maintained their property along the water's edge, nearly half the respondents stated they maintained lawns or walking access up to the water. One quarter of respondents stated they did not maintain the water's edge on their property.

Figure 2 illustrates responses related to specific activities and frequency of the activities over the last year. Half the respondents who cleaned-up animal waste on their property did so frequently. Over 20% of the respondents stated that they or a member of the household volunteered in the last year – a possible opportunity to enlist willing hands in future planning efforts. Some respondents either tested their drinking water or took steps to maintain their on-site septic systems. Also, the vast majority of respondents refrained from using herbicides or fertilizers on their properties. About half disposed of hazardous wastes in an appropriate manner, which begs the question about what the other half of the respondents are doing with their hazardous wastes.

**Figure 2: Frequency of Activities in the Last Year**

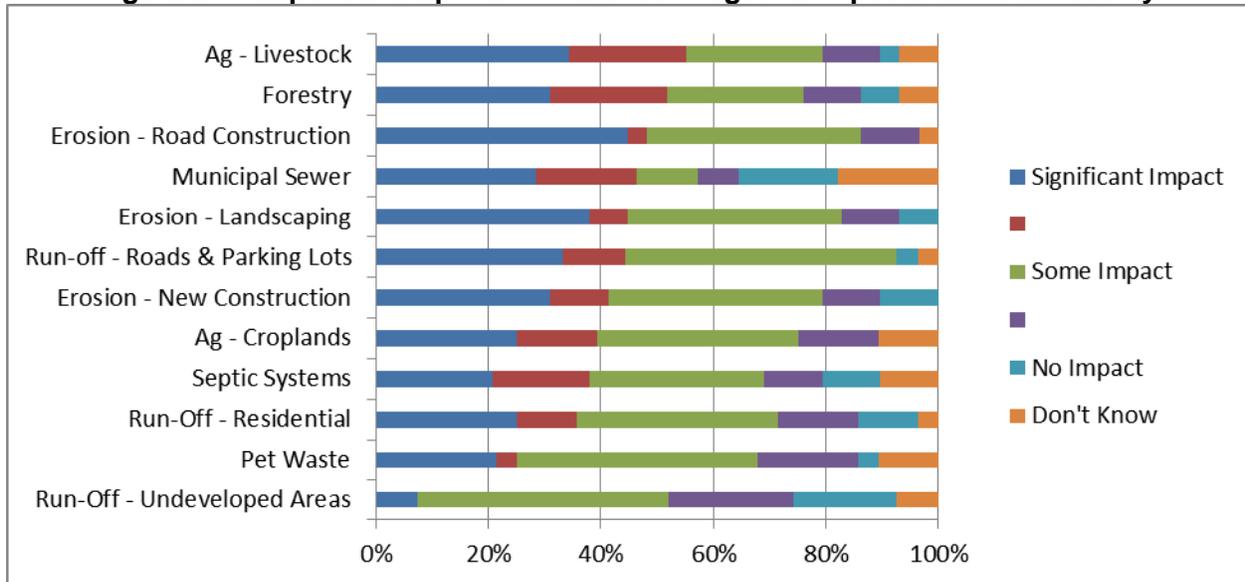


### Opinions on Water Quality Impacts

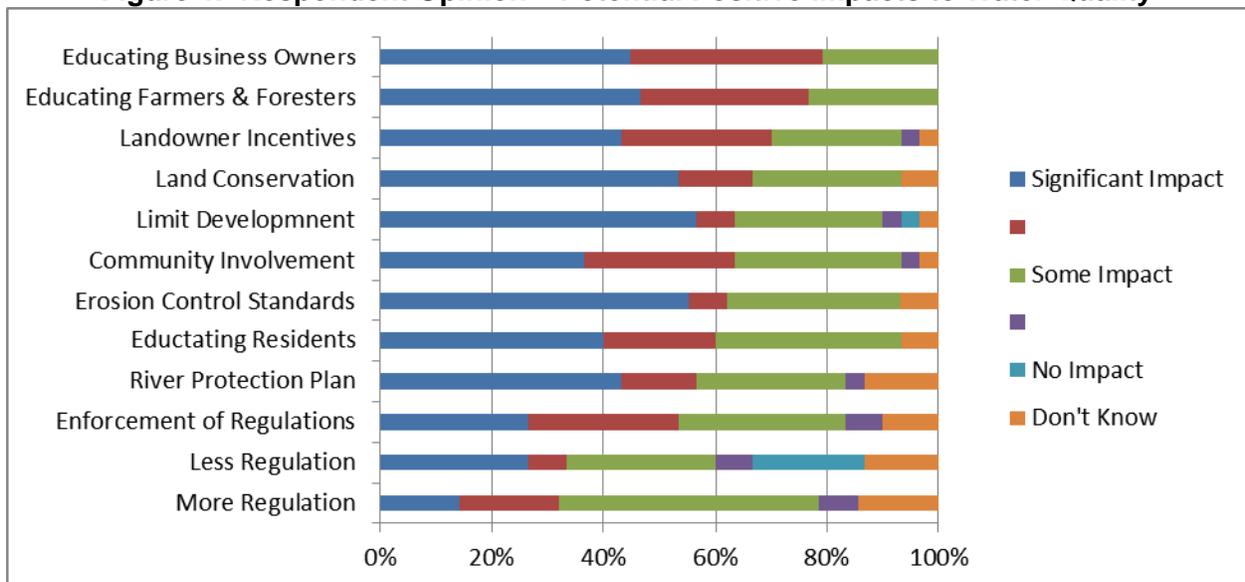
Figures 3 and 4 summarize individual opinions regarding the potential negative and positive impacts certain activities may have on surface water quality. Most respondents believed significant negative impacts derive from land development, either during or after construction (erosion from road or new construction, run-off from parking lots), followed closely by farming and forestry. Activities over which respondents have the most control (run-off from residential properties, pet waste, and managing septic systems) received relatively low negative impact ratings.

The strongest responses regarding potential positive impacts to water quality focused on educating farmers and foresters about protecting water quality (nearly 80% of responses indicating significant or high impact for both). Educating residents about protecting water quality ranked 8 of 12 (60% responded significant or high impact). Landowner incentives, land conservation, and community involvement were among the top ranked activities with positive impacts to water quality. Opinions about the positive impacts regulations have on water quality indicate possible indifference on the topic – meaning that new regulations may not be the most effective approach to addressing water quality.

**Figure 3: Respondent Opinion – Potential Negative Impacts to Water Quality**



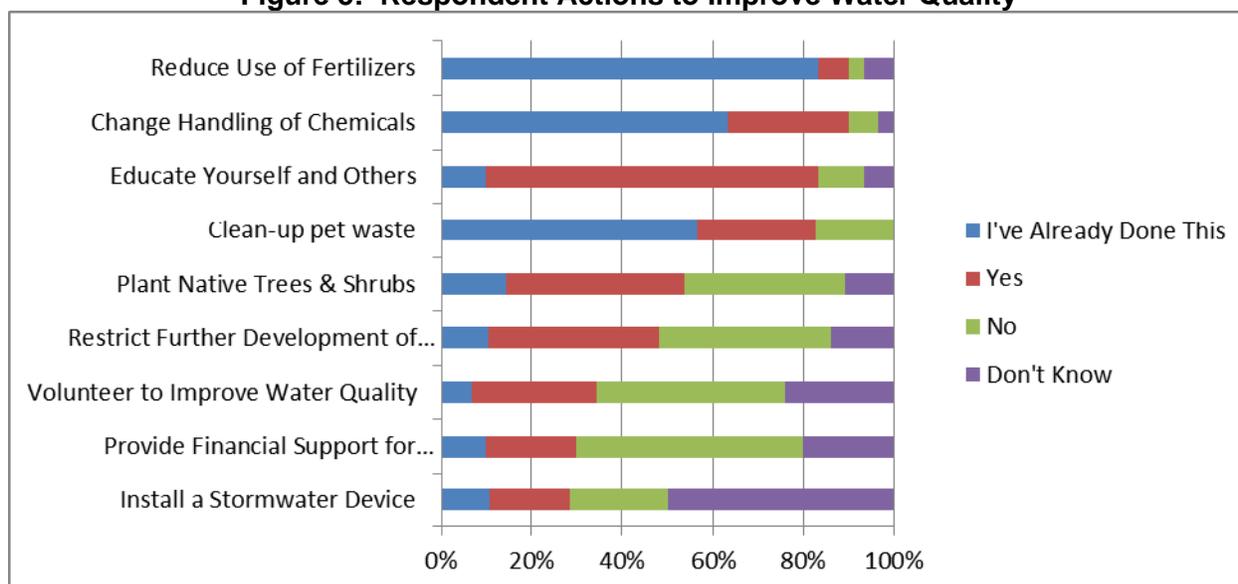
**Figure 4: Respondent Opinion – Potential Positive Impacts to Water Quality**



*Moving Forward – Riparian Buffers and Water Source Protection*

When asked what actions the respondents would take to improve water quality, many indicated they already took action to reduce the use of fertilizers, handled chemicals differently, and clean-up pet waste. There appeared to be relatively strong commitments from respondents to educate themselves and others, plant trees and shrubs, take action to restrict further development of their property, though there appear to be an equivalent number of respondents responding 'no' to the latter two items. Whenever a respondent answers, "don't know," that indicates an opportunity for education on the topic as may be the case for responses regarding whether property owners would install stormwater devices.

**Figure 5: Respondent Actions to Improve Water Quality**



Additionally, responses addressed topics of responsibility for protecting the river and preferred method of educating the public regarding water source protection issues.

- Respondent opinions stated responsibility for protecting the river – 41% believed it was the City's responsibility and 28% felt the individual owners need to take the responsibility. Many comments indicated that everyone is responsible.
- When asked which educational opportunities they would most likely take advantage of, the most popular in order were:
  - Read more about how to select certain plants and landscaping to protect the river,
  - Take a free landscaping course offered by the City, NH Cooperative Extension or other organization,
  - Watch an instructional video online,
  - Visit a site in Lebanon where landscaping along the river's edge has improved the property and filtered contaminants from run-off.
- 73% were willing to educate themselves and others about local water issues.
- 50% were not willing to provide financial support to land conservation initiatives.
- 39% are willing to plant native trees and shrubs along the shoreline.

## **V. SUMMARY FINDINGS AND RECOMMENDATIONS**

### **Principal Water Quality Threats**

The analyses for the Riparian Buffer Plan identified principal threats to the City's source water quality. The study utilized both computer-based GIS analyses and detailed review of source water quality threats by the Source Water Protection Committee. The following bullets summarize the critical threats:

- The GIS analysis, which focused on potential nonpoint pollution sources, provided important information on the overall threats to water quality based on a threat matrix. Review of the threat matrix revealed that the parcels within the Riparian Focus Area (RFA) that scored a high on the threat matrix (high vulnerability and low protections) tended to be parcels along tributaries to the Mascoma River. Given the even distribution of vulnerability indicators like erodible soils and steep slopes in the RFA the most significant influences on protecting water quality are the presence of riparian land use controls (specifically, the Shoreland Water Quality Protection Act along the Mascoma River) and land conservation.
- The ongoing development of land within the water source catchment area, particularly development within the RFA – the focus of this study – presents a persistent threat to source water quality. Progressive development of land adjacent to surface waters threatens the integrity of the riparian areas, which serve as important buffers to absorb and treat potential contaminants entering the surface waters.
- The Enfield to Lebanon sewer main is situated along the thread of the Mascoma River from Mascoma Lake to the Lebanon Wastewater Treatment Plant. This utility is critically important to the viability of Enfield's downtown and some land uses along the shores of Mascoma Lake. The sewer line poses a specific threat to the river if a break in the line releases untreated wastewater into the river. While there are safeguards to protect the public if such a release occurs, preventing such releases through regular maintenance of the sewer line would be a preferred course of action.
- An interstate highway and busy state highway encroach on the riparian areas along the Mascoma River and a couple of tributaries upstream of the City's water intake. The increasing traffic volumes along these roadways and the necessary wintertime applications of sand and salt increase the risk of potential contamination of the Mascoma River. A major fuel spill into the river in 1951 demonstrated the vulnerability of Lebanon's water source to vehicle accidents.
- The City's current Source Water Protection Plan includes regular monitoring and periodic surveys of likely contamination sources within a specific area upstream of the water supply intake. Known and potential contamination sources within the RFA pose a critical threat to water quality because of their proximity to the river and tributaries.

### **Approaches for Effective Water Source Protection**

Municipal influence on protecting and maintaining water quality can occur in many different forms. The following three general approaches are available to municipalities:

Municipal Ownership and Conservation

Protecting a water source by owning and conserving lands within the watershed is a long-standing practice for protecting public water supplies. Purchasing land or obtaining conservation easements ensures an enduring measure of protection of the municipal water supply.

Land Use Regulations and Design Standards

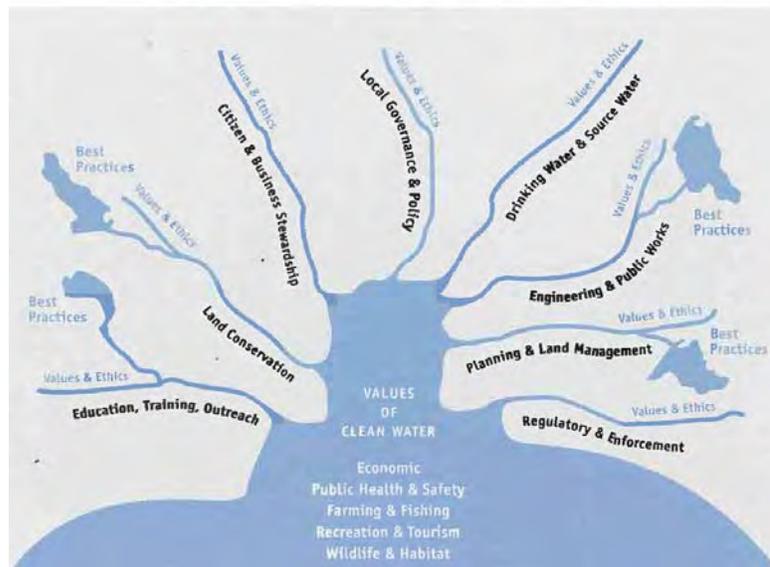
The municipality might act, based on planning assessments or public petition, to implement land use regulations to protect water quality. This approach requires developing specific land use regulations, enacting them, and having the capacity to enforce the regulations.

Community Engagement

A broader approach to maintaining water quality requires engaging neighboring communities, property owners, and other organizations, like the Lake Sunapee Protective Association, to achieve a common goal. These partnerships can benefit all parties by drawing from the strengths and capabilities of each member. This approach enables the municipality to be involved in regional watershed initiatives, which extend beyond municipal boundaries.

A comprehensive Source Water Protection Plan may incorporate all three of these approaches to meet the City’s goals of ensuring a stable, clean public water supply. The following discussion of recommendations identifies opportunities for the City to promote water quality through management of the riparian areas.

Figure 3. The Social System Influencing Water Quality and Quantity



Source: *Collaborative Learning Guide for Ecosystem Management*, UNH/NOAA CICEET, Wells Reserve, 2008

**Recommendations for Water Source Protection and Riparian Areas**

After completing the analyses and developing a framework for a riparian buffer plan the study findings were presented to the Lebanon Conservation Commission, Planning Board, and City Council. Each presentation sought to inform the respective groups of the findings of this Riparian Buffer Plan and gain insight from its members about how future planning and implementation efforts may take place. The following recommendations incorporate these comments.

City Action, Enforcement, and Regulations

The City can begin the planning and implementation process by assessing City ordinances and regulations. The important first steps will be filling the gaps in municipal regulations and policies that will promote water quality protection.

*City Staff Enforcement Powers*

Feedback from City Council, Planning Board regarding source water protection:

- A City-wide education effort should be a priority.
- Explore the balance of protecting the water source and minimizing regulatory restrictions to property owner rights.
- It will be important to address septic systems in the catchment area.
- Coordination among City departments will help promote successful completion of the project.
- The City should take proactive action to promote source water quality and lead by example.
- It will be important for the Source Water Protection Committee to remain in place to continue important project and planning work.

Chapter 182, Section IV of the Lebanon City Code outlines the powers of the Water Source Protection Program and the duties of the Director of Public Works or duly authorized City employees. These powers include observing, sampling, and information-gathering on private property – with the permission from the property owner.

Action to intervene may – in cases of clear threat to the municipal water source – be a reasonable increase in authority. The City should explore opportunities to empower local authorities, like the Director of Public Works, to intervene if there are activities on private property that threaten the public water supply. An example of how these new powers may be applied: Construction work on a site has no erosion control measures with observed impacts into surface waters and potential impacts to the public water supply. An authorized City employee would be able to order site work cease and erosion controls installed.

*Emergency Response Procedures to Protect the Water Source*

The record of incident reports indicate that first response teams arriving at an vehicle accident are doing a good job at identifying and containing chemical spills and notifying Water Department staff of the issue. It would be advantageous to formally incorporate spill response procedures in the City's emergency response program.

*Evaluate Land Use Regulations and Design Review*

The GIS analysis identified significant gaps in local riparian buffer protections. Many communities address this regulatory gap by writing new regulations or amending the local zoning ordinance. Upon review of this recommendation City Councilor and volunteer responses ranged from strong support to strong caution against imposing new land use regulations.

This report demonstrates that regulatory gaps are a principal vulnerability that increases risks to maintaining good water quality. This report recommends a broad assessment of existing regulations and how education or regulatory changes could reduce the risks to water quality:

- City Planning Department Staff can provide educational programs to the Planning Board and other volunteer boards to help citizen volunteers better understand the importance of managing and protecting riparian areas, particularly those in the water source catchment.
- Develop design guidelines for applicants to use as a reference when working in riparian areas. These guidelines may include erosion control best management practices and

references for maintaining stormwater management features. This effort may only require collecting informational material developed by organizations like NHDES and the Connecticut River Joint Commissions.

- Require erosion and sedimentation control best management practices for any terrain alteration project.

#### *Review Opportunities for Conservation*

Municipal conservation of land is an effective water source protection measure. The City should identify and prioritize parcels within the water source catchment area for conservation, particularly lands with riparian areas. A less costly option may be seeking commitments from property owners to convey conservation easements including riparian areas.

#### *Improve Municipal Riparian Areas*

The City owns a number of parcels along the Mascoma River. The City could review these riparian areas and identify segments that require stabilization or other improvements. A completed project could serve as an example to promote private property owners to take the same steps in riparian area improvements.

#### *Engage the Public*

The public, particularly riparian area property owners, are an important, untapped resource. The City can begin with some basic efforts to engage the public with simple newsletters and develop the efforts into a robust water quality protection outreach programs focused on private citizen engagement and participation.

#### *Begin Public Outreach and Education Program*

This study has the fundamental information for a good first-round public outreach and education program. The SWPC may want to take this report, particularly information regarding property owner attitudes and develop some interesting articles and statistics for publication. As the Source Water Protection Program evolves the level of communication and sophistication of the City's outreach efforts can evolve.

#### *Broaden the Scope of the Water Quality Survey*

The public survey for this report focused on riparian area property owners. A minor modification to the survey format and questions asked could yield a useful public survey to distribute for general community input on water source protection topics. This survey could inform the broader water quality outreach and education campaign.

Education and outreach ideas for source water quality protection:

- Mail a summary of the survey responses to riparian area property owners and invite property owners to join the SWPC.
- Work with Lebanon School District to develop a curriculum related to the Mascoma River and water quality.
- Develop a water quality educational and training program for municipal staff, volunteers and land use boards.
- Work with the Lebanon Recreation Dept and the NH Dept of Recreation and Economic Development to install educational stations along the Mascoma River rail trail at river crossings.

Ideas for SWPC projects and project partners:

- SWPC should participation in the Mascoma River Watershed Plan and designate a representative to attend the Mascoma River Local Advisory Committee meetings.
- Develop a partnership with the region's Rotary Clubs and their annual Mascoma River clean-up program.
- The Student Conservation Association may be a resource for providing a workforce for riparian improvement projects.

#### *Engage Riparian Property Owners for Improvement Projects*

The survey results indicate many property owners would be willing to participate in projects to improve riparian areas and possibly learning about what landscaping can be done. The City could, with financial and technical assistance from NHDES and others, develop a pilot program to assist one or two property owners in making improvements to their properties. Successful projects could be used to promote subsequent improvement programs.

#### *Regular Progress Reports*

The SWPC should measure success of the Source Water Protection Program and report back to of the work being done. Developing metrics by which to measure success of the program and reporting back to municipal policy makers will increase confidence in the SWPC and remind them of the groups mission and goals.

#### *Continue Source Water Protection Planning*

Efforts to further develop Lebanon's Source Water Protection Plan can follow the findings of a supplemental, community-wide survey as mentioned above. The City has the opportunity to participate in municipal planning and regional and watershed planning at the same time. The adoption of the segment of the Mascoma River passing through Lebanon, Enfield, and Canaan into the NH Rivers Management and Protection Program will yield many opportunities for the City to seek increased water quality on the watershed level.

#### *Develop Alliances for Source Water Protection*

A successful approach to source water protection planning includes seeking complementary alliances among groups with the same goal. In this case, the City has the opportunity to develop alliances with many organizations and groups including:

- State Rivers Management Protection Program, Local Advisory Committee
- Connecticut River Joint Commissions, Upper Valley Subcommittee
- NHDES Volunteer Lake & River Assessment Programs
- Lebanon Rotary
- Enfield, Canaan, Dorchester
- Mascoma Lake, Crystal Lake, Canaan Street Lake, Goose Pond Lake Associations
- Mascoma Watershed Conservation Council
- Trout Unlimited
- Land Trusts/Conservation Organizations

#### *Identify Funding Sources*

Project funding will be critically important to support planning, activities, and initiatives for the Lebanon Source Water Protection Committee. It will be important to be able to identify a range of funding sources for the SWPC's efforts, which may range from municipal funding to government grants and private donations.