

Canaan Master Plan



September 29, 2006

Revises prior master plan certified on February 27, 1997

Following a public hearing held on September 14, 2006, this Canaan Master Plan was adopted by vote of the Canaan Planning Board, on September 28, 2006. This plan was filed with the Canaan Town Clerk on September 29, 2006. A copy was sent to the New Hampshire Office of Energy and Planning on September 29, 2006.

Certified:

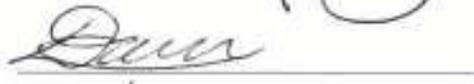
Andrew Musz, Chairman

Signature


Date

9/28/06

Daniel B. Ware, Vice Chairman



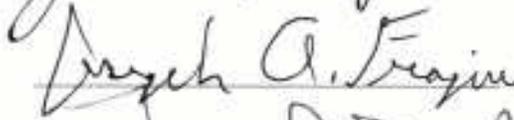
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John H. Bergeron



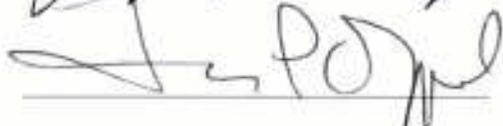
9/28/06

Joseph Frazier



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9/28/06

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Section I Introduction

PLAN PURPOSE

The purpose of this Master Plan is fourfold. First, the Plan serves as the guiding document for future development in Canaan. As such, it establishes the key principles that the town of Canaan holds related to land use change, and articulates them in a clear, practical and concise manner. Second, the Master Plan serves as the guiding document to assist the Planning Board as it updates Subdivision and other appropriate ordinances and regulations that fall under its jurisdiction. Third, the Master Plan acts as a cornerstone document for any Zoning Ordinance that the town may consider. Finally, the Master Plan serves as the basis for other responsibilities of the board as it strives to preserve and enhance the quality of life of all residents in Canaan.

Ultimately, this plan articulates the values and vision that the people of Canaan hold dear. The Plan identifies many of the key issues facing the community, and the concerns that residents have about the future of the town related to land use change and development. This Master Plan acknowledges that personal property rights and the ability of Canaan's private property owners to pursue their goals is now, and will continue to be, a prized community value.

With the values and vision of the community clearly defined, the Master Plan also establishes priorities for the Planning Board to consider as it continues its work towards the smart management of growth, sound planning, and wise resource conservation.

AUTHORITY

According to NH RSA 674:1, the Planning Board has the explicit duty to prepare and amend a Master Plan from "time to time". The citizens of Canaan elect six of the seven members of the Planning Board. The seventh, an Ex-Officio member, is a representative of the three member Canaan Select Board. Alternate members may be appointed by the Planning Board. The Canaan Planning Board has prepared and adopted this Master Plan in accordance with the content requirements and adoption procedures outlined in NH RSA 674:2-4.

PLANNING PROCESS

The Planning Board decided that in order for the Master Plan to be a success, and truly represent the desires and ambitions of the residents of Canaan, an extensive public involvement process was needed. In 2001 a UNH sponsored "Canaan Community Profile" was created. In the fall of 2005 a Community Survey was prepared and distributed to Canaan residents and the Planning Board hosted three community forums designed to solicit input from the people of Canaan on a range of issues.

The information gathered helped to shape this Master Plan. The results of the Community Survey are summarized in the appendix and selectively included throughout the document.

In March of 2006 the Canaan Planning board formed a sub committee to update the 1997 Master Plan. In April 2006 the Master Plan Committee began its work. The full Planning Board reviewed the Master Plan in July of 2006 and in August 2006 public meetings were held.

The contents of this Plan include the following sections: Vision for Canaan's Future; Canaan's People; Housing; The Canaan Economy; Our Town Buildings and Services; Our Road and Transportation Systems; Natural Resources and Recreation; Preserving Our History; Land Use and town Survey.

ACKNOWLEDGEMENTS

The Planning Board would like to thank all those who participated in the development of this Master Plan but most importantly, the citizens of Canaan. Without their participation, this plan would not have been possible. The Planning Board would like to encourage the ongoing participation of all Canaan citizens.

Section II VISION

Canaan's People

Canaan will remain a diverse rural community, growing at a moderate pace. Many school graduates, after finishing their education, will be attracted back to Canaan as a place to live and work.

Housing

As a bedroom community for the Upper Valley, the majority of Canaan housing will consist of single family homes. But multifamily homes and apartments will also be found in limited quantities, most often in the villages. An increase in the quantity of mobile home parks is unlikely due to the complex requirements of park water systems. However mobile homes will be found throughout town on individual lots. Eventually as land supply diminishes and prices rise, the percentage of single family custom homes will increase and mobile homes will decrease. Seasonal properties, especially lakeshore properties will increasingly be converted to year round use.

The Canaan Economy

Canaan Village will be a lively commercial, social and municipal center, with restaurants, stores and medical services. While Canaan will remain primarily a bedroom community, commercial and industrial opportunities will expand, providing new levels of economic vitality. More people who live in town will also be able to work in town. We will see growth of home industries. Businesses that expand will develop facilities close to major transportation routes, away from residential neighborhoods and valuable natural resources. All new commercial and industrial development will respect the natural landscape, with minimal impact on abutting properties and landowners.

Our Town Buildings and Services

The Town of Canaan will remain a safe place to live and visit, with excellent police and fire departments. The Town will maintain its roads well, and residents and Village visitors will value the sidewalks. The Library will be extensively used by people of all ages. The Mascoma Area Senior Center and other Town buildings will be focal points for the community, where people come together for recreation and leisure in a variety of ways. Although community facilities and services in Canaan will be more than adequate, they will remain affordable. The school system will continue to provide a high quality education to the youth of the Mascoma Valley. Municipal taxes will not spike as a result of unanticipated capital improvements, but rather the local tax burden will remain relatively constant and predictable into the future.

Our Roads and Transportation System

Automobile transportation will remain the dominant mode of travel in Canaan. Canaan will continue to ensure that roadways are as safe as possible for motorists, pedestrians, and cyclists. The Village area will become the focal destination point in Canaan, a walkable and livable community. In rural areas, only those roads that warrant paving will be converted from dirt to asphalt. Traffic calming design characteristics will be integrated into new town road improvements, especially when improving rural town roads. The Town will support and work with organizations such as the Upper Valley Lake Sunapee Regional Planning Commission and the Upper Valley Transportation Management Association to improve public transportation opportunities to meet the needs of Canaan's changing population.

Natural Resources and Recreation

Canaan will be a place where Town residents will continue to benefit from the natural environment. The Town will strengthen protection of its surface waters and will employ exemplary measures to protect river and lake shorelines. The quality of the water in Canaan Street Lake and the aquifer under US 4 will be better protected, ensuring a long-term drinking water source for residents. The shorelines along Canaan Street Lake and the Mascoma River will largely be free from development and accessible to the public,

particularly along the Mascoma where the Northern Rail Trail runs. The rural areas of Canaan will contain low-density residential development among larger areas of forestland and wildlife corridors.

Preserving Our History

Locations that people cherish will be better protected, and the history of the community will be preserved. Children will gain better understanding and respect the history of Canaan, including its unique educational history and its development from an agricultural economy, to the home of small industries, and now to becoming a residential town. Residents will be proud of community facilities such as the Town Meeting House and the Canaan Historical Museum. Community events such as Old Home Day will continue to draw large crowds, and will remind people that Canaan is a great place to live.

Land Use and Housing

The Town of Canaan will preserve the rural character that our people cherish so much. Open lands and stone walls will remain scattered throughout the countryside.

The Town will continue to have a mix of housing, with our historic frame houses complemented by dwellings of newer construction. Construction will be encouraged near village areas. Forest and agricultural lands will be further protected, and new subdivisions in town will integrate open space conservation ideals into their design. Clustered development that preserves expanses of undeveloped land will become the norm for the rural areas. Rural roads will remain uncongested, and increased traffic will be accommodated on the larger roads connecting to the Village as opposed to the country roads elsewhere in town.

Regional Cooperation

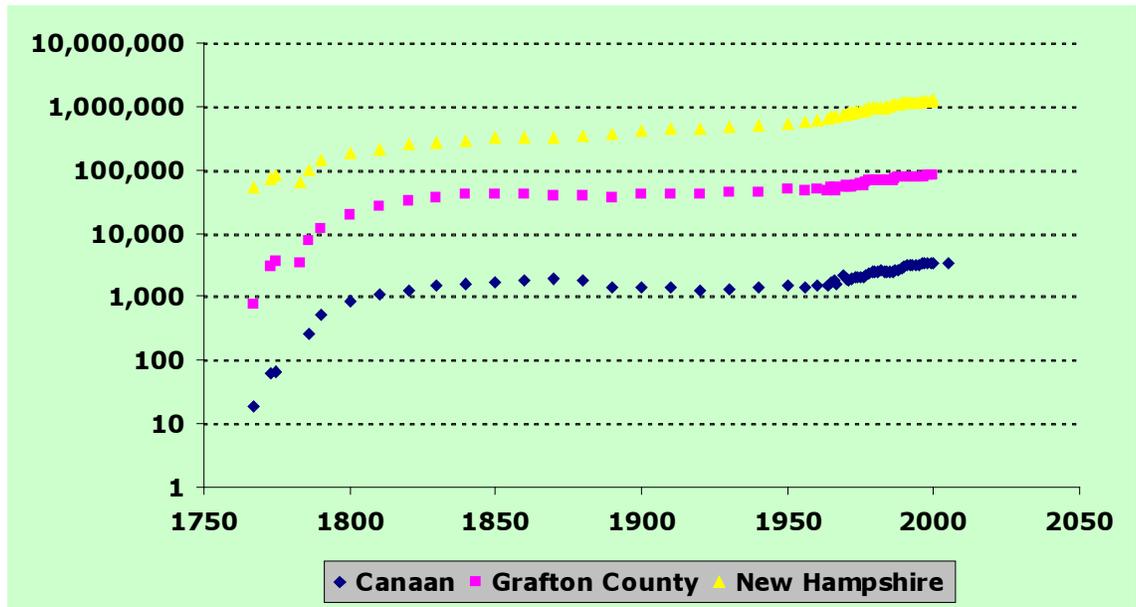
The Town of Canaan will continue to engage in activities that involve other Mascoma Valley Communities. Our history of shared education and emergency planning will be models for other joint projects that not only benefit our own residents, but those who live in the greater region. Canaan will work together with its neighbors in seeking regional solutions to the problems of rural life in the 21st century.

Section III Canaan's People - Policies and Recommendations

- (1) Consider the cumulative impacts of growth, particularly with respect to the Town's natural resources, community facilities, finances, visual and aesthetic character, and the social implications associated with the growth.
- (2) Direct growth away from the town's critical natural resources and toward land which is suitable for development.
- (3) Since the elderly age group will grow significantly as a segment of Canaan's population, make the special needs of the elderly population a major consideration in future planning and development and in the provision of community facilities and services.
- (4) Require impact studies at the developer's expense for any development that may have significant community impact.
- (5) Require developers, as a condition of approval, to pay the associated cost of the municipal improvements and costs associated with a proposed development.

Canaan's People – Background Information

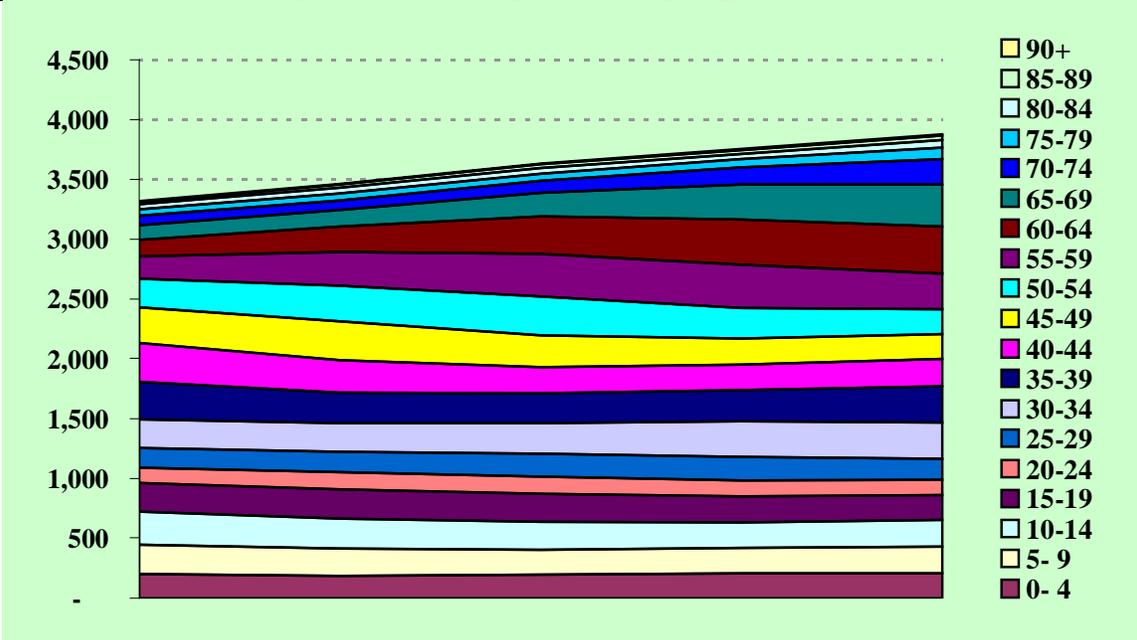
Population History



Data: NH DoEP

After little change in population from 1800 through 1950, Canaan stated growing rapidly after 1960. It is growing faster now than Grafton County or New Hampshire as a whole. From 3,500 now, the population is headed for perhaps as high as 10,000 in 2050.

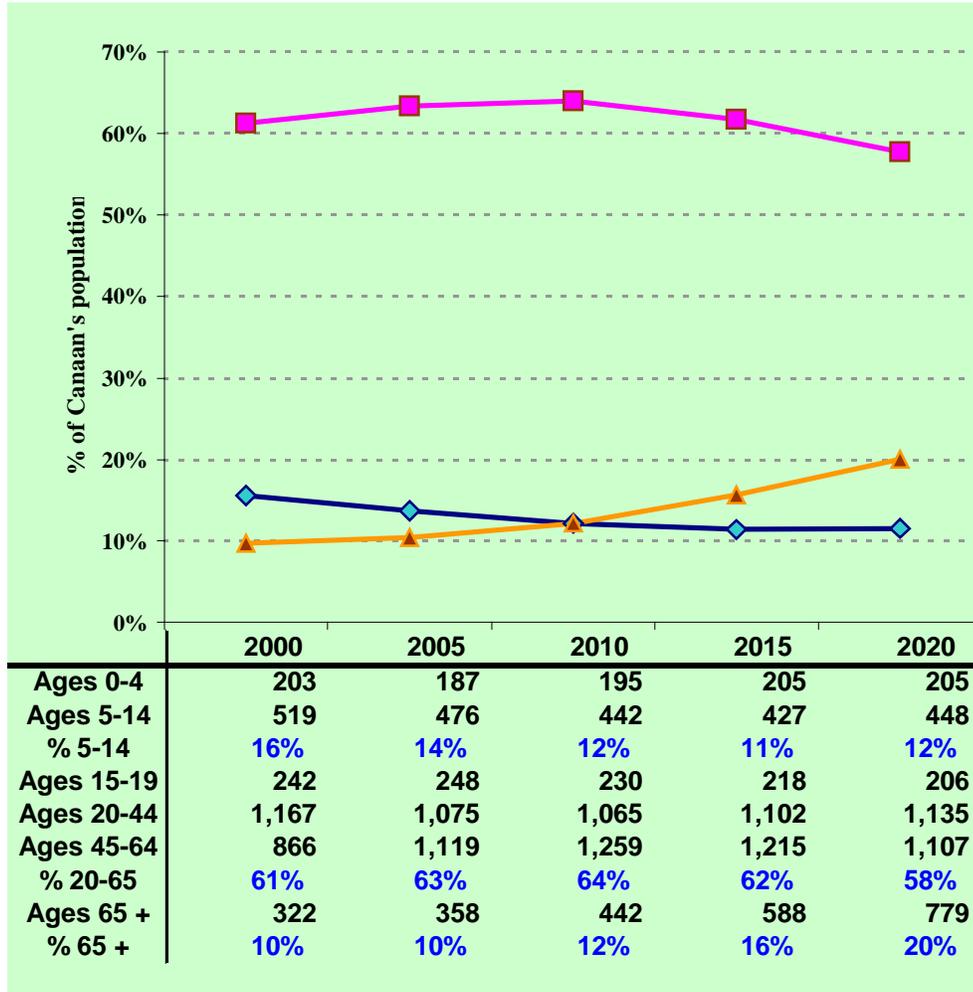
Canaan Town Population Projection by Age



Ages	2000	2005	2010	2015	2020	Change 2005-2020
0- 4	203	187	195	205	205	10%
5- 9	240	226	207	214	226	0%
10-14	279	251	235	213	222	-11%
15-19	242	248	230	218	206	-17%
20-24	129	142	145	134	128	-10%
25-29	158	168	194	197	176	5%
30-34	246	246	261	298	306	25%
35-39	306	249	247	259	299	20%
40-44	328	270	218	214	227	-16%
45-49	300	326	268	214	212	-35%
50-54	236	298	322	260	209	-30%
55-59	186	284	355	364	297	4%
60-64	144	210	315	377	389	85%
65-69	115	137	198	290	351	156%
70-74	82	84	99	142	211	153%
75-79	54	58	58	69	103	79%
80-84	40	45	47	47	62	39%
85-89	24	27	30	31	39	46%
90+	7	8	9	9	12	46%
Total	3,319	3,462	3,633	3,755	3,881	12%

The Census Department expects our total Town population to increase by 12% between 2005 and 2020. That change is not expected to occur evenly across ages, though. The school age and young adult population will decrease. There will be about a third fewer mature working age adults from 45 to 54 years old. The 65 and older age range will more than double in size, from 358 to 779.

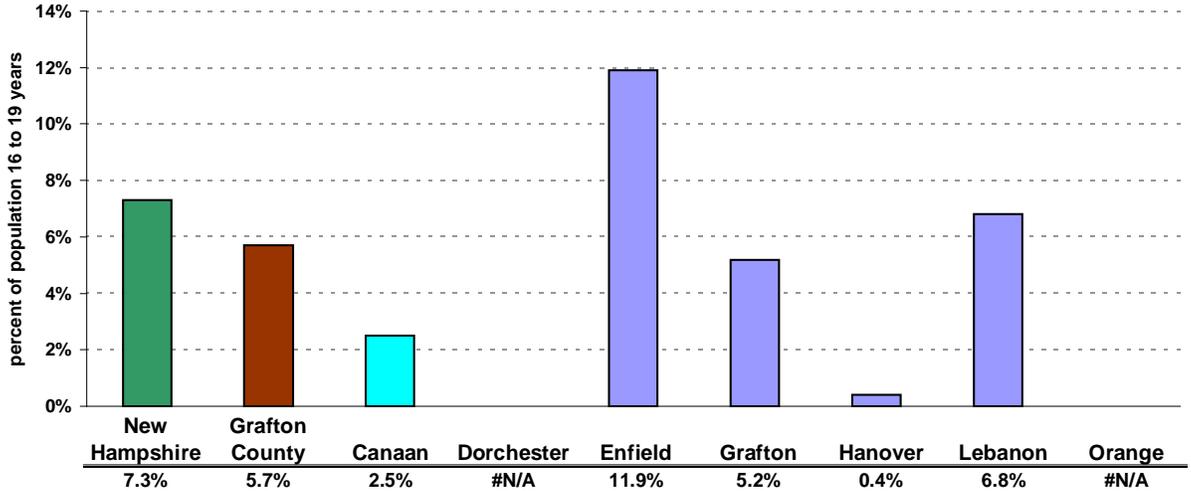
Projecting Canaan's Youth, Working, and Elder Populations



Data: US Census projections

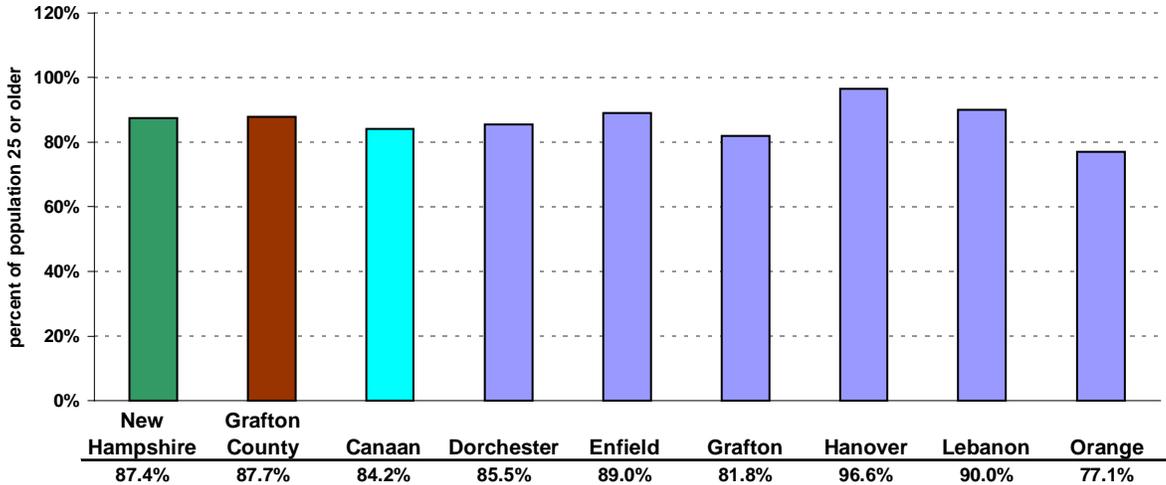
If the Census projections hold true, we can expect youth to decrease as a percentage of our population and in absolute number over the next ten years. The number of working age adults will stay steady for five years and then begin decreasing. Our elder population will double over the next 15 years.

Teens Not Enrolled In School And Not High School Graduate



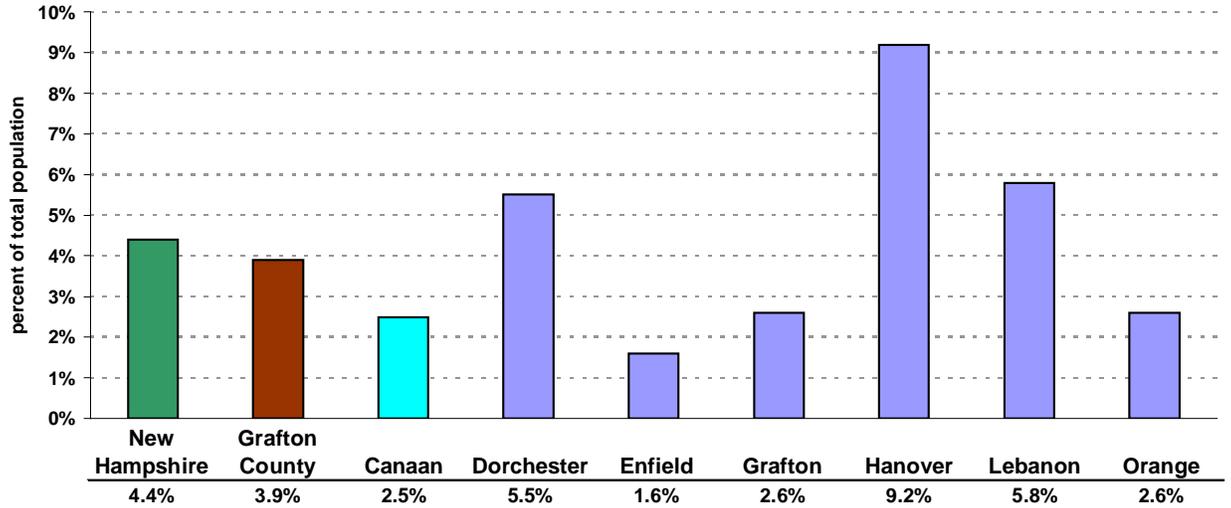
Source: US Census 2000 Report

High School Graduate Or Higher



Source: US Census 2000 Report

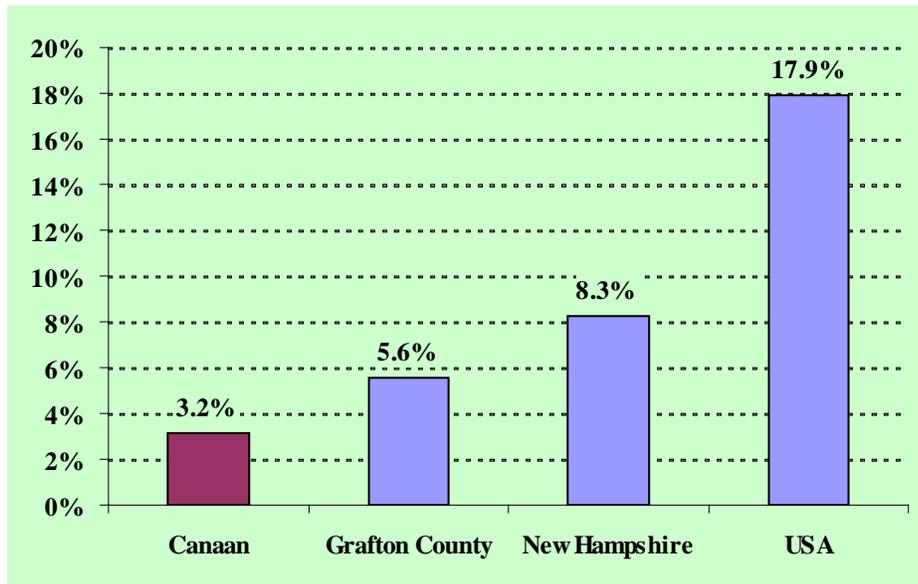
Foreign-Born Population



Source: US Census 2000 Report

Our population includes a number of foreign-born residents. We may overlook them because the town is predominantly long-time citizens.

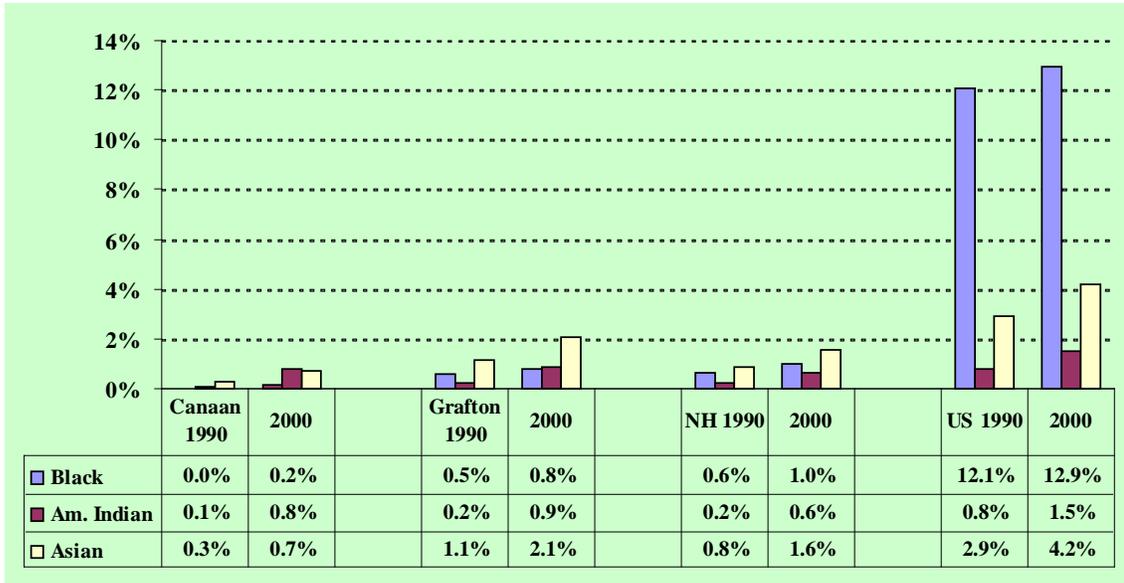
Language other than English spoken at home



Data: Census 2000, Population age 5 and older

While Canaan's population overwhelmingly uses English, we can not overlook the small but growing number of residents who do not speak English as their first language.

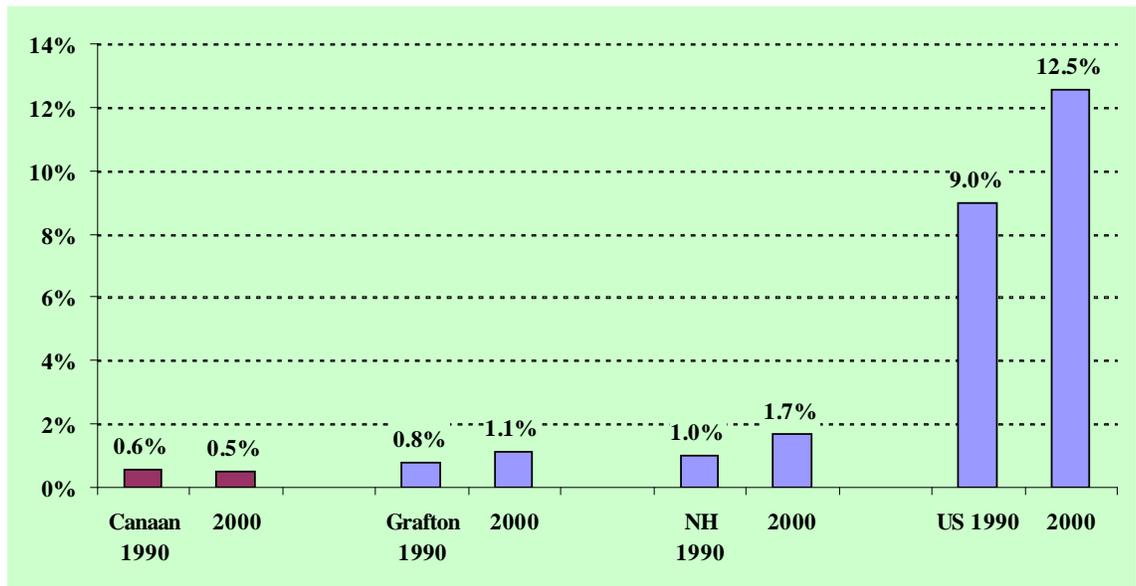
Racial Diversity



Data: Census 2000, Census 1990

Most Canaan residents are white, but diversity is beginning to come to Canaan.

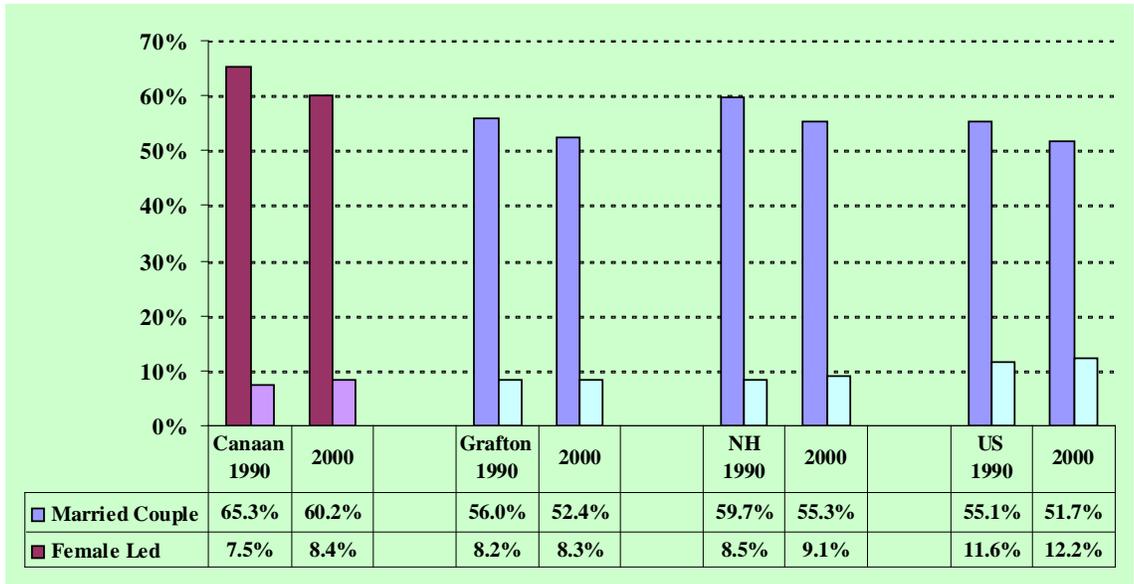
Hispanic Residents



Data: Census 2000, Census 1990

Our Hispanic population remains small.

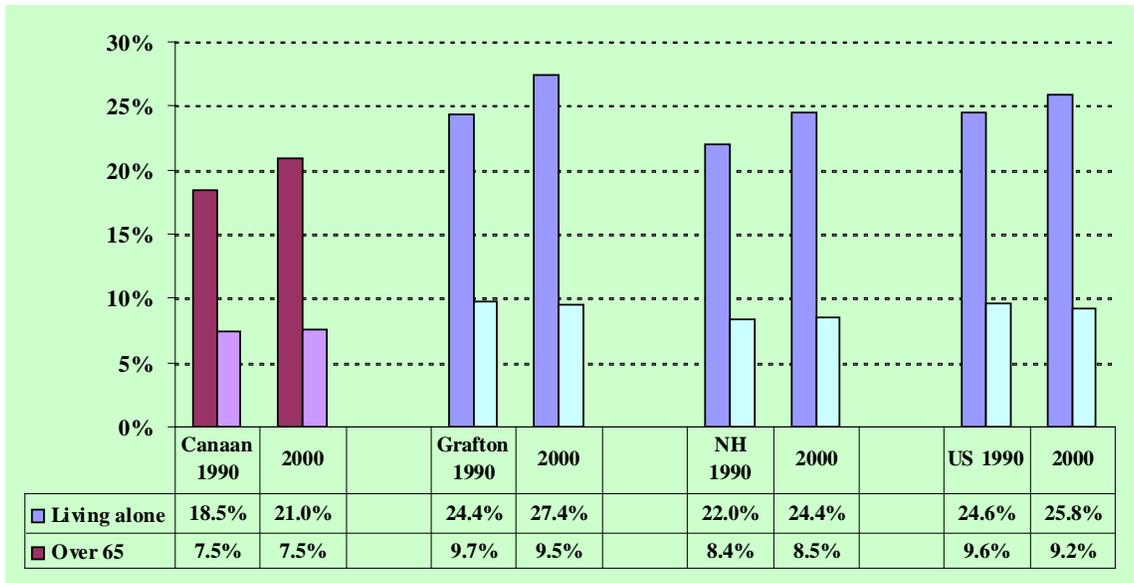
Family Household Types



Data: Census 2000, Census 1990

We have more married-couple family households than most areas, but more than 8% of our households are led by a single woman, and 5% are led by a single man.

Householders Living Alone



Data: Census 2000, Census 1990

More than 20% of our households have a single resident. About one third of those are single persons over 65 years old.

Section IV Housing Policies and Recommendations

- (1) Encourage a diversity of safe and affordable housing consistent with the character and scale of a rural New England community.
- (2) Reinforce small-town settlement patterns through local land use regulations.
- (3) Encourage a land use pattern that has the higher density housing in close proximity to village centers with water service, and the lower-density housing in the more remote area of town. By allowing higher-density new housing in these areas, the town can offer a housing alternative to meet the future needs of its residents and help reduce the pressure to convert the landscape along the roads in Canaan. New housing in these areas can also help local commercial activity, minimize cost for municipal services, and conserve energy.

For many areas not served by the town's water system, it is crucial that any land being developed should be capable of supporting the water needs of the use being proposed. The historic character of these areas is another important consideration. However, if good siting and design principles are followed, the new developments will be harmonious with the traditional small-town qualities of Canaan.

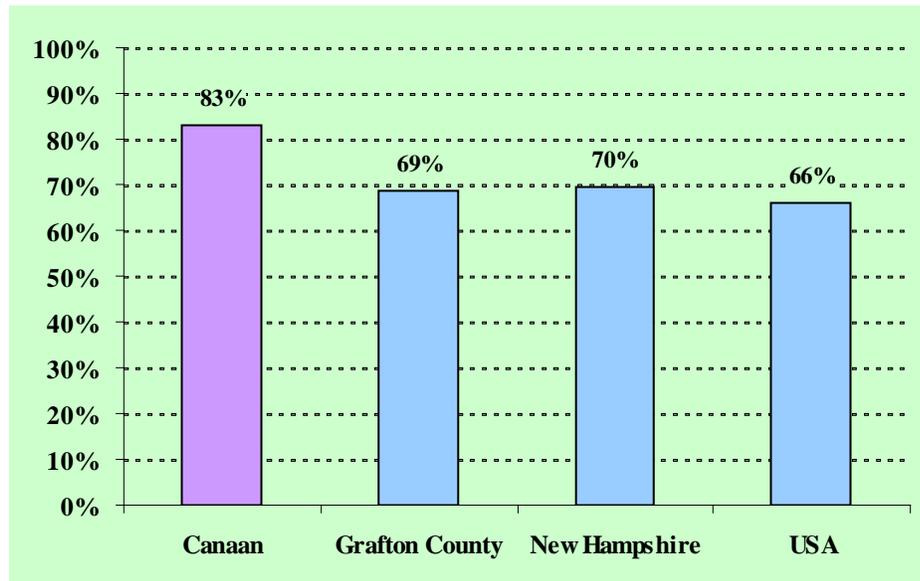
Housing development in remote areas results in higher municipal service costs, larger response times for emergency services and higher transportation costs. Large lot size is required to ensure lower densities in outlying areas.

- (4) Require environmental and fiscal impact studies for all large-scale residential development proposals.
- (5) Establish a shoreline buffer zone along all water bodies. This will protect the water bodies and increase property values throughout Canaan.
- (6) Employ land use regulations to discourage development on prominent hills and especially in those areas where
 - the slope (greater than 15 percent) renders development and maintenance of town services expensive;
 - seepage and erosion damage are more severe; or
 - undue visual impact would detract from the character of the town.
- (7) Restrict residential development in critical resource areas such as wetlands, steep slopes, floodplains and prime agricultural land.
- (8) Encourage cluster housing development in appropriate areas to preserve open space and maintain the rural character of the town.
- (9) Encourage rehabilitation of the Town's older housing stock.
- (10) Adopt local land use controls that will allow mobile homes to be located in most of the town, while preventing their location in existing neighborhoods where other types of housing are more appropriate. Strictly control mobile home parks, especially in terms of water, sewage disposal, landscape buffering, access, and density.

- (11) Carefully control the conversion of existing buildings into apartments and condominiums. While in many cases it is both practical and desirable to convert single-family homes and other buildings into multi-family dwellings, the issues of sewage disposal, water supply, parking, structural and landscaping alterations, and compatibility with adjacent land uses should be reviewed by the Planning Board. With proper guidance, this form of housing growth can greatly help Canaan accomplish its goal of providing affordable housing in a desirable manner.
- (12) Encourage energy-efficient subdivisions and site plans. East/west streets, south-oriented lots and cluster development should be encouraged to promote energy conservation as appropriate.
- (13) Encourage the Town to adopt a Building Code to promote safe, well constructed and attractive housing as well as commercial and industrial buildings
- (14) Encourage provision of adequate housing to meet the needs of Canaan's elderly and handicapped population, especially in the village areas.
- (15) Preserve architecturally and historically significant houses and buildings.
- (16) Discourage commercial and industrial intrusion in residential neighborhoods. Such intrusion can lead to problems such as noise, safety of children and adults, and a decline in both residential property values and the quality of life for residents of the neighborhood.

Land Use and Housing – Background Documents

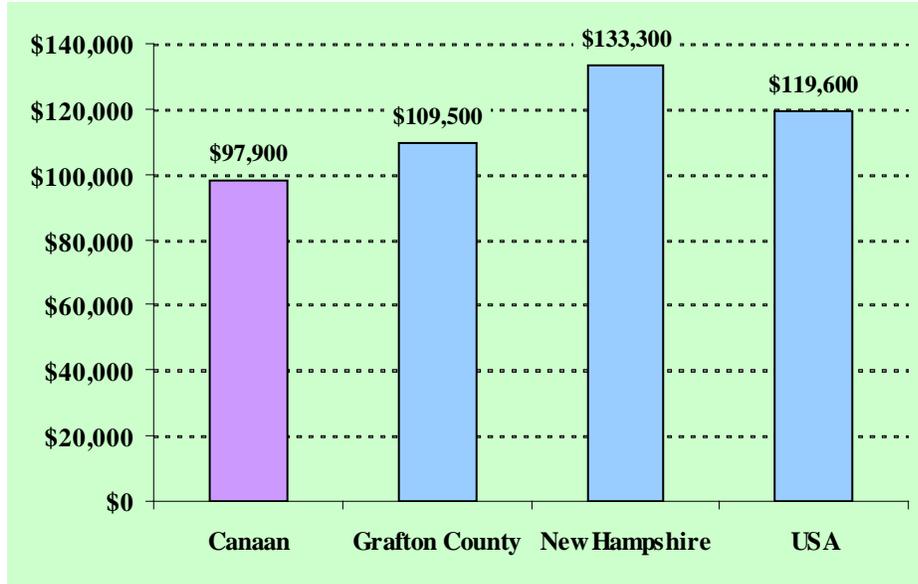
Home Ownership



Data: Census 2000, housing units

Canaan has less rental housing than other areas. Most of our households are in residences they own.

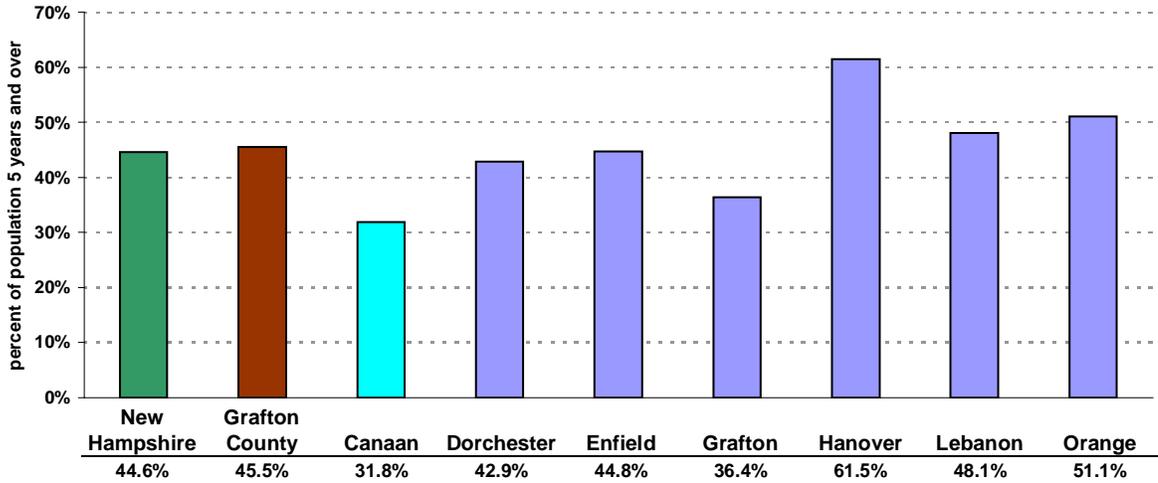
Median Value of Owned Homes



Data: Census 2000, housing units

In the year 2000, half of the Canaan’s owner-occupied housing units were valued at less than \$100,000. We had more low-cost housing than other areas.

Living In Different House In 1995

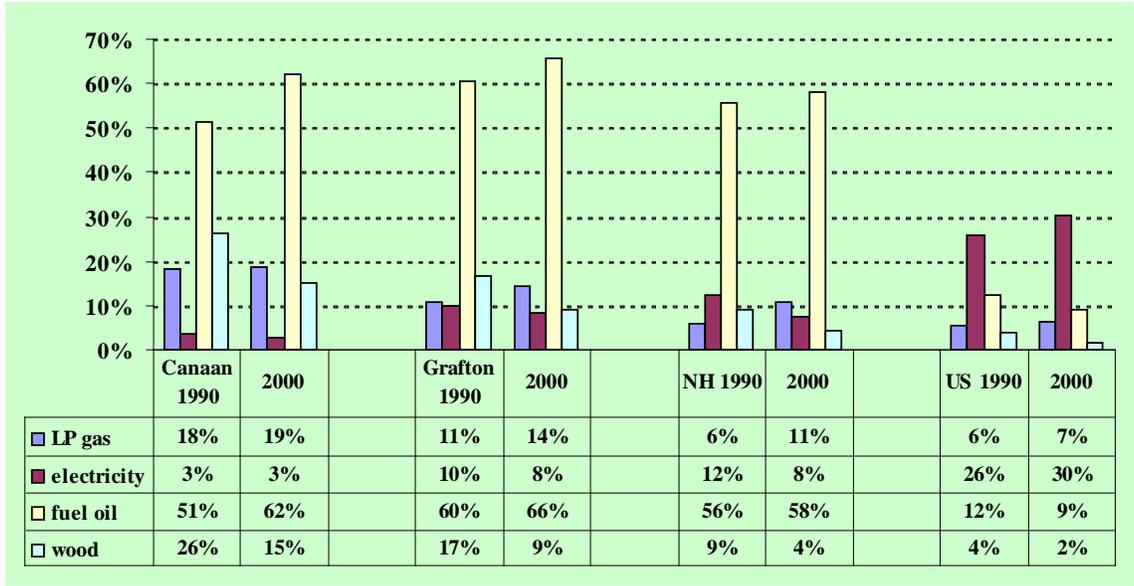


Source: US Census 2000 Report

Data: population age 5 and older

Canaan has a more settled population than other areas. Less than a third of its residents had moved in the five years before Census 2000.

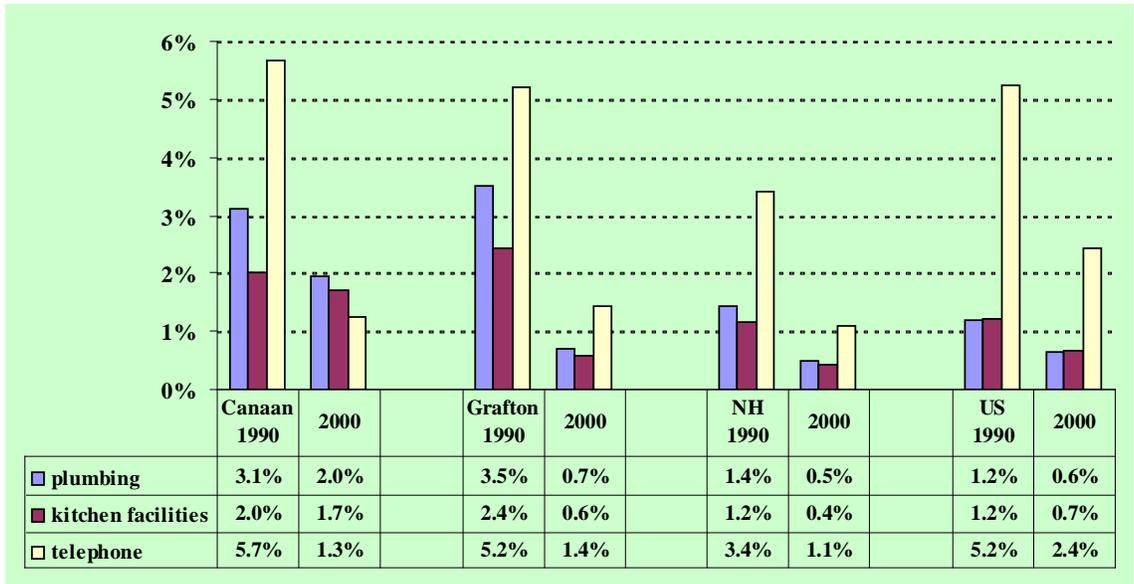
Household Heating



Data: Census 2000, occupied housing

A large but decreasing portion of our households depends on wood for heat.

Housing Resources



Data: Census 2000, occupied housing

Canaan has a comparatively high percentage of housing units lacking complete plumbing or kitchen facilities.

Town Survey Results

Housing

Master Plan should encourage	N	Yes	No	No Opinion	Encourage with limits
Rental properties	95	59%	28%	11%	2%
In-Law Apartments	93	63%	15%	19%	2%
Mobile Homes	93	27%	62%	10%	1%
Condominiums	90	52%	34%	12%	1%
Developments	90	51%	38%	9%	2%
Multi-Family Residences	92	47%	40%	12%	1%
Unrestricted Development	96	18%	74%	8%	0%

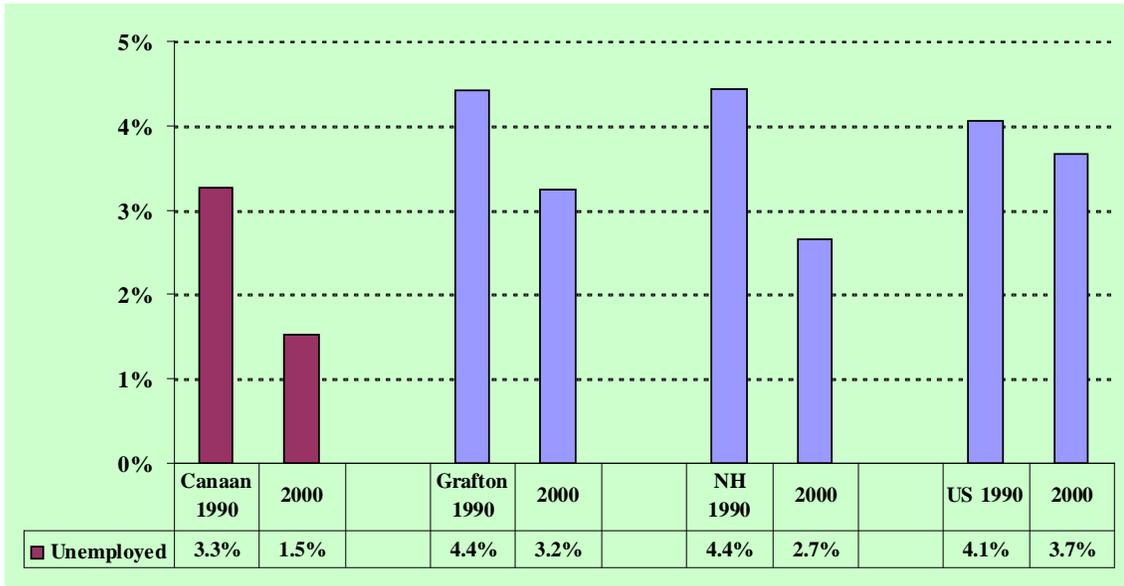
	N	Yes	No	No Opinion
Adopt provisions to encourage preservation of antique residences	103	74%	25%	1%

Section V Economic Policies and Recommendations

- (1) Create a prosperous and esthetically pleasing Village area.
- (2) Inventory available industrial sites and designate suitable areas for future industrial development.
- (3) Encourage commercial cluster development that will reduce curb cuts.
- (4) Adopt a sign ordinance to help preserve nighttime dark skies and to maintain a scenic rural environment.
- (5) Upgrade street lighting to achieve energy efficiency.
- (6) Educate homeowners in energy efficient, properly shaded, exterior lighting.
- (7) Encourage agriculture and forestry.
- (8) Encourage home businesses, which are already a strong sector of local economy.
- (9) Encourage "bed and breakfast" lodging facilities.
- (10) Support the Northern Rail Trail and other recreational trails.
- (11) Protect Canaan's natural, scenic and historical resources.
- (12) Encourage electric power distributors to upgrade the capacity of power lines serving Canaan
- (13) Work with communications providers to make broadband technology and cell-phone access more widely available in Town.
- (14) Ensure adequate setbacks between roads and building/parking lots to allow for future road widening projects.
- (15) Encourage adult education and job-training programs to enable local residents to upgrade their skill levels and adapt to changing conditions.
- (16) Study the need for a cell-tower ordinance.
- (17) Consider incentives for increasing commercial investment.

The Canaan Economy - Background Information

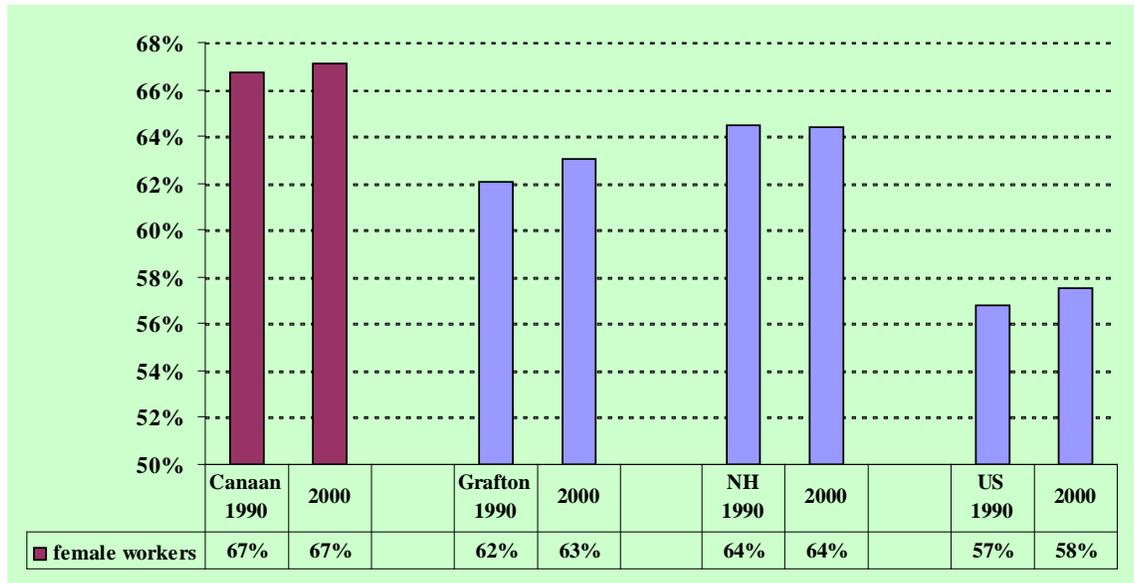
Employment



Data: Census 2000, civilian labor force age 16 and older

Our working population was unlikely to be unemployed, either in 1990 or in 2000.

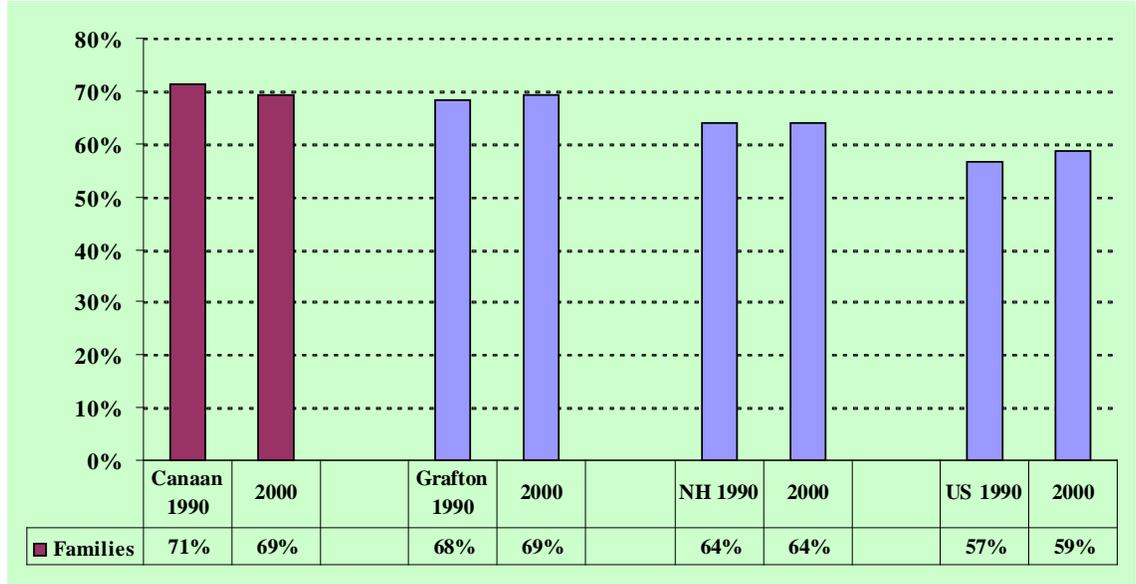
Female Population in the Work Force



Data: Census 2000, female population age 16 and older

Two thirds of Canaan's female population, 16 years and older are in the work force.

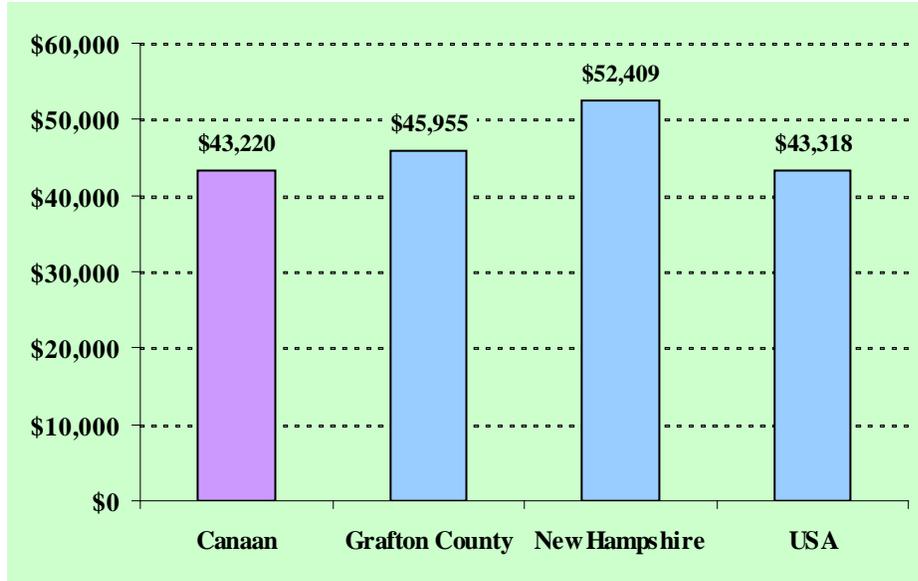
Families with Both Parents in the Work Force



Data: Census 2000, families with all parents in the work force

In most families with children under 6, all parents are in the work force.

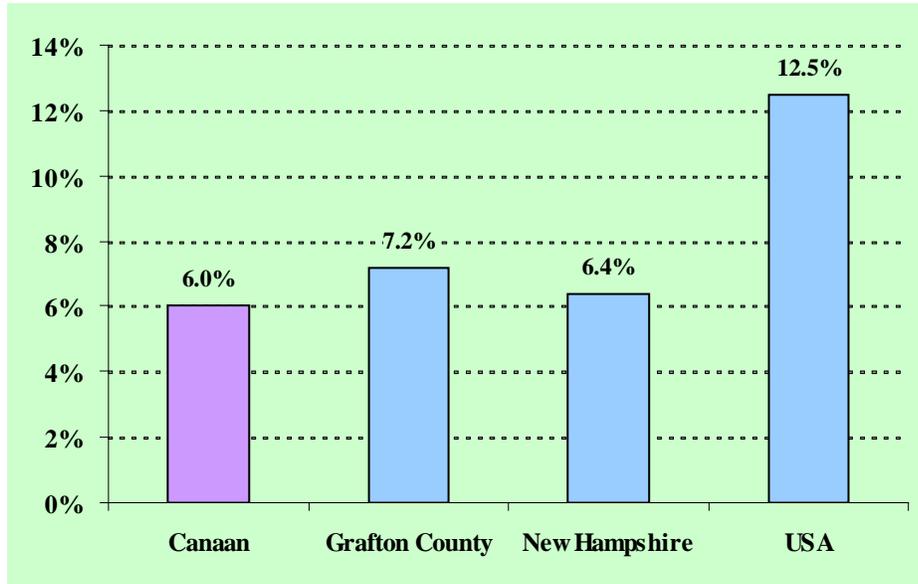
Median Household Income



Data: 2003 Economic Census

Half of Canaan's household had 2003 earning of \$43,220 or more.

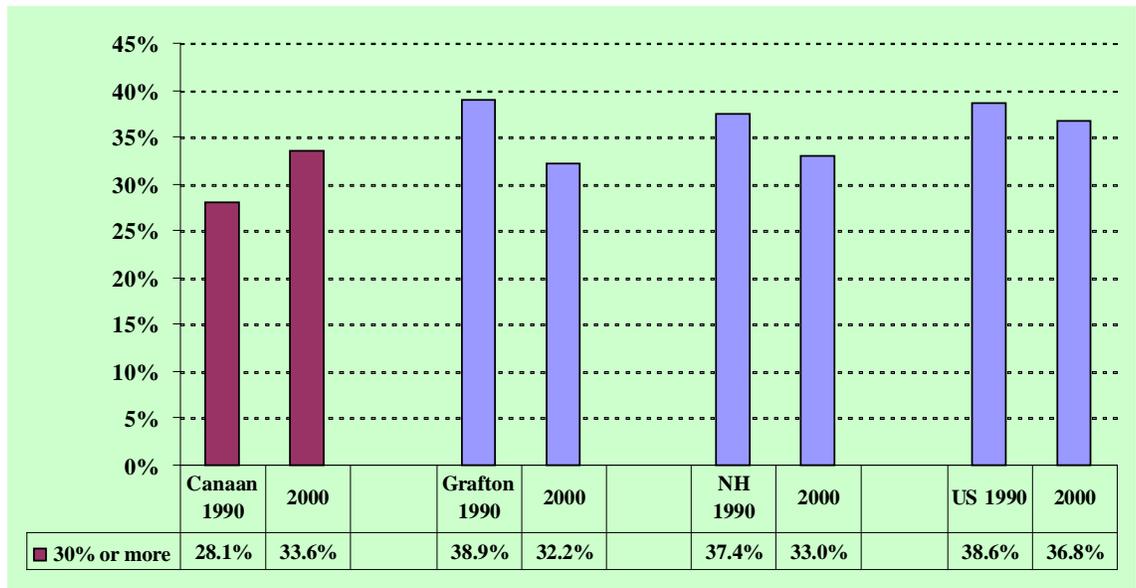
Persons below Poverty



Data: 2003 Economic Census

Most Canaan residents have middle-class incomes, but 6% of our residents live with less than the US defined poverty income.

Portion of Income used for Rent



Data: Census 2000, occupied rental housing

In one third of Canaan’s rental housing units the residents use 30% or more of their income to pay for their housing costs.

Town Survey Results

Business/Economy								
	N	Mean	Median	Mode	25th Percentile	Median	75th Percentile	
Percentage of your shopping do you do in Canaan	99	11%	7%	10%	2%	7%	15%	
	N	Yes	No	Other				
Support a different tax rate for residential vs. business/commercial property	88	66%	27%	7%				
	N	Along Route 4	Near Population Centers	Spread throughout	No Opinion	Other (Business Park, etc)	Multiple selected	Out of Canaan
New manufacturing should be located	98	44%	6%	8%	15%	20%	3%	3%

Section VI

Community Facilities and Services Policies and Recommendations

- (1) Provide community facilities and services in the most efficient manner to meet the existing and future needs of Canaan's residents and businesses.
- (2) Ensure that population and business growth will occur at a slow to moderate rate and not outpace the Town's ability to provide community facilities and services.
- (3) Improve handicapped access to all public buildings and facilities in Canaan.
- (4) Favor upgrading of existing facilities and utilities. Accomplish this before new facilities are developed. Develop a comprehensive safety plan for Town buildings, including fire and accident prevention planning and emergency management planning.
- (5) Adopt a work safety policy for Town personnel in each department.
- (6) Consider access for fire engines and emergency vehicles as a major element in evaluating the location and design of proposed subdivisions and developments. Avoid development of long, dead end streets, driveways, or rights of ways to remote sites. Study and establish guidelines regarding building permits on non town maintained roads. Provide two potential means of access for fire trucks and other emergency vehicles whenever possible.
- (7) Discourage development in outlying areas to minimize municipal service costs, minimize the response time for emergency vehicles, and create a more desirable land use pattern.
- (8) Limit building heights to ensure that each floor and roof can be reached without the need to obtain an expensive ladder truck.
- (9) Locate community facilities in central, convenient locations on walkable and side-walked roads with good access.
- (10) Whenever possible, plan multi-purpose use of community facilities to maximize public use and benefit.
- (11) Create a plan for upgrading energy efficiency and providing adequate parking for all community facilities. Budget for improvements using the Capital Improvement Plan process
- (12) Develop incentives to increase recycling and reduce the portion of solid wastes that require landfill disposal.
- (13) Avoid overlap of municipal services and responsibilities.
- (14) Whenever feasible, provide community services on a regional basis to minimize cost and/or ensure a higher level of service.
- (15) Participate in regional planning.
- (16) Plan water and sewer system expansion for village areas and other high density areas.
- (17) Investigate options for creating a youth/community center.

Community Facilities – Background

Town Survey Results

Town buildings visited in the last year	N	Yes	%
Town Offices	108	103	95%
Library		74	69%
Senior Center		59	55%
Museum		36	33%
Police Station		48	44%
Fire Department		59	55%
Meeting House		56	52%

Town Services -

	N	Cut Back	Improved	Expanded	OK as Is	Other
Assessor's Office	78	9%	26%	6%	58%	1%
Conservation Commission	85	13%	11%	26%	51%	
Fire Department	82	0%	9%	11%	80%	
Library	88	9%	14%	26%	51%	
Recreation Dept	85	11%	15%	27%	46%	1%
Water & Sewer	78	3%	17%	3%	78%	
Selectboard	81	6%	15%	5%	74%	
Clerk's Office	81	0%	2%	6%	90%	1%
Road Dept	82	0%	33%	9%	59%	
Planning Board	82	11%	9%	10%	71%	
Schools	88	14%	31%	15%	41%	
Health Officer	75	7%	5%	5%	79%	4%
Elder Services	79	6%	19%	11%	62%	1%
Building Inspector	78	6%	10%	8%	73%	3%
Police Dept.	86	16%	13%	12%	59%	
Tax Office	80	1%	5%	3%	89%	3%

Section VII Transportation Policies and Recommendations

- (1) Ensure a cost-effective transportation system that will meet, to the maximum extent possible, the mobility needs of local residents and will provide for the safe, efficient movement of goods and people within and through Canaan.
- (2) Require the developer/subdivider to improve off-site roads as a condition for subdivision approval, if proposed subdivisions may have an adverse effect on off-site roads. Even if the new road in a subdivision meets the town's specifications, the other roads in the area may not be adequate to accommodate the increased traffic resulting from the development. In this case the developer/subdivider should pay his proportion of the cost to up-grade these off-site roads.
- (3) Maintain an inventory of Town roads and develop a road maintenance plan. Incorporate road maintenance and improvement in the CIP process.
- (4) Require adequate setbacks. It is recommended that the town require a 50-foot right-of-way for all roads to allow for road maintenance (plowing, drainage, etc.) and road improvements (widening, straightening curves, improving drainage, etc.). An adequate setback is also needed for buildings, fences, etc. which would obstruct the vision of motorists and bicyclists.
- (5) Encourage and support Advance Transit. The implementation of public bus service has had a very positive, impact upon the town, improving the mobility of commuters to employment centers and providing the only mode of transportation for many elderly persons. Free fare transportation on Advance Transit buses is valuable to retired persons and to students going into Lebanon after school, as well as to commuters.
- (6) Implement improvements that will improve pedestrian and bicycle travel. Such improvements include the construction or widening of sidewalks, trees and other plantings, benches, curb ramps, crosswalks, signals and signs, etc. which will make walking safer and more convenient. Bicycle-related improvements include bike racks, road shoulder improvements and signage and bike routes.
- (7) Encourage commercial cluster development that will reduce curb cuts.

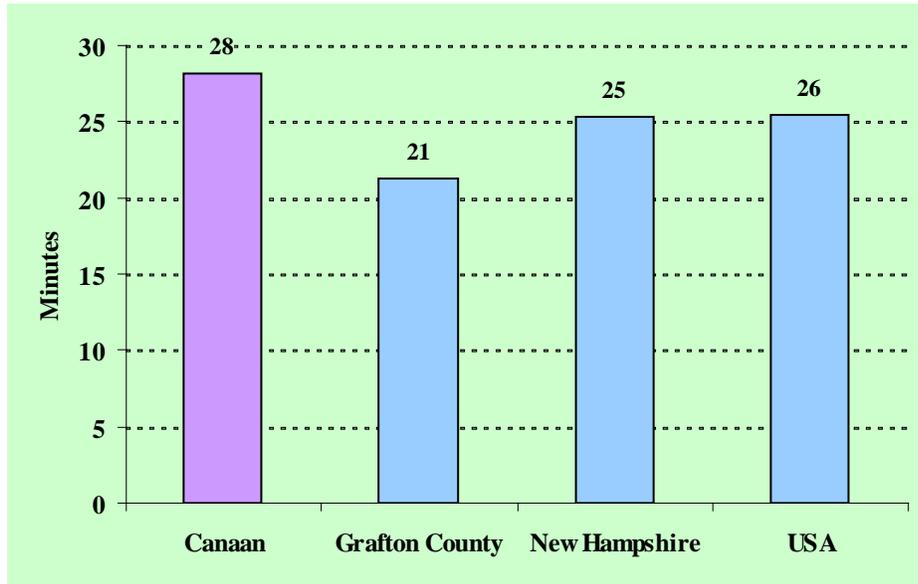
Our Roads and Transportation System – Background information

Resident Work Locations

Work Location	Workers		Via
Lebanon, Grafton Co. NH	652	37.8%	4 west
Canaan, Grafton Co. NH	349	20.3%	
Hanover, Grafton Co. NH	266	15.4%	4 west
Enfield, Grafton Co. NH	82	4.8%	4 west
Hartford, Windsor Co. VT	72	4.2%	4 west
Littleton, Grafton Co. NH	26	1.5%	118 north
Bristol, Grafton Co. NH	24	1.4%	4 east
Woodstock, Windsor Co. VT	23	1.3%	4 west
Newport, Sullivan Co. NH	22	1.3%	4 west
Plymouth, Grafton Co. NH	17	1.0%	118 north
Rumney, Grafton Co. NH	17	1.0%	118 north
Haverhill, Grafton Co. NH	16	0.9%	118 north
Springfield, Windsor Co. VT	14	0.8%	4 west
Chester, Windsor Co. VT	9	0.5%	4 west
Claremont, Sullivan Co. NH	9	0.5%	4 west
Concord, Merrimack Co. NH	9	0.5%	4 east
Dover, Strafford Co. NH	9	0.5%	4 east
Norwich, Windsor Co. VT	9	0.5%	4 west
Campton, Grafton Co. NH	8	0.5%	118 north
Grantham, Sullivan Co. NH	8	0.5%	4 west
Bath, Grafton Co. NH	5	0.3%	118 north
Durham, Strafford Co. NH	5	0.3%	4 east
Gorham, Cumberland Co. ME	5	0.3%	118 north
Lisbon, Grafton Co. NH	5	0.3%	118 north
Lyme, Grafton Co. NH	5	0.3%	Grafton Tpk
Plainfield, Sullivan Co. NH	5	0.3%	4 west
Warren, Grafton Co. NH	5	0.3%	118 north
Andover, Merrimack Co. NH	4	0.2%	4 east
Ashland, Grafton Co. NH	4	0.2%	118 north
Grafton, Grafton Co. NH	4	0.2%	4 east
Lincoln, Grafton Co. NH	4	0.2%	118 north
Lowell, Middlesex Co. MA	4	0.2%	4 east
Ludlow, Windsor Co. VT	4	0.2%	4 west
New London, Merrimack Co. NH	4	0.2%	4 east
Reading, Windsor Co. VT	4	0.2%	4 west
Royalton, Windsor Co. VT	4	0.2%	4 west
Nashua, Hillsborough Co. NH	3	0.2%	4 east
Sharon, Windsor Co. VT	3	0.2%	4 west
Sugar Hill, Grafton Co. NH	3	0.2%	118 north
Springfield, Sullivan Co. NH	2	0.1%	4 west
	1,723		

Data: Census 2000, workers age 16 and older

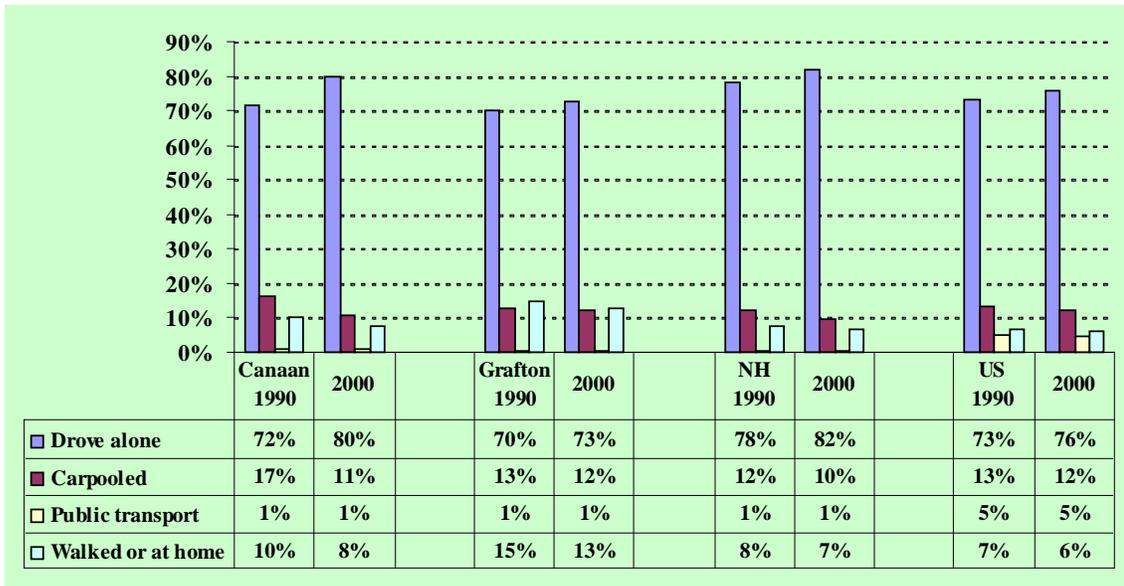
Mean Travel Time to Work



Data: Census 2000, workers age 16 and older

With most of its working population employed in the Lebanon area, Canaan residents have to spend more time commuting. Most of the commuting is by auto, alone, along US Route 4.

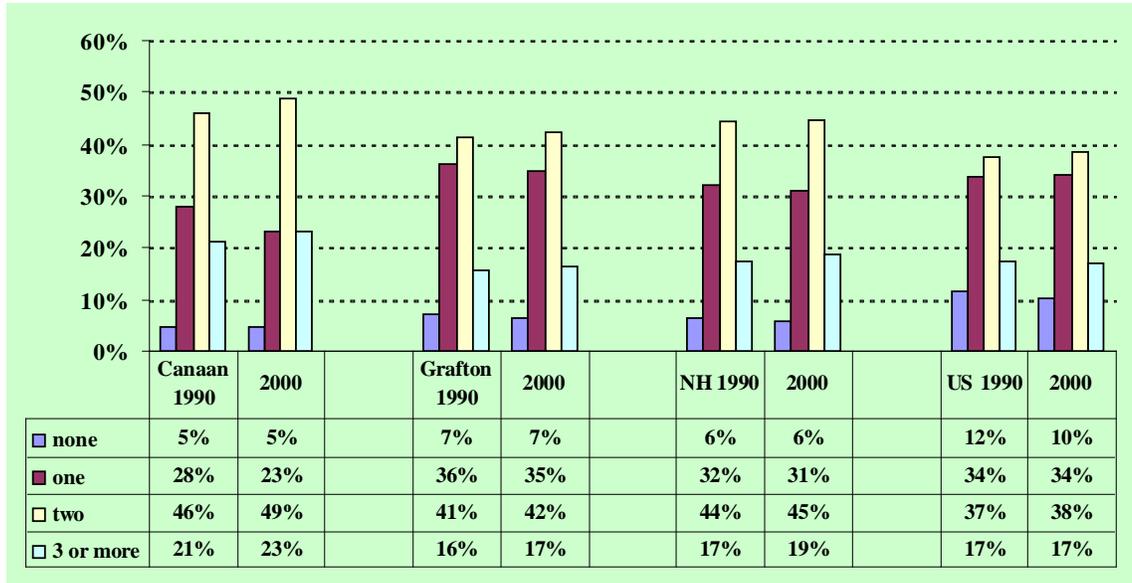
Transportation to Work



Data: Census 2000, workers age 16 and older

The number of workers from Canaan who carpool to work has been decreasing.

Number of Vehicles Owned



Data: Census 2000, occupied housing units

Canaan households are likely to have two or more vehicles available, but 5% of our households have no vehicle available for transportation.

Town Survey Results

Transportation & Roads

	N	Mean	25th P'tile	Median	75th P'tile
Travel Distance to Work	61	18	6	16	24

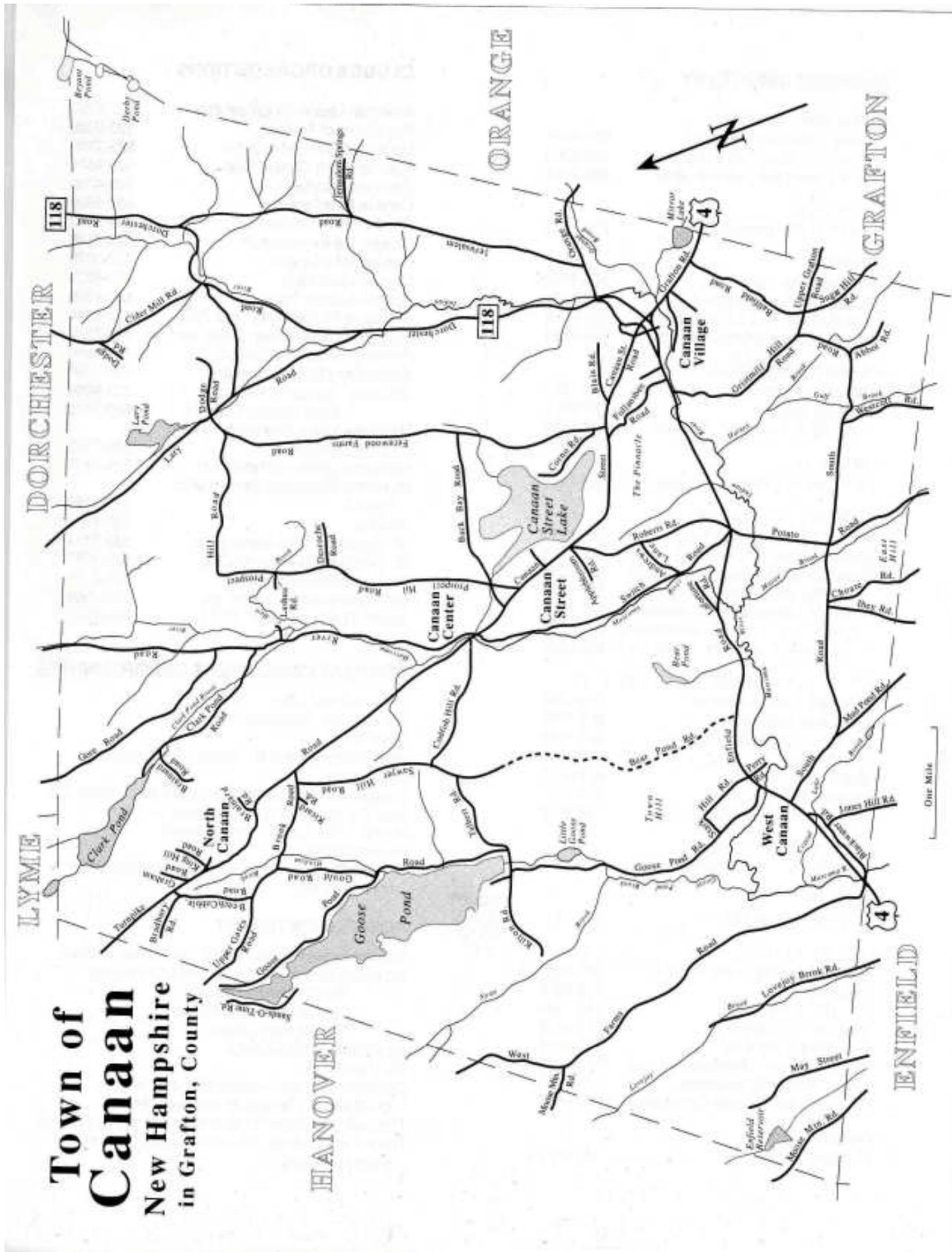
	N	Local in Canaan	Rt 4 West	Rt 4 East	Rt 118 North	At Home	Other
Travel Direction	60	20%	65%	8%	3%	2%	2%

Effect of Downtown Development Project	N	Yes	No	No Opinion	Other
Safer to Drive	95	65%	20%	14%	1%
More Attractive Shopping	92	58%	16%	24%	2%
More Pleasant Walking	95	74%	9%	15%	2%
Waste of Money	92	22%	61%	15%	2%

	N	Yes	No
Have Used Advance Transit	99	32%	68%

Communication

Info about town issues comes from	N	Yes	%	
Word of mouth	108	78	72%	
Valley News		70	65%	
Spectator		69	64%	
The Cardigan		48	44%	
Public Postings		32	30%	
Radio		9	8%	
Town Web Page		8	7%	
	N	Yes	No	No Service
Use Cell Phone	104	37%	47%	16%
	N	Yes	No	Depends on location
Support Building a cell-phone tower	98	71%	24%	4%
	N	Yes	No	Other
Have Cable Service	100	54%	43%	3%
	N	Yes	No	
Use the Internet from Home	101	85%	15%	
	N	Yes	No	Other
Have visited the town web site	97	32%	67%	1%



Section VIII

Natural Resources and Recreation Policies and Recommendations

- (1) Rehabilitate and enhance the Town Park.
- (2) Preserve and expand parkland, open space and public access in areas approved for public access.
- (3) Cooperate with the School District to share recreational facilities.
- (4) Encourage the Recreation Committee to develop additional recreational programs and areas.
- (5) Discourage development in outer lying areas of Canaan. Forests, rugged terrain, natural scenic beauty and large tracts in single ownership characterize many of these undeveloped areas. They are also far from Town, making it both difficult and expensive for the town to provide them services. Minimum lot sizes should be fairly large in outlying areas.
- (6) Encourage forestry, agriculture, and low-density housing for outlying areas. By encouraging these uses and discouraging development, the town will
 - o help keep property taxes low,
 - o encourage residents to live in areas where emergency services can be provided quickly and economically,
 - o reserve areas for commercial forestry and agriculture,
 - o provide areas for outdoor recreation,
 - o encourage wildlife, especially those species which need to roam over large areas and
 - o conserve energy.
- (7) Support the granting of conservation easements through organizations such as the Upper Valley Land Trust. Enable use of the Conservation-Recreation fund to buy land or the development rights to land for open space, agricultural, forestry, wildlife, conservation and recreational purposes.
- (8) Develop a wildlife corridor map, and direct development so that corridors can be kept open.
- (9) Encourage cluster development that will reserve common permanent areas of open space in all major proposed residential developments. Land set aside for parks and playgrounds should be reserved for the common use of all property owners in the subdivision by covenant in the deed and should be reasonable size, character and location for neighborhood playgrounds or other recreational uses. Cluster housing under regulations which would intensify density beyond that normally permitted and require useable open space will allow developers to maximize the return on their investments by clustering housing units and leaving the remaining land in permanent open space.
- (10) Adopt and enforce regulations such as those proposed by the Source Water Protection Committee that are designed to protect water quality. Develop watershed and Aquifer Protection Zones to prohibit or control any use that would potentially introduce either point or non-point pollutants to Canaan's aquifers and water sources.
- (11) Expand the Source Water Protection Plan to include all town lakes, ponds, streams, rivers, watersheds, and aquifers.
- (12) Adopt a Canaan Street Lake Watershed Management Plan in order to protect public water supply systems while preserving lake recreational activities.

- (13) Pass a shorefront ordinance for Canaan Street Lake that will prevent new septic or other potential pollution sources within a shoreline buffer zone of this water body that serves as Canaan's reservoir. Establish a regular and standardized water-testing program for Canaan Street Lake.
- (14) Provide a lifeguard for the swimming area at Canaan Street Lake.
- (15) Provide additional public open space along the shoreline of ponds and rivers in town.
- (16) Preserve and encourage agriculture, forestry, and wildlife. Encourage deed restrictions and conservation agreements to protect agricultural land (RSA: 477:45).
- (17) Adopt a wetlands conservation and riparian buffer ordinance.
- (18) Guide future residential, commercial and industrial growth into locations that are on non-agricultural soils. There is ample non-agricultural land for future development.
- (19) Evaluate land that becomes available to the town from tax default for retention by the town for conservation or other municipal use
- (20) Ensure that any future zoning ordinance specifies that existing farms and future farms in rural areas will not be unduly restricted with respect to odor, light and noise.
- (21) Encourage "soft edges", transitional areas between woodlands and open fields. Many species rely upon this type of habitat.
- (22) Prevent the diversion and pollution of small and large tributaries that result from development on the lakeshore and adjacent areas.
- (23) Incorporate a minimum-runoff requirement in the subdivision regulations, requiring new development to design drainage systems that will not discharge additional runoff into existing surface waters in Town.
- (24) Encourage landowners to leave their shorefronts in a natural state. Homeowner's associations on Goose Pond and Canaan Street Lake are already concerned with this issue. Support them in education of shorefront landowners so that DES regulations on shorefront development are observed. Canaan local government officials should enforce DES wetland, shoreland and reservoir regulations.
- (25) Encourage local organizations to continue to help with recreation programs and park improvement projects.
- (26) **In accordance with RSA 674:2 III d, the entire Canaan Source Water Protection Plan is incorporated into this master plan. The water plan summary and recommendations are presented here and the complete plan is found in Appendix E.**

Canaan Street Lake Watershed Protection Plan

Executive Summary

Canaan Street Lake is the largest drinking water source in the Town of Canaan and supplies water to approximately 600 residents and local businesses in Canaan Village. In order to protect the quality of the Lake's water as a drinking water source the Board of Selectman appointed a Drinking Water Protection Committee to develop a Watershed Protection Plan.

The Drinking Water Protection Committee, assisted by Granite State Rural Water Association throughout the seven-month planning process, identified potential contamination sources to Canaan Street Lake and developed specific recommendations to manage water quality threats. Additionally, the plan aims to increase the understanding of the Canaan Street Lake Watershed and provide a meaningful foundation for decision-making.

Overall, the Committee found that the Canaan Street Lake Watershed is in good condition, however recent data suggests that water quality is diminishing. While the Watershed is predominantly forested, which helps maintain water quality and ecosystem functions, increasing conductivity values indicate that recreational uses and surrounding land uses are having an effect on Canaan Street Lake.

Increasing conductivity levels signify that human induced pollution is degrading Canaan Street Lake. Conductivity levels increased annually from 1998 – 2004, with a total increase of nearly 65% from original levels. Road salt is a probable factor for the increased conductivity levels, as sodium and chloride levels in the Lake have also risen. However, conductivity increases are also known to occur from most pollutants including: septic-system effluents, nutrient inputs, erosion, or any other substance that dissolves in water.

Recreational uses, especially those that utilize gasoline-powered engines, are also a source of pollutants. Typically, surface waters that serve as a drinking water supply should not be used as a recreational resource. Canaan Street Lake has a long history as a recreational amenity for Canaan and the surrounding region. To date, there is no direct evidence that the recreational activities enjoyed on the Lake are impairing its waters. However, recreational use still poses a significant risk to drinking water quality.

Finally, without a zoning ordinance, the Town has no way to regulate land use within the Watershed. Essentially, what this means is that in the future, any use – even those that are known sources of contamination to water resources – is possible. While it is difficult to envision, the development seen in the Watershed today is very different, and most probably less than, what will be seen in the Watershed in fifty to one hundred years. Studies show that as watersheds are developed and impervious cover increases, the water quality of its receiving waters is significantly degraded.

The Town of Canaan is in a unique position, in that it has the ability to protect its valuable drinking water resources before they are heavily impacted by surrounding land uses. In taking the initiative to develop a watershed protection plan now, the Town of Canaan has ensured that Canaan Street Lake will continue to supply quality drinking water and enrich the lives of residents and visitors alike.

Source Water Protection Plan Recommendations

A review of potential contamination sources (PCSs) was completed in order to identify areas where corrective and preventative measures in the watershed are necessary. The review included information compiled from a variety of sources including: NH DES source water assessment reports, a database search using NH DES on-line OneStop Database, a review of town documents, and a windshield survey of the watershed.

All identified PCSs threaten not only the environmental health of Canaan Street Lake but also the drinking water supplied by the Canaan Water Department. Any decline in the Lake's water, which is the Town's municipal water source, will eventually increase the Department's treatment costs. Under extreme circumstances, degradation of the Canaan Street Lake's water quality could force the Town of Canaan to change to another drinking water source. New sources of water are costly to develop and come with no guarantee that water quantity or quality will meet Canaan's needs.

Land Use Threats

Below is a review of land use threats identified within the watershed. Each land use topic is followed by management objectives. While the land use topics are in no order of significance, the listed management objectives are given hierarchically in order of importance.

Road Management

Roads allow for the movement of people, goods, and services important to our daily lives. However, road surfaces accumulate pollutants deposited from vehicles during travel. Typical pollutants associated with roads are: nutrients, metals, oils and grease, salts, and volatile organic compounds. Road drainage systems also collect contaminants from atmospheric deposition, soil erosion, street dirt and litter, leaf litter, and animal waste. Many of the substances that accumulate on roadways are toxic and have negative health effects on humans and the environment. When a storm event happens, these pollutants are washed from the road surface, especially paved, impervious roads, into nearby surface waters, or infiltrate into groundwater. Potential spills of hazardous materials and fuels during transport or vehicular accidents also represent a high risk to water quality, especially since many transportation routes run alongside surface water resources.

In the Canaan Street Lake watershed, there are approximately 4.7 miles of public roads, maintained by either NH DOT or the Town of Canaan, and many private roads and driveways. Of primary concern is the portion of Canaan Street, which is in close proximity to Canaan Street Lake. Water quality concerns regarding this portion of the road stem from poor drainage and the application of road salt. While road salt is applied to the road for winter safety, it is extremely soluble in water and can contaminate wells and surface waters. At high concentrations salt can impact human and environmental health.

Water quality data collected indicates that conductivity levels have significantly increased in Canaan Street Lake since sampling began in 1988. According to NH DES's recent update of its Lakes and Ponds Inventory, sodium and chloride levels have also increased over the last twenty years. Road deicing materials are a known contributor to increased conductivity values. During storm and snowmelt events, runoff from Canaan Street travels towards the Town Beach, where it runs directly into the Lake.

Additionally, dirt roads in the watershed also pose challenges to water quality. For example, the erosion of earthen drainages along Fernwood Farms Road contributes a significant amount of sediment to Sucker Brook, which is Canaan Street Lake's primary inlet. Sediment has negative environmental effects because it buries aquatic habitat, increases water temperature, decreases dissolved oxygen, and increases turbidity.

After reviewing the status of public roads within the watershed and their associated potential contaminants, the Committee developed the following objectives to address identified issues.

Objective #1: Resolve drainage issues along Canaan Street with the assistance of New Hampshire Department of Transportation.

Objective #2: Reduce the application of deicing agents along Canaan Street in areas in close proximity to the lake.

Objective #3: Remediate drainage issues on town maintained roads.

Objective #4: Establish town road standards for the watershed to ensure that new roads do not negatively impact water quality.

Septic System Management

A septic system processes and provides treatment for wastewater generated from flushing toilets, taking showers, doing laundry, and disposing of anything down a sink or other drains. A properly functioning septic system can process household wastewater and destroy disease-producing bacteria. However, when not properly maintained or used, septic systems pose a significant risk to water quality and human health. When functioning improperly or incorrectly sited, septic systems are potential sources of bacteria, viruses, and protozoa, which can cause gastrointestinal illness, cholera, hepatitis A, or typhoid if consumed. Additionally, if improperly used, such as for the disposal of paints, solvents, petroleum products and other household hazardous wastes, septic systems can be a source of chemical compounds. All residences and facilities located within the watershed rely on septic systems to process wastewater as the municipal sewer system does not extend into the watershed.

Regular maintenance of septic systems requires that the accumulated wastes in the septic tank be pumped out approximately every three to five years. Unfortunately, once installed, individual systems often receive little attention from homeowners and problems may go unnoticed until system failure occurs. Septic failures can occur if: a septic system is improperly sized and more wastewater is entering the system than it was originally designed to handle, by improperly disposing of household hazardous wastes, and if soils are not suitable for wastewater treatment and the installation of a septic system .

It is difficult to assess the current status of septic systems in the Canaan Street Lake watershed. Town records provide little information regarding septic system types and installation dates for parcels within the watershed. It is estimated however that approximately fifty percent of parcels in close proximity to the shoreline may have aging septic systems that are not designed to process wastewater and protect water quality. Along with road salt, failing septic system may also be responsible for the Lake's increased conductivity.

Based upon the available information, the Committee developed the following objectives for septic system maintenance:

Objective #1: Minimize the negative impacts of existing septic systems in the watershed through proper maintenance and timely replacement.

Objective #2: Minimize the environmental impact of new septic systems within the watershed.

Recreational Management

Canaan Street Lake has a long history as a recreational resource for the Town of Canaan, the surrounding area, and even the greater New England region. Recreational activities that take place on/or in Canaan Street Lake are: boating (both motorized and non-motorized), swimming, fishing, waterskiing, ice fishing, snowmobiling, and occasional seaplane activities. While these activities are beneficial to those that utilize the lake for recreation, recreational activities can have a negative impact on the lake's water quality and jeopardize the lake as a drinking water source.

The American Water Works Association discourages body contact recreation, e.g. swimming, and use of gasoline engines in water sources that supply public drinking water. Swimming and other body contact activities have the potential to introduce pathogens, such as cryptosporidium and other fecal contaminants, into water supplies. Some of these pathogens, like cryptosporidium, are very difficult to treat and are resistant to disinfection.

Gasoline-powered engines, especially carbureted two-cycle engines, pose a significant risk to drinking water resources. Carbureted two-cycle engines exhaust approximately thirty percent of their unburned fuel directly into the water. Depending on water and air temperatures, roughly half of the exhausted fuel evaporates immediately while approximately fifteen percent persists in the water column for some amount of time. Gasoline that is directly exhausted to the water column introduces volatile organic chemicals (VOC) into the lake, which are difficult to remove.

Two polluting substances associated with the operation of gasoline-powered engines are the gasoline additive MtBE and motor oil. A small amount of MtBE can render water undrinkable. MtBE can cause kidney and liver damage. Once introduced into water supplies, MtBE is extremely difficult to remove and treat. While MtBE is being phased out of gasoline, the environmental effects of other gasoline oxygenates, like ethanol, are unknown. Motor oil also persists in the environment and contains harmful metals and toxins. One pint of spilled motor oil can cause an oil slick approximately one acre in size, whereas a gallon of motor oil can contaminate up to one million gallons of water.

VOC testing of the Lake shows that VOCs have not been detected in the Lake. The last VOC sampling took place in July 2005. However, the sampling date occurred mid-week when motorboats are less likely to be using the lake. Depending upon the compound, some chemicals associated with fuels and motor oils will rapidly volatilize into the air, but others will persist in the water column. Additionally, motor boating may also increase the turbidity of Canaan Street Lake, which can lead to higher treatment costs and greater health risks.

Seaplane operation on Canaan Street Lake represents less of an environmental risk than lake contact activities and carbureted two-cycle engines. Risk of pollution from seaplanes is lower because seaplane exhaust is discharged to the air, aviation fuel does not contain MtBE or motor oils, and there is a minimal amount of contact time with the water surface. Although risks to water quality from seaplanes are significantly lower, the size and layout of Canaan Street Lake requires seaplanes to take off and land near the surface water intakes. If a catastrophic seaplane crash were to occur close to the intakes, the effects could be significant and costly.

Finally, threats to water quality also occur from winter recreational activities when the lake freezes over. The presence of ice on the lake allows for ice fishing and motor vehicle operation on the lake. Operating vehicles on the ice allows for automotive fluids and deicing salts to be deposited on the lake surface. The refueling of snowmobiles, ice augers, and other gasoline-powered engines poses a contamination risk if gasoline is spilled on the lake or in close proximity to it. Fishing activities (in all seasons) may be a source of organics to the lake water if bait or fish parts are left on or disposed of in the lake.

Based upon the above information, the Committee developed the following objectives to address the risks posed to Canaan Street Lake by recreational activities:

Objective #1: Heighten recreational users awareness of potential water quality impacts to Canaan Street Lake.

Objective #2: Reduce impacts of current recreational uses on Canaan Street Lake's water quality.

Objective #3: Conduct more frequent water quality sampling in order to effectively evaluate the impacts of recreational activities.

Objective #4: Assess the impact that motorized boating has on Canaan Street Lake's water quality.

Land Use Management

Zoning regulation is a tool that allows communities to define and direct future land use by determining what land uses are acceptable in a given area. Without a zoning ordinance, the Town of Canaan has minimal oversight regarding future development and its subsequent land use. The lack of zoning is considered a potential contaminant source because any land use is acceptable in any given area, even those that are disruptive or potentially harmful.

Besides allowing potentially contaminating land uses, unregulated development of the Watershed could lead to its eventual “over-development.” According to a Build-Out Analysis of Canaan, under the current “no zoning” conditions an additional 451 residential units could be built within the watershed. Increased development also means a relative increase in impervious cover throughout the watershed. Impervious cover decreases the ability of the watershed to provide valuable ecological services, increases nonpoint pollution loads, and negatively impacts local hydrology. Along with increasing impervious cover, residential development poses threats to water quality from several sources including: storage of household heating fuels; on-site septic systems; improper disposal of household hazardous wastes; and improper application of lawn and garden chemicals and fertilizers.

Presently, the only “zoning” district that exists within Canaan is the Historic District, which is located partially in the watershed. The Historic District encompasses the properties on either side of Canaan Street and dictates some property use restrictions. Lots within the Historic District may have low-impact commercial uses on the property and must meet a minimum two-acre lot requirement.

After careful review of risks that the lack of zoning poses to the quality of Canaan Street Lake the Committee has developed the following objectives:

Objective #1: Establish a Watershed Protection Area encompassing the Canaan Street Lake watershed.

Objective #2: Within the Watershed Protection Area, create a Shoreland Protection District to provide a higher level of protection in the immediate vicinity of Canaan Street Lake.

Land Conversion & Site Development

Land conversion and site development has the potential to occur throughout the watershed. When areas of natural cover are converted for development purposes, vegetation is removed, the ground surface is disturbed, and hydrogeological processes are altered. If drainage, grading, and re-vegetation are not well planned during site development activities, they can contribute a significant amount of sediment from soil erosion to surface waters. Forestry operations can also be a significant source of sediment if vegetative buffers are not maintained along water resources and if logging roads are constructed improperly.

The sediment that is washed into streams, rivers, ponds and lakes from construction sites is considered to be the greatest single nonpoint pollutant in the United States. Impacts of sedimentation on fisheries include reduction in water clarity, increased water temperature, decreased dissolved oxygen levels, and filling in of spawning habitat. Impacts of sedimentation on wetlands include reduction in flood storage capacity. Sedimentation can also have negative impacts on drinking water supplies by damaging water treatment pumps, increasing treatment costs, and increasing the production of carcinogenic disinfection byproducts. Maintaining natural land cover is one of the surest ways to protect water quality. Forests and natural vegetation maintain the hydrogeologic cycle by stabilizing soils, filtering pollutants, and providing water storage. Since natural land cover permits the infiltration of water, and thus filtration of pollutants, it also contributes the lowest pollutant load to water resources.

The committee developed the following objectives to address water quality concerns associated with land conversion and site development:

- Objective #1:* Educate watershed residents about the importance of maintaining buffers and natural vegetation.
- Objective #2:* Conserve key parcels within the watershed, focusing on the following areas: land surrounding surface water intakes; wetlands; steep slopes; and undeveloped waterfront properties.
- Objective #3:* Ensure site plan and subdivision review requirements adequately protect water quality from erosion and sedimentation. Revise requirements where necessary.

Management of Point Sources

Within the watershed there are no sources of pollution that meet the true definition of a point source. However, several potentially contaminating activities exist in the watershed that require state permits. While these activities are not point sources in the traditional sense, they are included in this section due to their known location and their ability to potentially contaminate either surface or groundwater.

The identified sites are associated with the operation of Cardigan Mountain School and include:

1. Three known groundwater hazard sites
 - a. The School's septic leach field. However, the leach field does not pose a threat to the Canaan Street Lake watershed, as it is located just beyond the watershed boundary, is in good condition, and is well maintained.
 - b. The sites of two leaking underground heating oil tanks. Both tanks were removed upon discovery (1991 and 1995) and the sites were completely remediated to NH DES's satisfaction.
2. Five underground storage tanks containing #2 heating fuel.
3. One dual, aboveground storage tank that contains gasoline and diesel fuel for maintenance equipment.
4. Cardigan Mountain School is classified as a "hazardous waste handler" under Resource Conservation and Recovery Act.

Upon review of the identified regulated sites, it was determined that Cardigan Mountain School follows regulatory standards and employs best management practices to minimize potential contamination threats.

The operational underground fuel tanks meet current safety and leak protection standards and are monitored annually by NH DES. The aboveground storage tank is located on an impervious surface that allows for spill containment. However, the tank is located within twenty feet of a storm drain that feeds directly to Canaan Street Lake and discharges near the outlet dam. The School has plans to relocate the aboveground tank to a safer location within the next year.

Based upon the available information, the Committee established the following objective:

- Objective:* Maintain communication with Cardigan Mountain School about the status of its regulated storage facilities.

Other Concerns

In addition to direct water quality threats caused by surrounding land uses, the Committee has expressed concern regarding non-land use activities in the watershed. These concerns range from improving knowledge of the reservoir area, the need for local enforcement of new and existing regulations, the lack of a detailed Emergency Spill Response Plan, garnering community support in protection activities, and expanding the source protection process.

Demarcation of the “Reservoir” Area

The “reservoir” area is established under NH DES Administrative Rule Env-Ws 386.18, Protection of the Purity of Canaan Street Lake and Its Watershed. The Rule states, “A person shall not trespass, boat, bathe, swim, fish or carry on any activity whatever whether of recreational, occupational or other nature, in the waters or on the ice of Canaan Street Lake, south of a line about 1,200 feet northwest of the lake’s southern most part...”

Keeping recreational users out of the reservoir area is critical to protect the surface water intakes as well as limit the potential for contaminants to be introduced in close proximity to the intakes. Signs are posted on the shore at either side of the line to inform users of the lake that the area is restricted. Traditionally, watershed residents have placed buoys in the summer months to visibly demarcate the line. In 2006, the Town assumed responsibility for placing the buoys to mark the reservoir area during the summer. No markers are placed in winter to keep winter enthusiasts out of the area.

Based upon this information, the committee has determined the following objective:

Objective: The reservoir area is well marked, in all seasons, and its use restrictions are respected and enforced.

Local Enforcement

Local enforcement is critical in ensuring protection of drinking water resources. Without consistent enforcement of established regulations, the recommendations identified in this plan will not safeguard Canaan’s drinking water resources. Part of developing a local enforcement plan is working with state and regional officials to determine official jurisdiction and enforcement responsibilities. Enforcement of regulation is a necessary requirement to providing access to quality drinking water and maintaining Canaan’s quality of life.

Based upon identified issues for local enforcement, the Committee has developed the following objectives:

Objective #1: Regulations for the protection of Canaan’s water resources are consistently enforced.

Objective #2: State, regional, and local jurisdiction is clearly defined.

Emergency Spill Response Plan

An Emergency Spill Response Plan is critical for protecting the quality of Canaan Street Lake. Dangerous spills could be the result of a vehicular accident on nearby roads, boating accidents, refueling of recreational equipment, snowmobiling accidents, a sinking vehicle, or a seaplane accident. Developing a detailed Emergency Spill Response Plan will help direct local emergency departments on how to take action and possibly minimize harm to the drinking water supply if a spill ever occurs.

The Committee's objective regarding the Emergency Spill Response in the watershed is:

Objective: Local emergency response departments are prepared for emergencies that may threaten the water quality of Canaan Street Lake.

Education & Outreach

Education and Outreach is critical to achieving comprehensive protection of the Canaan Street Lake watershed. Outreach and education will help create an awareness of the value of Canaan Street Lake, educate people about what's threatening its water quality, and encourage protective actions and behavioral change. Reaching out to community members also invests them in the process and helps build local support for the implementation of regulations and corrective actions.

Objective: Develop a local awareness of the need to protect Canaan Street Lake and other local water resources.

Comprehensive Testing Program

The Committee recognizes that more water quality data needs to be collected prior to the implementation of its recommendations. While VLAP, NH DES, the Town of Canaan, and the Canaan Water Department have conducted a significant amount of testing, the data collected is, at this time, insufficient to scientifically support some recommendations made in this plan. In light of this, the Committee realizes that some of the recommendations made in this plan might be "hard sell." However, the previously collected data does suggest a gradual decline in lake water quality.

Without fully understanding the causes behind degrading water quality, the Town will not be able to appropriately manage and mitigate pollution sources and identified water quality threats. Consequently, absent the data, the Committee has attempted to make the strongest recommendations possible that will result in the full protection of water supplies within the Canaan Street Lake watershed.

Based upon the recognized need for more scientific study of Canaan Street Lake the committee has identified the following objective:

Objective: A comprehensive testing regime and body of data regarding the water quality of Canaan Street Lake exists.

Plan Implementation & Expansion of the Drinking Water Protection Process

While the Committee has accomplished the goal of drafting the Canaan Street Lake Watershed Protection Plan, the next step in the process is for the plan to be adopted and implemented. One way to ensure implementation is reappoint the Committee for another year, so that they can begin the plan's implementation.

Additionally, the process that was applied toward protecting the Canaan Street Lake watershed should also be expanded and applied to the remaining five public drinking water systems located outside the watershed. Each of these water systems will benefit from source protection and should be included in water resource protection efforts. Also, consideration should be given to protecting Canaan's stratified drift aquifer.

The Committee's objectives for plan implementation and the expansion of the drinking water protection process are:

Objective #1: The Canaan Street Lake Watershed Plan is adopted and implemented.

Objective #2: All drinking water resources in Canaan have some level of water quality protection.

Source Water Protection Plan Conclusion

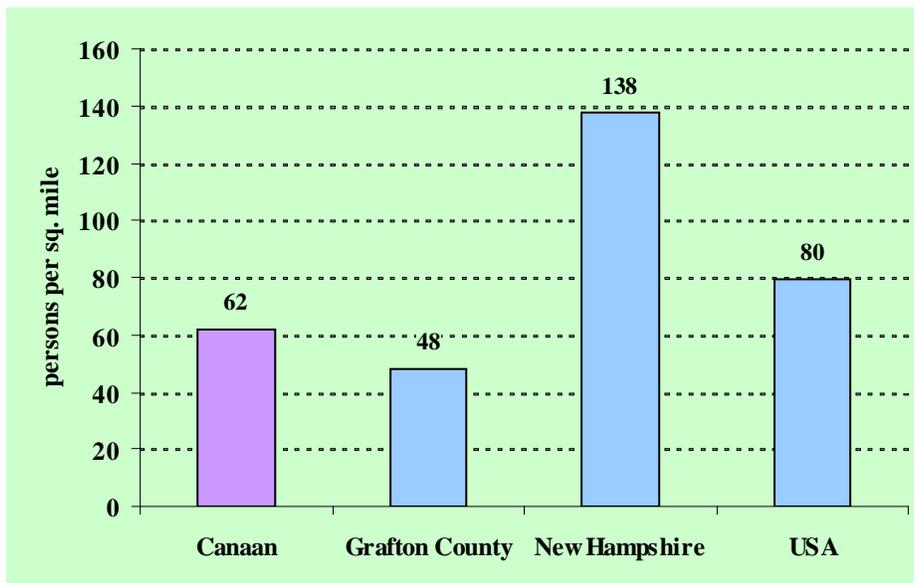
The Canaan Drinking Water Protection Committee worked with a variety of individuals, groups, and agencies to develop this Watershed Protection Plan. The next step is to share the plan with the community to develop local support for implementation. Additionally, it is important that the Canaan Drinking Water Protection Committee continue to exist in order to shepherd implementation of these recommendations. As evidenced by this plan, the Committee has already played an important role in developing watershed awareness, identifying current concerns, and has begun to plan for the future of the Canaan Street Lake watershed.

The management objectives and strategies identified in this plan represent one step in a multiple stage process to protect water quality. As strategies are implemented and goals and objectives are met, new ones need to be developed and the watershed plan will need to be amended to reflect these changes. No planning process is complete without a review of the benchmarks set forth in a management plan. The benchmarks outlined in Chapter V should be revisited periodically to evaluate whether strategies have been successfully implemented. In order to keep the plan current and practical, and for this plan to be successful, benchmarks will need to be met or exceeded.

The Committee believes that Canaan Street Lake and all other drinking water sources within the Town should be considered as long-term resources that need to be properly protected for all generations. Preservation of these resources should occur in a manner that maintains water quality so that it is as good, or better, in one hundred years as it is today. Without comprehensive protection, that is adjusted to address future threats, Canaan’s drinking water resources run the risk of being contaminated and potentially unusable for future generations.

Natural Resources and Recreation – Background Information

Population per Square Mile



Data: Census 2000

At 62 persons per square mile, Canaan is rural.

Public Access to Water Bodies

WATER BODY	Mascoma River	Canaan Street Lake	Goose Pond	Clark Pond
WATERBODY TYPE	Stream	Lake	Lake	Lake
AREA (acres)		303	554	136
OWNERSHIP	NH FG	Canaan	NH DES	NH FG
FEE	No	No	No	No
FISH	Yes	Yes	Yes	Yes
BOAT	Yes	Yes	Yes	Yes
ACCESS TYPE	Cartop	Ramp/ Beach	Trailer	Trailer
SWIM	No	Yes	Yes	No
CAMP	No	No	No	No
PICNIC	No	Yes	Yes	No
REST-ROOM	No	Yes	Yes	No

Recreation – Background

Town Survey Results

Open Space & Recreation

	N	Yes	No	Other
Recreation Facilities Should Be Increased	99	48%	46%	5%
Tax Dollars Should be Used for Rec Facilities	94	43%	54%	3%
Youth/Community Center Needed	101	58%	35%	7%
Taxes Should Go to Youth/Community Center	100	49%	43%	8%

Section IX
Historic Preservation Goal Policies and Recommendations

- (1) Support the Historic District Commission in the preservation of cultural resources, and particularly of structures and places of historic, architectural and community value. The heritage of the Canaan will be safeguarded by:
 - I. Preserving districts which reflect elements of its cultural, social, economic, political, community and architectural history;
 - II. Conserving property values in such districts;
 - III. Fostering civic beauty;
 - IV. Strengthening the local economy; and
 - V. Promoting the use of historic districts for the education, pleasure and welfare of the citizens of Canaan.
- (2) Establish a Heritage Commission in accordance with RSA 673 for the proper recognition, use, and protection of resources, tangible or intangible, primarily man-made, that are valued for their historic, cultural, aesthetic, or community significance within their natural, built, or cultural contexts throughout Canaan. The Heritage Commission will have the power to accept gifts or property and manage these to conserve or use cultural resources. The commission may be a separate commission or these duties may be assigned to the Historic District Commission.
- (3) Investigate National Register listing for significant local structures and sites.
- (4) Ensure that any building change, site improvement, or any other alterations to a Town-owned building respects the historical qualities of the structure.
- (5) Locate and map sites and/or cellar holes of original schoolhouses, places of business, industries, and homes. Place markers at key historic sites and structures.
- (6) Locate, identify, catalogue, preserve and protect town records, documents, manuscripts and artifacts, and provide a suitable and safe repository for them.
- (7) Promote the collection, preservation and protection of early photographs. Encourage photography of townspeople and structures for permanent reference.
- (8) Prepare a historic resources survey with information updated periodically to indicate changes to buildings, including remodeling, fire, demolition or changes to surroundings.
- (9) Document, preserve, upgrade and protect the town's graveyards and private burial grounds.
- (10) Facilitate an oral and written history of the town.
- (11) Work to improve communication and cooperation between the Historic District Commission and Town residents. This will keep owners up-to-date on developments affecting the District and the benefits of district designation. Toward this end the Commission should publish guidelines on appropriateness of applications.

- (12) Assure the support needed by the Canaan Historical Museum in making collected historical information accessible to Town residents and future generations. Support and promote its research into and protection of all of Canaan's historic resources.
- (13) Encourage the designation and protection of scenic roads.

Section X Land Use Policies

- (1) Encourage contiguous, staged, and compact patterns of growth around existing village settlements and provide economic and timely provision and extension of public facilities and services.
- (2) Outside of Canaan's village areas, discourage development other than farm, forestry, and low-density residential uses. Guide and direct higher density residential housing in or adjacent to Canaan's village areas.
- (3) Discourage the intrusion of commercial and industrial uses in residential neighborhoods. Develop off-highway malls along Route 4 for commercial and light industrial uses.
- (4) Enforce state junkyard regulations. Adopt and enforce additional regulation of junk in Canaan.
- (5) Base future land-use decision-making upon the natural capability of the land and other resources to sustain varying types and intensities of development.
- (6) Take positive steps to identify and protect and increase appreciation of critical natural resources that contribute to the health, safety, and well-being of Canaan residents. .
- (7) Develop ordinances to control air, noise and water pollution, and enforce them.
- (8) Plan the extension of utilities to encourage appropriate growth and better support existing development.
- (9) Encourage cluster development in rural areas where development is desirable.
- (10) Promote, protect and enhance Canaan's visual/cultural resources at both the community-wide scale as well as on a site-by-site basis.
- (11) Promote the renewal of the Canaan Village area in order to reinforce this area as the social, cultural, economic, and governmental center of the community.
- (12) Rehabilitate Canaan's older housing stock and underutilized historic structures using tools such as Rehabilitation Tax Credits and Community Development Block Grant Funds.
- (13) Conserve and protect selected undeveloped land for wildlife corridors, open space and recreation purposes. Protect lake, pond and river shore frontage for public access.
- (14) Establish a 150-foot minimum shore frontage requirement for new lots created fronting on Canaan's lakes and major ponds and the Mascoma and Indian Rivers west of Canaan Village.
- (15) Adopt and enforce site plan and zoning regulations dealing with water protection, septic systems, and signage.
- (16) Encourage energy efficiency in subdivision, site plan and building design.
- (17) Adopt subdivision regulations that limit creation of lots with a large perimeter to area ratio.
- (18) Restrict subdivision in rural areas so that adjacent narrow-frontage subdivisions are not created.
- (19) Enact a minimum lot size for new narrow-frontage lots.
- (20) Comply with RSA 674:41 which limits building permits, unless there is road frontage

- (21) Require a septic evaluation and a current septic permit for any building permit affecting habitable dwelling space. This will reduce dependence on inadequate septic systems as older homes and summer residences are modified.

Rural Areas					
Our rural lands should have	N	Encourage	Encourage w Limits	Dis-courage	Other
Forest Management	100	86%	14%	0%	
Agriculture	101	86%	13%	1%	
Woods	96	88%	11%	1%	
Privacy	94	93%	6%	1%	
Home-Based Business	98	62%	36%	2%	
Non-Motorized Summer Recreation	97	77%	21%	2%	
Wildlife	96	88%	10%	2%	
Quiet/Silence	98	87%	10%	3%	
One-Family Dwelling	94	77%	20%	3%	
Campgrounds	93	49%	47%	3%	
Barn Preservation	92	73%	24%	3%	
Non-Motorized Winter Recreation	98	76%	20%	4%	
Scenic Views	83	83%	12%	4%	1%
Sparse Population	83	57%	33%	11%	
Two-Family Dwelling	91	46%	42%	12%	
Office Buildings	93	53%	34%	13%	
Road Frontage for New Lots	85	47%	38%	14%	1%
Industrial w/o Noise or Odor	96	36%	49%	15%	
Unpaved Roads	87	45%	34%	21%	
Apartments	94	33%	39%	28%	
Condominiums	91	33%	37%	30%	
High Density Housing w Common Spaces	95	41%	27%	32%	
Motorized Winter Recreation	95	23%	44%	33%	
Service Depots	83	30%	36%	34%	
Warehouse Service	92	36%	29%	35%	
Outdoor Equipment/Material Storage	93	17%	43%	39%	1%
Town Acceptance of Private Roads	87	15%	45%	39%	1%
Gravel Pit/Excavation	96	17%	44%	40%	
2nd Dwelling on Single Lot	94	33%	27%	40%	
Motorized Summer Recreation	98	21%	36%	43%	
Mobile HomeParks	96	17%	31%	52%	
Land-Locked Parcels	77	12%	23%	61%	4%
Racetracks	98	13%	23%	63%	
ATV Parks	98	14%	20%	65%	
Commercial Landfills	91	12%	13%	75%	
Adult Bookstores	94	4%	6%	89%	

Residential Growth

	N	Too Rapid	About Right	Not Fast Enough	No Opinion
The rate of residential growth in Canaan	100	31%	46%	11%	12%

	N	Large Rural Lots	Compact Settlements	Rural Clusters	No Opinion
Most of our residential growth should be	100	14%	16%	22%	27%

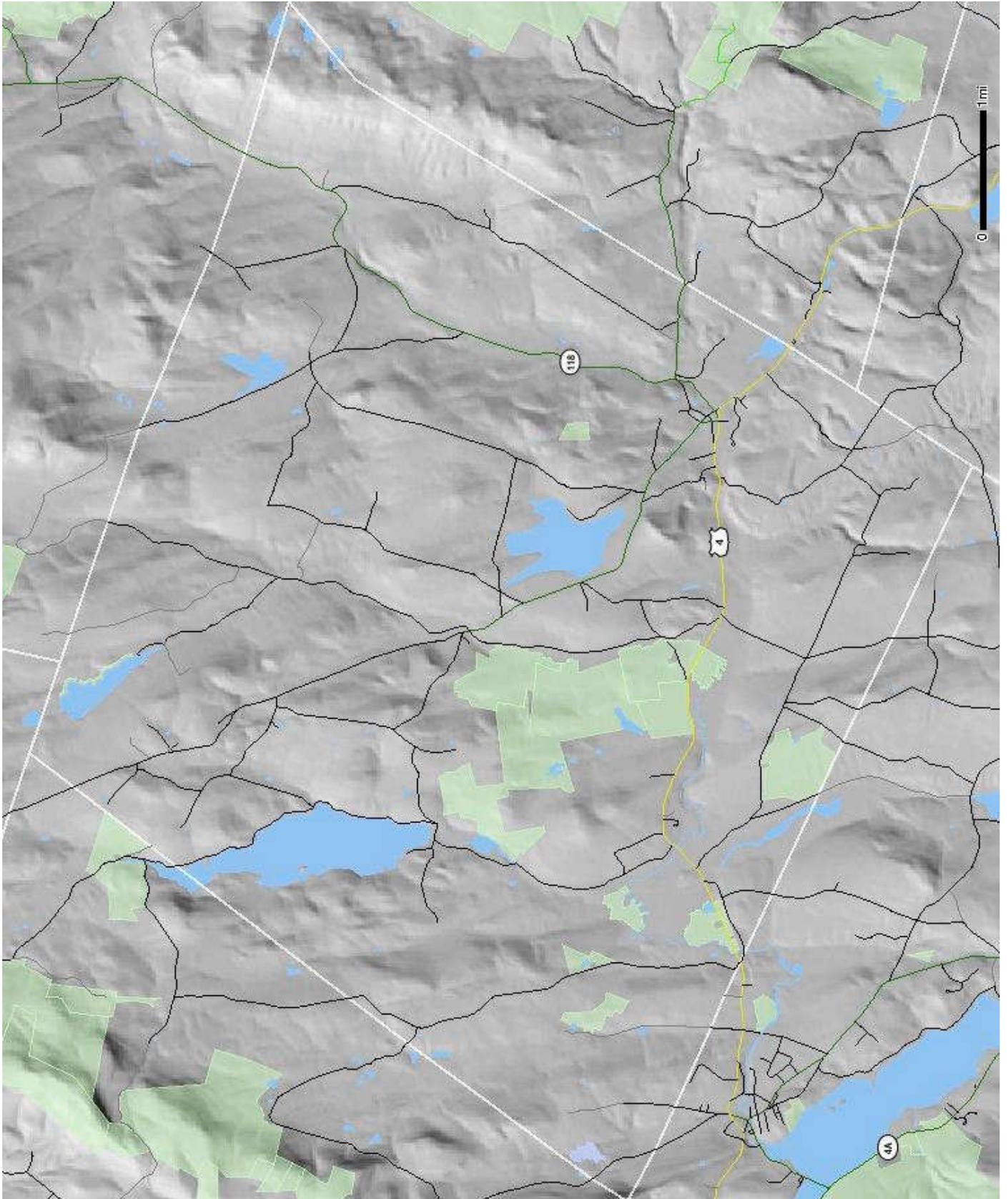
	N	Yes	No	Yes for large developments
Cost of the building permit should include an impact fee	99	58%	35%	7%

	N	Yes	No	Other
New construction be regulated differently depending on location	99	52%	45%	3%

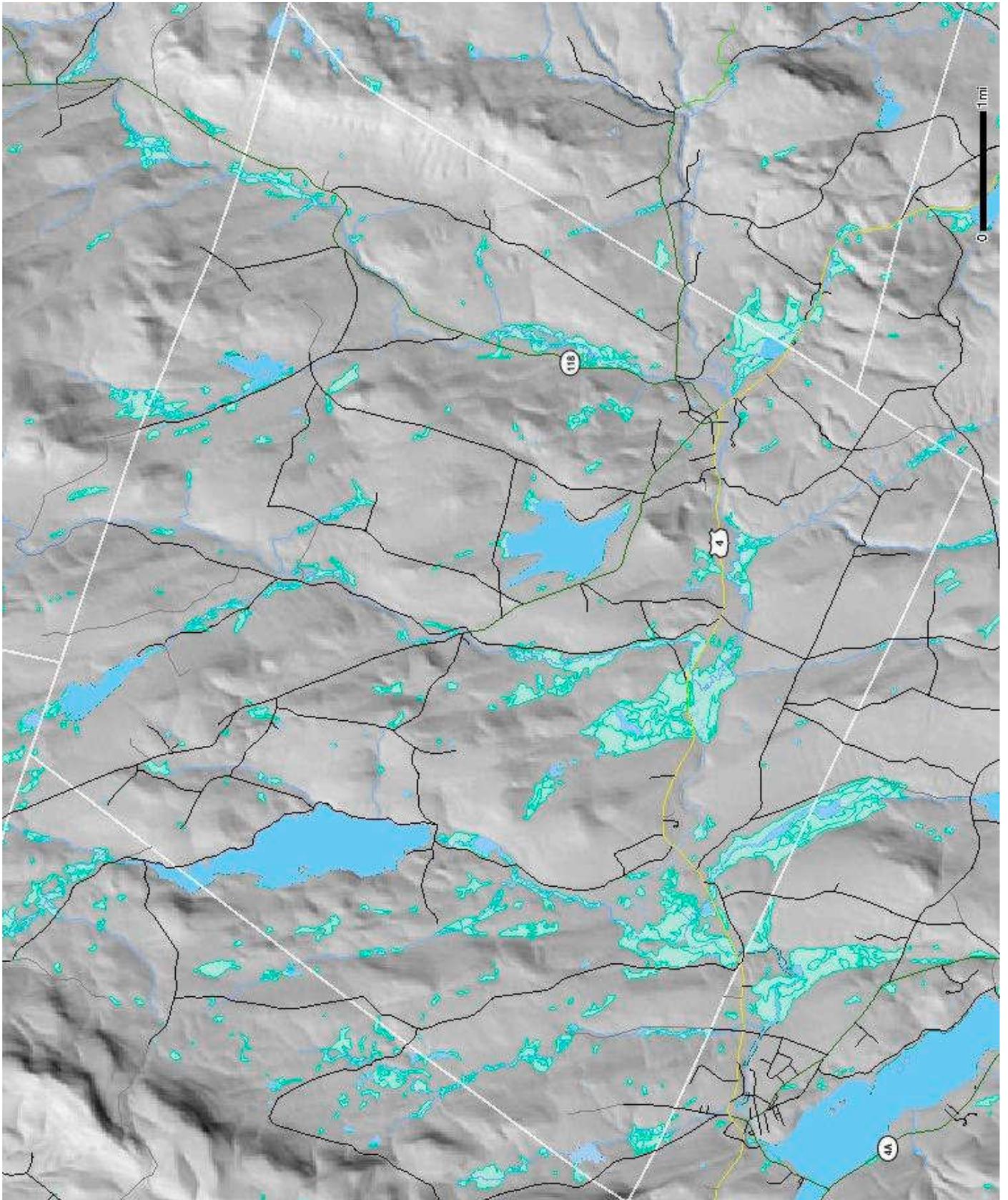
Canaan's Landscape

	N	Yes	No
Do you support town involvement in preserving its special places?	96	89%	11%

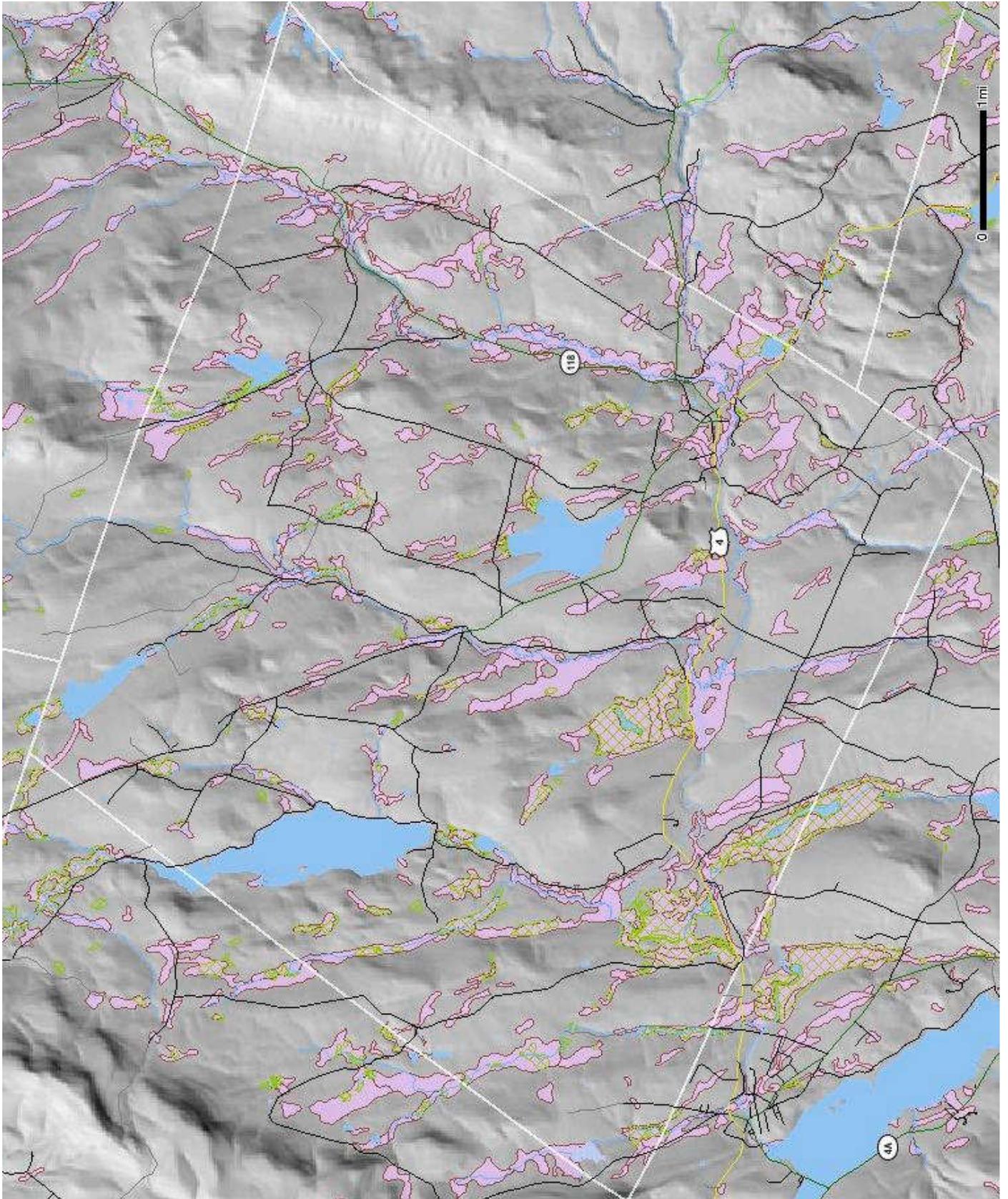
Land Conservation



Wetlands



Hydric Soils (saturated with water)



Map Legends for previous three maps.

For all three maps:

Gray shading indicate slopes of land, with dark shades being steeper.

Blue is used for lake, pond, river, stream and other open waters.

Roads are shown in black, except US route 4, which is yellow.

On Land Conservation map, light green indicates conserved land.

On Wetlands map, solid green indicates wetlands. Darker green lines, within wetlands, mark boundaries between classes of wetlands.

On Hydric Soils map, purple is used for water saturated soils, with yellow/green cross hatch marking swap or marsh.

Appendix A: Related Documents

The following documents were valuable information sources for the master plan, and should be consulted when implementing master plan topics.

Canaan Community Profile Report, University of New Hampshire Cooperative Extension, November 16 & 17, 2001 <http://extension.unh.edu/CommDev/Pubs/CananCPR.pdf>

Available at Canaan Town Library, in the vertical file.

Mascoma River Watershed Natural Resource Inventory,

Prepared for: The Mascoma Watershed Conservation Council,

Prepared by: The Society for the Protection of New Hampshire Forests

March, 2003

Report <http://www.des.state.nh.us/REPP/UVLSRPC/March03Report.pdf>

Maps (7 maps) <http://www.des.state.nh.us/REPP/UVLSRPC/MascomaWatershedMaps.pdf>

(above maps are 31 MB, download with broadband only)

Alternate map source (low resolution)

<http://www.spnhf.org/research/recent-mapping-projects.asp>

Natural Resource Inventory of the Bear Pond Natural Area 2003-2005

Funded by Mascoma Watershed Conservation Council

In contract with New England Institute for Landscape Ecology

Submitted February 2006

CD on file in Canaan Town Library

Goose Pond Watershed Analysis 1998-2000

Prepared by the University of New Hampshire (UNH) Center for Freshwater Biology and Cooperative Extension Water Resource Program. Supporting data were collected by UNH personnel and by volunteers from the Goose Pond Lake Association (GPLA) over the 22-month period from December 1998-September 2000.

Hard copy on file in Canaan Town Library.

Appendix B: Town Survey Questions

September 2005

Dear Canaan Resident:

It is time for the Canaan Planning Board to work with the town in preparation of a new Master Plan for Canaan, and perhaps to plan for zoning.

The survey will assist the Planning Board in developing the Master Plan. This long-range plan will be based, in part, on input received from Canaan citizens like you. Your participation in this survey is important so that we can incorporate your concerns, thoughts and ideas as to the future character of Canaan. The members of the Planning Board thank you in advance for your input and look forward to hearing from you.

We may also use the results of the survey as a resource in developing a zoning ordinance for the town, depending on the wishes you express. An important aspect of this survey is the inclusion of your independent comments. *Please feel free to use the margins and the last page of this survey for additional comments.*

Copies of the survey are available for additional family members at the town offices. You can also drop off copies of the complete survey there, mail it to the Selectmen's Office, PO Box 38, Canaan, or drop it off at

We will discuss this survey and land use in Canaan during three public forums at the Senior Center. Save these dates and come to one or all of the meetings.

Thursday Sept. 15th at 7:00

Saturday Sept 24th at 1:00

Wednesday Oct 5th at 7:00

Canaan Planning Board
Town of Canaan
PO Box 38
Canaan, NH 03741

Canaan Resident
Canaan, NH 03741

Canaan Master Plan Survey

TOPIC

QUESTIONS

Background Are you a year-round resident? Resident ____ Summer Visitor ____

Information Do you own your home? **Homeowner** **Renter**

How long have you been in Canaan? ____
 Are you registered to vote in Town? Yes ____ No ____
 What is your approximate age? ____
 Are you Male? ____ Female? ____
 Are you retired? ____ Working at home ____ Working in Canaan ____
 Working outside of Canaan ____
 How large is your household? Adults ____ School-age children ____
 Preschool children ____

Town Services What town government and/or administration services do you believe need to be cut back, improved or expanded? Please label those you think should be: **C** – cut back; **I** – Improved; **E** – Expanded; **O** – OK as is

- ___ Assessor’s Office ___ Board of Selectmen ___ Health Officer
- ___ Conservation Comm. ___ Clerk’s Office ___ Elderly Services
- ___ Fire Department ___ Road Department ___ Building Inspector
- ___ Library ___ Planning Board ___ Police Department
- ___ Recreation Dept. ___ Schools ___ Tax Collector’s Office
- ___ Water & Sewer Department
- ___ Other: _____

Canaan’s Landscape What are special places in Canaan that are important to you?
 Recreational and Conservation Areas:

 Churches and Historic Buildings:

 Attractive Residential Areas:

 Scenic and Open Spaces:

 Ponds and Streams:

Do you support town involvement in preserving any of these? Yes ____ No ____

Business Economy Approximately what percentage of your shopping do you do in Canaan? ____%
 What type of shopping and retail facilities, if any, would you like to see **encouraged** in Canaan?

What kinds of professional offices should we have in Canaan?

What kinds of manufacturing should we encourage in Canaan?

What type of businesses, (commercial, retail, manufacturing, etc.) if any, would you like to see **discouraged** in Canaan?

Canaan is an old town with many lovely antique residences. Should the town adopt provisions to encourage their preservation? Yes _____ No _____

Rural Areas

How should we guide the future of our rural lands? For the purposes of this survey, rural areas include all of except: village areas served by water & sewer, Canaan Street Historic District, pond & lakes frontage already protected by the state, and frontage along route 4. Please select one blank for each row.

	Encourage	Encourage with Limits	Discourage
Agriculture	_____	_____	_____
Forest	_____	_____	_____
Gravel pit or excavations	_____	_____	_____
Outdoor equipment or material storage	_____	_____	_____
Industrial without noise or odor	_____	_____	_____
Office buildings	_____	_____	_____
Warehouse Service	_____	_____	_____
Service depots	_____	_____	_____
Commercial landfills	_____	_____	_____
Outdoor recreation (motorized winter)	_____	_____	_____
Outdoor recreation (not motorized winter)	_____	_____	_____
Outdoor recreation (motorized summer)	_____	_____	_____
Outdoor recreation (not motorized summer)	_____	_____	_____
Campgrounds	_____	_____	_____
Racetracks (auto)	_____	_____	_____
ATV parks	_____	_____	_____
One family dwelling	_____	_____	_____
Two family dwelling	_____	_____	_____
Second dwelling on single lot	_____	_____	_____
High density housing with common open space	_____	_____	_____
Condominiums	_____	_____	_____
Apartments	_____	_____	_____
Mobile Home Parks	_____	_____	_____
Home based business	_____	_____	_____
Land-locked parcels	_____	_____	_____
Woods	_____	_____	_____
Quiet/Silence	_____	_____	_____
Wildlife	_____	_____	_____
Privacy	_____	_____	_____
Scenic views	_____	_____	_____
Sparse population	_____	_____	_____
Unpaved roads	_____	_____	_____
Town acceptance of private roads	_____	_____	_____
Preservation of barns	_____	_____	_____
Road frontage for new lots	_____	_____	_____
Adult bookstores and clubs	_____	_____	_____

Transportation and Roads

How far do you travel to work? _____

Which way do you travel to work? In Canaan _____ Rt 4 West _____
Rt 4 East _____ Rt 118 North _____ At home _____

How has the Canaan Downtown Development Project affected Canaan Village?
Safer to drive in Yes _____ No _____ No Opinion _____
More pleasant to walk in Yes _____ No _____ No Opinion _____
More attractive for shopping Yes _____ No _____ No Opinion _____
A waste of money Yes _____ No _____ No Opinion _____

List the roads in Canaan, if any, which you feel are inadequate to serve existing traffic.

Have you used Advance Transit buses? Yes _____ No _____

What would encourage you to use the bus more?

Communication:

How do you get information about issues going on in Canaan?

The Spectator _____ The Cardigan _____
Public Postings _____ Valley News _____
Town Web Page _____ Word of mouth _____
Radio _____ Other _____

Do you use a cell-phone in Canaan? Yes _____ No _____

Would you support building a new cell-phone tower in the area? Yes _____ No _____

Do you have cable service available? Yes _____ No _____

Do you use Internet from home? Yes _____ No _____

Have you visited Canaan's new website, www.TownofCanaanNH.us? Yes _____ No _____

What would facilitate communication within the town?

Future Concerns

What do you think are the three (3) most serious issues facing Canaan in the next 5 to 20 years

What other things should the planning board consider in preparing our new Master Plan?

Do you believe that the Planning Board should develop and propose a zoning ordinance for Canaan, that would be voted on at a Canaan Town Meeting?

Yes _____ No _____ ? _____

Would you consider helping us develop our Town's Master Plan and/or a zoning ordinance? If so, please add or attach contact information.

Thank you for participating in this crucial part of Canaan planning and the Master Plan development.

Appendix C: Results of Town Wide Survey, October 2005

Background Information								
	N	Resident	Visitor	Visitor becoming Resident				
Are you a year-round resident?	107	93%	6%	1%				
	N	Home-owner	Renter					
Do you own your home?	107	93%	8%					
	N	Mean	25th Percentile	Median	75th Percentile	1 year	60 Yrs or more	
How long have you been in Canaan?	105	20	5	17	31	9%	6%	
	N	Yes	No	Will Register by Spring				
Are you registered to vote in Town?	106	88%	10%	2%				
	N	Mean	25th Percentile	Median	75th Percentile	Min	Max	65 Yrs or more
What is your approximate age?	102	55.4	45	56.5	67.25	22	85	30%
	N	Male	Female					
Are you male/female?	101	53%	47%					
	N	Retired	At Home	In Canaan	Outside Canaan			
Are you working?	103	41%	15%	10%	35%			
How large is your household?	N	0	1	2	3			
Adults in Household	104	0%	15%	81%	4%			
School-Age Children in Household	104	84%	9%	6%	2%			
Pre-School Children in Household	102	96%	2%	2%	0%			

Town Services -						
	N	Cut Back	Improve	Expanded	OK as Is	Other
Assessor's Office	78	9%	26%	6%	58%	1%
Conservation Commission	85	13%	11%	26%	51%	
Fire Department	82	0%	9%	11%	80%	
Library	88	9%	14%	26%	51%	

Recreation Dept	85	11%	15%	27%	46%	1%
Water & Sewer	78	3%	17%	3%	78%	
Selectboard	81	6%	15%	5%	74%	
Clerk's Office	81	0%	2%	6%	90%	1%
Road Dept	82	0%	33%	9%	59%	
Planning Board	82	11%	9%	10%	71%	
Schools	88	14%	31%	15%	41%	
Health Officer	75	7%	5%	5%	79%	4%
Elder Services	79	6%	19%	11%	62%	1%
Building Inspector	78	6%	10%	8%	73%	3%
Police Dept.	86	16%	13%	12%	59%	
Tax Office	80	1%	5%	3%	89%	3%

Canaan's Landscape

	N	Yes	No
Do you support town involvement in preserving its special places?	96	89%	11%

Business/Economy

	N	Mean	Median	Mode	25th Percentile	Median	75th Percentile
Percentage of your shopping do you do in Canaan	99	11%	7%	10%	2%	7%	15%

	N	Yes	No	Other
Support a different tax rate for residential vs. business/ commercial property	88	66%	27%	7%

	N	Along Route 4	Near Population Centers	Spread throughout	No Opinion	Other (Business Park, etc)	Multiple selected	Out of Canaan
New manufacturing should be located	98	44%	6%	8%	15%	20%	3%	3%

Residential Growth

	N	Too Rapid	About Right	Not Fast Enough	No Opinion
The rate of residential growth in Canaan	100	31%	46%	11%	12%

	N	Large Rural Lots	Compact Settlements	Rural Clusters	No Opinion	Other	Multiple Selection

Most of our residential growth should be	100	14%	16%	22%	27%	19%	2%
	N	Yes	No	Yes for large develop-ments			
Cost of the building permit should include an impact fee	99	58%	35%	7%			
	N	Yes	No	Other			
New construction be regulated differently depending on location	99	52%	45%	3%			

Open Space & Recreation

	N	Yes	No	Other
Recreation Facilities Should Be Increased	99	48%	46%	5%
Tax Dollars Should be Used for Rec Facilities	94	43%	54%	3%
Youth/Community Center Needed	101	58%	35%	7%
Taxes Should Go to Youth/Community Center	100	49%	43%	8%
Town buildings visited in the last year	N	Yes	%	
Town Offices	108	103	95%	
Library		74	69%	
Senior Center		59	55%	
Museum		36	33%	
Police Station		48	44%	
Fire Department		59	55%	
Meeting House		56	52%	
	N	Yes	No	Other/ Don't Know
Enough resources are used in maintaining town Buildings	101	47%	45%	9%

Housing

	N	Yes	No	No Opinion	Encourage with limits
Master Plan should encourage					
Rental properties	95	59%	28%	11%	2%
In-Law Apartments	93	63%	15%	19%	2%
Mobile Homes	93	27%	62%	10%	1%

Condominiums	90	52%	34%	12%	1%
Developments	90	51%	38%	9%	2%
Multi-Family Residences	92	47%	40%	12%	1%
Unrestricted Development	96	18%	74%	8%	0%

	N	Yes	No	No Opinion
Adopt provisions to encourage preservation of antique residences	103	74%	25%	1%

Rural Areas

Our rural lands should have	N	Encourage	Encourage w Limits	Dis-courage	Other
Forest Management	100	86%	14%	0%	
Agriculture	101	86%	13%	1%	
Woods	96	88%	11%	1%	
Privacy	94	93%	6%	1%	
Home-Based Business	98	62%	36%	2%	
Non-Motorized Summer Recreation	97	77%	21%	2%	
Wildlife	96	88%	10%	2%	
Quiet/Silence	98	87%	10%	3%	
One-Family Dwelling	94	77%	20%	3%	
Campgrounds	93	49%	47%	3%	
Barn Preservation	92	73%	24%	3%	
Non-Motorized Winter Recreation	98	76%	20%	4%	
Scenic Views	83	83%	12%	4%	1%
Sparse Population	83	57%	33%	11%	
Two-Family Dwelling	91	46%	42%	12%	
Office Buildings	93	53%	34%	13%	
Road Frontage for New Lots	85	47%	38%	14%	1%
Industrial w/o Noise or Odor	96	36%	49%	15%	
Unpaved Roads	87	45%	34%	21%	
Apartments	94	33%	39%	28%	
Condominiums	91	33%	37%	30%	
High Density Housing w Common Spa	95	41%	27%	32%	
Motorized Winter Recreation	95	23%	44%	33%	
Service Depots	83	30%	36%	34%	
Warehouse Service	92	36%	29%	35%	
Outdoor Equipment/Material Storage	93	17%	43%	39%	1%
Town Acceptance of Private Roads	87	15%	45%	39%	1%
Gravel Pit/Excavation	96	17%	44%	40%	
2nd Dwelling on Single	94	33%	27%	40%	

Lot				
Motorized Summer Recreation	98	21%	36%	43%
Mobile Home Parks	96	17%	31%	52%
Land-Locked Parcels	77	12%	23%	61%
Racetracks	98	13%	23%	63%
ATV Parks	98	14%	20%	65%
Commercial Landfills	91	12%	13%	75%
Adult Bookstores	94	4%	6%	89%

Transportation & Roads

	N	Mean	25th P'tile	Median	75th P'tile		
Travel Distance to Work	61	18	6	16	24		
	N	Local in Canaan	Rt 4 West	Rt 4 East	Rt 118 North	At Home	Other
Travel Direction	60	20%	65%	8%	3%	2%	2%
	N	Yes	No	No Opinion	Other		
Effect of Downtown Development Project							
Safer to Drive	95	65%	20%	14%	1%		
More Attractive Shopping	92	58%	16%	24%	2%		
More Pleasant Walking	95	74%	9%	15%	2%		
Waste of Money	92	22%	61%	15%	2%		
	N	Yes	No				
Have Used Advance Transit	99	32%	68%				

Communication

	N	Yes	%			
Info about town issues comes from						
Word of mouth	108	78	72%			
Valley News		70	65%			
Spectator		69	64%			
The Cardigan		48	44%			
Public Postings		32	30%			
Radio		9	8%			
Town Web Page		8	7%			
	N	Yes	No	No Service		
Use Cell Phone	104	37%	47%	16%		

	N	Yes	No	Depends on location
Support Building a cell-phone tower	98	71%	24%	4%
	N	Yes	No	Other
Have Cable Service	100	54%	43%	3%
	N	Yes	No	
Use the Internet from Home	101	85%	15%	
	N	Yes	No	Other
Have visited the town web site	97	32%	67%	1%

Future Concerns

	N	Yes	No	?
Develop zoning ordinance	107	65%	29%	6%

Appendix D Build-out Analysis

INTRODUCTION

The Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC) performed this build-out analysis at the request of the Canaan Planning Board in conjunction with the Board's update of the town master plan. The build-out analysis is a tool for assessing the compatibility between the community's vision for the future and the current regulatory environment. The term "build-out" is a planning reference to a hypothetical calculation of the maximum development allowed under existing regulations. The purpose of the build-out is to answer questions such as:

- How many new lots can be developed?
- How would this potential growth be distributed throughout town?
- How many dwelling units would these new lots represent?
- How much would the population increase?

The results of a build-out analysis often facilitate further discussion within the context of planning for the community's future, including:

- How will the projected growth affect the community?
- Are there areas projected for development which the community would prefer not to develop or to develop at a lower density?
- Are there areas that the community would prefer to develop at higher densities to concentrate growth where facilities and services will be more efficient and cost effective to provide?
- What additional facilities and services will be required to serve the needs of future residents?
- What steps should the community be initiating in the near future to accommodate future growth?

A build-out analysis is a model for calculating development potential. This build-out analysis estimates potential residential development in Canaan under current land use controls. It is predicated on certain assumptions which are outlined in this report. A different set of assumptions would result in a different projected population. A build-out analysis, unless performed lot-by-lot, also relies on many generalizations. The underlying assumption is that factors which may bias the numbers in one direction or the other balance out; and that presenting the numbers aggregated for larger areas of the community also balances out irregularities associated with data collected on smaller geographic areas.

Timing is not relevant to the build-out analysis as it is assumed that time is condensed to allow all possible development to occur today. The build-out analysis holds at today's conditions factors such as demographics, technology, municipal infrastructure and other variables that may affect development patterns.

METHODOLOGY AND ASSUMPTIONS

The UVLSRPC used its geographic information system (GIS) and data layers provided through GRANIT, the state's GIS system housed at the UNH Complex Systems Research Center, as well as those developed by UVLSRPC and others, to perform much of the analysis. Each of the GIS data layers and other data sources, as well as the assumptions associated with this analysis, is outlined below. The UVLSRPC utilized PC ARC/INFO 3.5.2 and Arcview 3.2 software to perform the GIS analyses. Spreadsheet analysis was performed using Quattro Pro v.11.

The town was analyzed in fifteen study areas as shown on the attached map.

Future residential development was calculated for each of these fifteen sections of town and presented accordingly. The results are shown on the attached map and a more detailed large colored map available for viewing at the town office.

Development Density

This build-out analysis projects the future population of Canaan in the absence of a local zoning ordinance. To incorporate development limitations associated with the land into the analysis, including wet and steep areas, soil-based lot sizes utilized by NH Department of Environmental Services for reviewing proposed residential subdivisions were used for the build-out analysis where neither public water or sewer is available. In study area #12 where public water and sewer are available, the density was estimated at two dwelling units per acre at the direction of the Planning Board.

Surface Water

The area occupied by ponds and lakes was excluded from the developable land area. Surface water information was based on the USDA NRCS Soil Survey for Grafton County.

Land Protected From Future Development

Publicly-owned conservation land and privately-owned land protected from development with conservation easements or other development restrictions was deducted from the land area available for future development. The GRANIT conservation land layer developed in 1995 by the Society for the Protection of NH Forests, updated in 2002 by UVLSRPC, was updated and used to identify conservation lands.

Existing Land Use

Existing land use was identified and digitized by UVLSRPC using 1998 digital orthoquads provided through the NH Department of Transportation. The results were then reviewed by local officials. Lands identified as currently containing the following land uses were excluded from land considered developable:

- Residential
- Commercial
- Institutional
- Industrial
- Outdoor recreation

Existing Road Rights-of-way

Road centerlines were based on 1:24000 digital line graph data provided through GRANIT. Centerlines were buffered twenty-five feet on either side to approximate general right-of-way areas. These areas were then excluded from developable land calculations.

Future Roads

The area that would be taken up with future road rights-of-way associated with potential growth was deducted from the land area available to form new lots. The percentage of land needed for roads and other utilities increases with the density of development. A deduction of 18% was used for this analysis based on previous sampling by UVLSRPC of densities in the Region similar to that which would be found in Canaan at build-out.

Residential vs. Nonresidential Land Area

The proportion of developed land area currently estimated to be developed for residential uses is listed below for each study area. These percentages are based on current ratios derived from the GIS land use mapping. These numbers were applied to future development to estimate the proportion of new development that would be residential.

Study Area	% of Future Development Assumed to be Residential
1	100
2	100
3	100
4	100
5	100
6	81
7	90
8	100
9	80
10	100
11	86
12	76
13	20
14	100
15	100

RESULTS

The 2000 US Census counted 1,588 dwelling units in Canaan. It is estimated that 12,057 additional dwelling units could be built in Canaan under current conditions for a total of 13,645. The distribution of potential residential development across town is listed below and shown on the attached map. As shown, the growth potential of the rural areas of town vastly exceeds that of the village and surrounding area. Rather than concentrating development where facilities and services are available and more cost effective to provide and maintain, in the absence of a zoning ordinance, development will eventually spread fairly evenly throughout the town.

Study Area	Additional Residential Lots Projected
1	998
2	1644
3	1825
4	841
5	1111
6	1187
7	1085
8	710
9	451
10	188
11	79
12	31
13	10
14	1867
15	30

The next step in calculating a potential future year-round population for Canaan under current zoning is to estimate the number of these residential units that would be occupied year-round. For the purposes of this analysis, the vacancy rate (4.4%) and percentage of housing units occupied seasonally (15.1%) were assumed to remain constant. These assumptions result in an estimated 10,984 housing units occupied year-round at build-out.

Occupancy Status	Housing Units Counted by 2000 U.S. Census	Total Number of Housing Units Projected at Build-out
Year-round occupied	1279	10,984
Vacant	70	600
For seasonal use	239	2060
Total housing units	1588	13,645*

*Does not add due to rounding.

Population

The U.S. Census reported a population of 3,319 for Canaan in 2000. Assuming an average household size of 2.59 persons per household as reported by the 2000 U.S. Census, the population of Canaan would increase by a factor of more than eight to approximately 28,449 at build-out. For comparison, the Region’s largest two communities in 2000 were Claremont with 13,151 residents and Lebanon with 12,568. Grafton County had a population of 81,743 in 2000, Concord had 40,687 and Laconia 16,411.

Seasonal dwellings represent an additional segment of the community requiring consideration for services as well. However, the number of seasonal residents or users of seasonal dwellings is difficult to estimate. Household size, length and frequency of stay, turnover of users, all affect the nature of the community’s needs relative to these dwelling units.

The U.S. Census counted 761 school-age children (ages 5 through 19) in Canaan in 2000. Assuming the age structure of the population remains the same at build-out, the potential school-age population for Canaan is 6,515. The U.S. Census counted 322 Canaan residents age 65 or over in 2000. Again assuming the percentage of the total population comprised of older residents remains the same at build-out, the potential population of older adults in Canaan is 2,760. Both of these segments of the population require special considerations when planning for facilities and services needed in the future.

Traffic Generation

Traffic generation estimates are based on factors developed from nation-wide sampling and provided by the Institute of Transportation Engineers (Trip Generation, 6 Edition, ITE, Washington, D.C., 1997). The figure for single-family residences (9.57 trips per day) was applied to all year-round housing in Canaan as multi-family housing in rural communities without public transit is also autodependent. This results in as estimated 12240 trips per day associated with today’s year-round residents increasing to about 105117 trips per day at build-out.

Some considerations relative to the magnitude of this potential traffic increase are:

- Without zoning, Canaan’s future is one in which growth is spread out all over town at relatively high densities, meaning the substantially increased traffic volume associated with this growth has the potential to also be widely distributed, posing a significant maintenance challenge for future local officials.

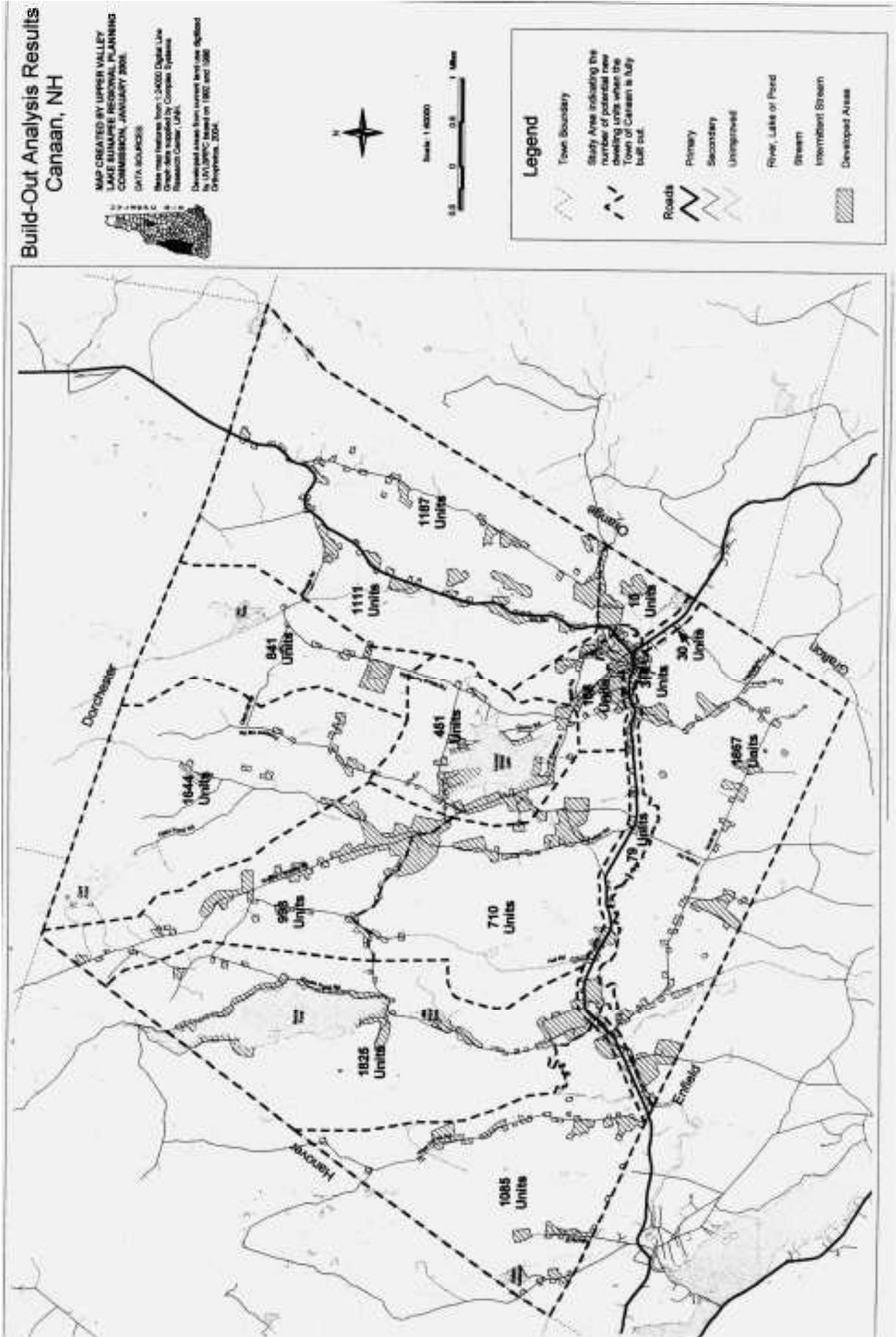
- The 105,117 figure reflects only locally-generated traffic. Non-local traffic will continue to increase as the regional population grows.
- Traffic generated by commercial and industrial growth can also be expected to grow.

CONCLUSION

This analysis of the potential residential growth associated with undeveloped land in Canaan indicates that under current conditions Canaan has the potential to grow to a year-round population of at least 28,449. This represents more than an eight-fold increase over the 3319 residents counted in the 2000 U.S. Census. An examination of developed land in Canaan would likely reveal some in-fill potential which would increase this number further.

It should be kept in mind that a build-out analysis is a model based on a set of assumptions - - a different "crystal ball" will yield different results. Whether the results predict the future with an accuracy of + 0.1 % or \pm 10%, they provide a basis for assisting the Planning Board as it continues to strive for a balance among growth, the community's vision for its future, and the municipality's ability to provide facilities and services.

The analysis lays a foundation for easily testing alternative regulatory schemes as part of the master plan process, such as a differential between the minimum lot size in and around the village area and the rural areas, to evaluate effects on total population and the distribution of population. Used in this way, a build-out analysis can serve not only as a catalyst for change if the impacts associated with the anticipated growth appear inconsistent with the community's desires and capacities, but also as a tool for examining options for affecting a different future.



Appendix E: Water Source Protection Plan



**Canaan Street Lake
Watershed Protection Plan
Town of Canaan, NH**



August 2006

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Canaan Drinking Water Protection Committee: *(left to right)* David Shinnlinger, John Bergeron, Robert Reagan, Tim Jennings, Jay Waldner. *(Not pictured: Wally Medeiros, Bill Wilson, Jim Linn, and Joe Damour)*

Review Annually and Update Every 3 Years

Date Reviewed	Reviewer	Changes or Comments

Canaan Street Lake Watershed Protection Plan for the Town of Canaan, NH

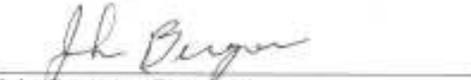
Adopted by the Canaan Drinking Water Protection Committee:


David Shinnlinger, Chair

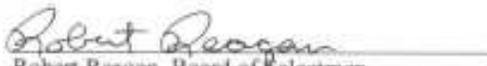
8/16/06
Date


Jay Waldner, Vice Chair

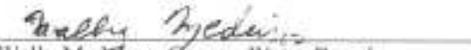
8/16/06
Date


John Bergeron, Secretary

8/16/06
Date


Robert Reagan, Board of Selectmen

8/16/06
Date


Wally Medeiros, Canaan Water Board

8-23-06
Date


Tim Jennings, Cardigan Mountain School

8/16/06
Date


Bill Wilson, Canaan Health Officer

8/22/06
Date

Joe Damour, Water System Operators

Date


Jim, Linn, Canaan Resident

8/23/06
Date

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Thanks are extended to New Hampshire Department of Environmental Services for their assistance and support throughout the planning process.

Executive Summary

Canaan Street Lake Watershed Protection Plan

August 2006

Canaan Street Lake is the largest drinking water source in the Town of Canaan and supplies water to approximately 600 residents and local businesses in Canaan Village. In order to protect the quality of the Lake's water as a drinking water source the Board of Selectman appointed a Drinking Water Protection Committee to develop a Watershed Protection Plan.

The Drinking Water Protection Committee, assisted by Granite State Rural Water Association throughout the seven-month planning process, identified potential contamination sources to Canaan Street Lake and developed specific recommendations to manage water quality threats. Additionally, the plan aims to increase the understanding of the Canaan Street Lake Watershed and provide a meaningful foundation for decision-making.

Overall, the Committee found that the Canaan Street Lake Watershed is in good condition, however recent data suggests that water quality is diminishing. While the Watershed is predominantly forested, which helps maintain water quality and ecosystem functions, increasing conductivity values indicate that recreational uses and surrounding land uses are having an effect on Canaan Street Lake.

Increasing conductivity levels signify that human induced pollution is degrading Canaan Street Lake. Conductivity levels increased annually from 1998 – 2004, with a total increase of nearly 65% from original levels. Road salt is a probable factor for the increased conductivity levels, as sodium and chloride levels in the Lake have also risen. However, conductivity increases are also known to occur from most pollutants including: septic-system effluents, nutrient inputs, erosion, or any other substance that dissolves in water.

Recreational uses, especially those that utilize gasoline-powered engines, are also a source of pollutants. Typically, surface waters that serve as a drinking water supply should not be used as a recreational resource. Canaan Street Lake has a long history as a recreational amenity for Canaan and the surrounding region. To date, there is no direct evidence that the recreational activities enjoyed on the Lake are impairing its waters. However, recreational use still poses a significant risk to drinking water quality.

Finally, without a zoning ordinance, the Town has no way to regulate land use within the Watershed. Essentially, what this means is that in the future, any use – even those that are known sources of contamination to water resources – is possible. While it is difficult to envision, the development seen in the Watershed today is very different, and most probably less than, what will be seen in the Watershed in fifty to one hundred years. Studies show that as watersheds are developed and impervious cover increases, the water quality of its receiving waters is significantly degraded.

The Town of Canaan is in a unique position, in that it has the ability to protect its valuable drinking water resources before they are heavily impacted by surrounding land uses. In taking the initiative to develop a watershed protection plan now, the Town of Canaan has ensured that Canaan Street Lake will continue to supply quality drinking water and enrich the lives of residents and visitors alike.

Chapter 1 – Introduction

Clean, fresh water is necessary for life. Although seventy percent of the Earth is covered by water, only a small fraction (2.4 percent) is fresh water. Of that small fraction of freshwater, approximately ten percent (0.24 percent of the Earth's total water supply) is available for human use. The tiny fraction of available fresh water is put to work for many purposes and is often vulnerable to both natural and human induced contamination. As water has many competing uses, it is critical to manage our water resources wisely to ensure clean, fresh drinking water for present and future generations.

Recognizing the need to protect Canaan's drinking water supply, the Board of Selectmen appointed members of the community to serve on a Drinking Water Protection Committee (hereafter referred to as the Committee). The Board of Selectmen invited Granite State Rural Water Association¹ (GSRWA) to work with the Committee throughout the project. The goal of the Committee was to review the various threats to Canaan's drinking water supplies and develop a plan to protect Canaan's drinking water resources into the future.

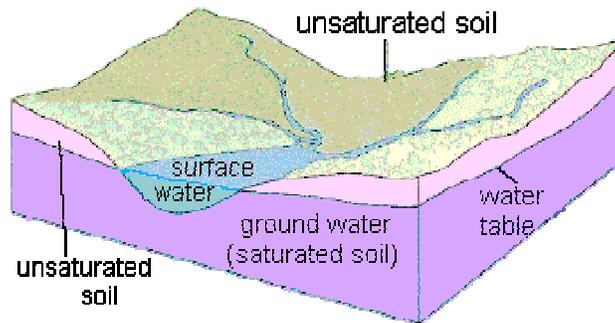
During its first two meetings, the Committee reviewed and discussed the nine public water supplies located within Canaan, Appendix A, and chose to focus its efforts only on the Canaan Street Lake watershed and the public water supply systems located within the watershed boundaries. The Canaan Street Lake watershed provides drinking water sources to three public water systems and a large number of private wells. Plans made to protect the watershed can serve as an adaptable model for the remaining five public water systems and drinking water resources.

This plan is the culmination of seven months of research, discussion, and decision-making by the Committee. The plan identifies potential contamination sources to water resources in the Canaan Street Lake watershed and provides specific recommendations to manage these potential threats. Additionally, the plan aims to increase the understanding of the Canaan Street Lake watershed and provide a meaningful foundation for decision-making. The Town of Canaan is safeguarding its valuable water resources by implementing a Watershed Protection Plan.

Chapter 2 – Why Watershed Planning

The Canaan Street Lake watershed is defined as the area of land and network of wetlands, ponds, and tributaries that drain to Canaan Street Lake. Canaan Street Lake's surface water basin is the land area from which all surface water drains toward the lake. The Lake's groundwater drainage basin is the subsurface area through which groundwater flows to the lake from higher elevations. One of the most important watershed concepts is that surface water and groundwater are inextricably linked. However, depending on factors such as soils, slopes, and surface cover, the Lake's surface and groundwater drainage basins may be different sizes. The surface water basin may be larger or smaller than the groundwater basin and vice versa.

¹ GSRWA is a federally funded, non-profit organization that provides technical and planning assistance to rural water and wastewater systems throughout New Hampshire. GSRWA services are provided at no cost to Towns and public water systems.

Figure 1 Depiction of a watershed

Source: U.S. Geological Survey

Watershed planning and management is an approach to protecting water quality and quantity that focuses on the whole watershed. Rather than manage sources of pollution individually (such as limiting the amount of wastes discharged from a pipe into a stream), a watershed plan sets a framework to manage a variety of pollutants from multiple land use activities (including development, transportation, agriculture and forestry) that may originate anywhere in the watershed. Watershed management is also about bringing various stakeholders together in partnership to protect watershed structure and function that is essential to maintaining good water quality.

Increasingly, federal, state, and local agencies are emphasizing the importance of planning on the watershed level to control nonpoint source pollution. Nonpoint source pollution is pollution that originates from sources that are not easily attributable to a specific location or point. For instance, a septic system pipe discharging raw sewage into a lake or stream is considered a point source, whereas surface water drainage and runoff carrying herbicides and pesticides from lawn care is nonpoint source pollution. Nonpoint source pollution is the primary source of surface water pollution in the United States.

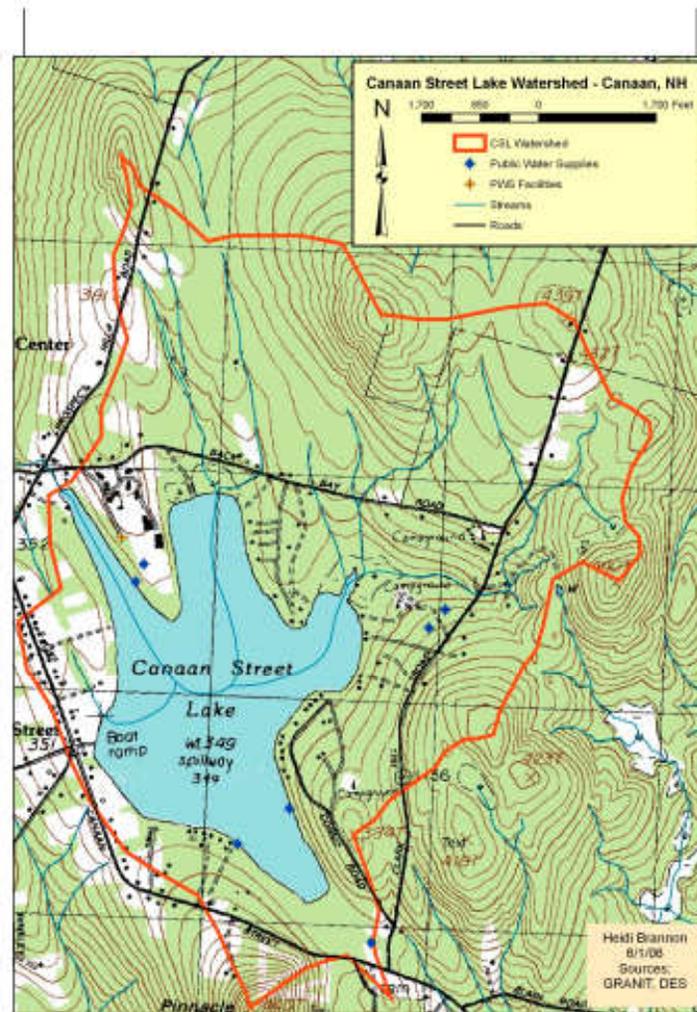
Monitoring and modeling studies indicate that nonpoint pollutant loads are directly related to watershed imperviousness (impervious cover does not allow water to infiltrate into soils). Research shows that when impervious cover exceeds ten percent of the total watershed area, pollutant loads increase and stormwater runoff makes stream channels unstable and easily eroded (Schueler, 2002). Once watershed imperviousness exceeds approximately twenty-six percent, streams become “non-supporting” – meaning stream channel stability and biodiversity are so seriously degraded that they cannot be maintained (Schueler, 2002).

Managing land use in a watershed is critical to its future wellbeing. By protecting the quality of Canaan Street Lake at a watershed level, the Town is ensuring that the Lake will continue to enrich the lives of residents and visitors alike.

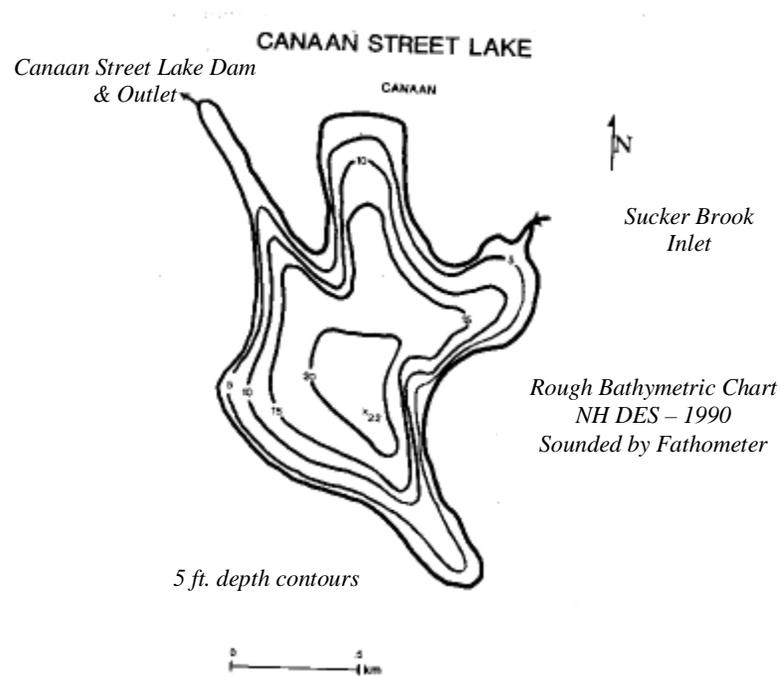
Chapter 3 – Description of the Canaan Street Lake Watershed

Located in the heart of Canaan, the Canaan Street Lake watershed is a relatively undeveloped watershed, with good water quality. The watershed is relatively small, encompassing approximately two-and-a-half square miles and is located entirely in the Town of Canaan. Topography in the watershed ranges from gently sloping areas around the lake (with gradients of three to eight percent) to steep slopes (with gradients of eight to sixty percent) in the remainder of the watershed (Grafton County Soil Survey). The highest elevation point in the watershed is approximately 1,476 feet, while the lowest point is 1,142 feet at the spillway of the Canaan Street Lake Dam.

Figure 2 Topographic Map –Canaan Street Lake Watershed



Canaan Street Lake is 303 acres and relatively shallow in depth. The average depth of the Lake is approximately eleven feet and the maximum depth of the Lake is twenty-two feet (Figure 3). It is estimated, that the lake has a volume of 4.1 million cubic meters or 3,330 acre-feet, and is predominantly spring fed (Hoyle, Tanner & Assoc., 2004). Sucker Brook, located in the northeast cove of the lake, is the only surface water inflow to the lake. In years of very dry weather, Sucker Brook flows only seasonally. The lake is irregular in shape and has four miles of shoreline.

Figure 3 Bathometric Map – Canaan Street LakeNatural Resources

Within the watershed there are a variety of valuable natural resources that are not only aesthetically pleasing but provide valuable ecological services as well. For the most part, the watershed is predominantly forested. Natural vegetative cover provides a variety of habitat and also helps to maintain clean water supplies by filtering freshwater and reducing soil erosion and sedimentation (World Resources Institute, 2000).

Upon a review of Town files, no active timber harvesting is occurring in the watershed. However, forestry activities have taken place in the northern portion of the watershed in the recent past. Timber is also harvested when forested lots are converted for development purposes.

Wetland complexes contribute greatly to water quality protection because they remove excess nutrients and sediments that contribute to water degradation. Wetlands also provide valuable habitat for a variety of species. According to a land use analysis completed by NH DES in 2002, wetlands comprise 16.3 percent of land cover in the watershed. From the analysis, it appears that most wetlands found in the watershed are associated with the Lake with the largest wetland complexes in the watershed on the northern lakeshore and at the tip of the lake's southern cove. These lakeshore wetlands play an important role in mitigating point and nonpoint pollution associated with land uses found along the shoreline.

According to the New Hampshire Natural Heritage Bureau, the following rare species and exemplary natural communities occur in the Canaan Street lake Watershed. (Appendix B)

- Rich mesic forest²

² "Rich mesic forests are hardwood forests growing on soils with relatively high levels of moisture, mineral

- Ginseng (*Panax quinquefolius*)
- Reversed Bladderwort (*Utricularia resupinata*)
- Squirrel Corn (*Dicentra canadensis*)
- Common Loon (*Gavia immer*)

Care should be taken to protect these rare species along with the valuable ecosystem services provided by the natural landscape.

Drinking Water Resources

Within the watershed there are three public water systems. These systems are: the Canaan Water Department, Cardigan Mountain School, and Crescent Campsites. A public water system is classified as any water system that provides the public with “piped water for human consumption if such a system has at least fifteen service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year” (New Hampshire Administrative Rule Env-Ws 300)³. Although there are three public water supplies in the watershed, no municipal water services extend into the area to serve watershed residents. Instead, Canaan residents living within the Canaan Street Lake watershed rely on private wells for their drinking water supply.

Table 1 Active Public Water Supplies – Canaan Street Lake Watershed

System Name	Address	System Type	Population	Well Type	Well Depth	Yield (gpm)
Canaan Water Department	Fernwood Farms Road	Community	600	Surface	--	1 million (gpd)
Cardigan Mountain School (Well #1)	Back Bay Road	Community	300	BRW	540	23
System Name	Address	System Type	Population	Well Type	Well Depth	Yield (gpm)
Cardigan Mountain School (Well #2)	Back Bay Road	Community	300	BRW	525	12
Crescent Campsites-North	Fernwood Farms Road	Non-community Transient	211	BRW	500	3
Crescent Campsites-South	Fernwood Farms Road	Non-community Transient	25	BRW	190	15

Source: NH DES

The Canaan Water Department is the only water system that obtains its water from Canaan Street Lake, which has served as Canaan’s municipal water supply since 1890. The Water Department supplies drinking water to approximately six hundred residents and local businesses in the Village area. The surface intakes for the Town’s water treatment plant are located in the Lake’s southern cove. Water is pumped

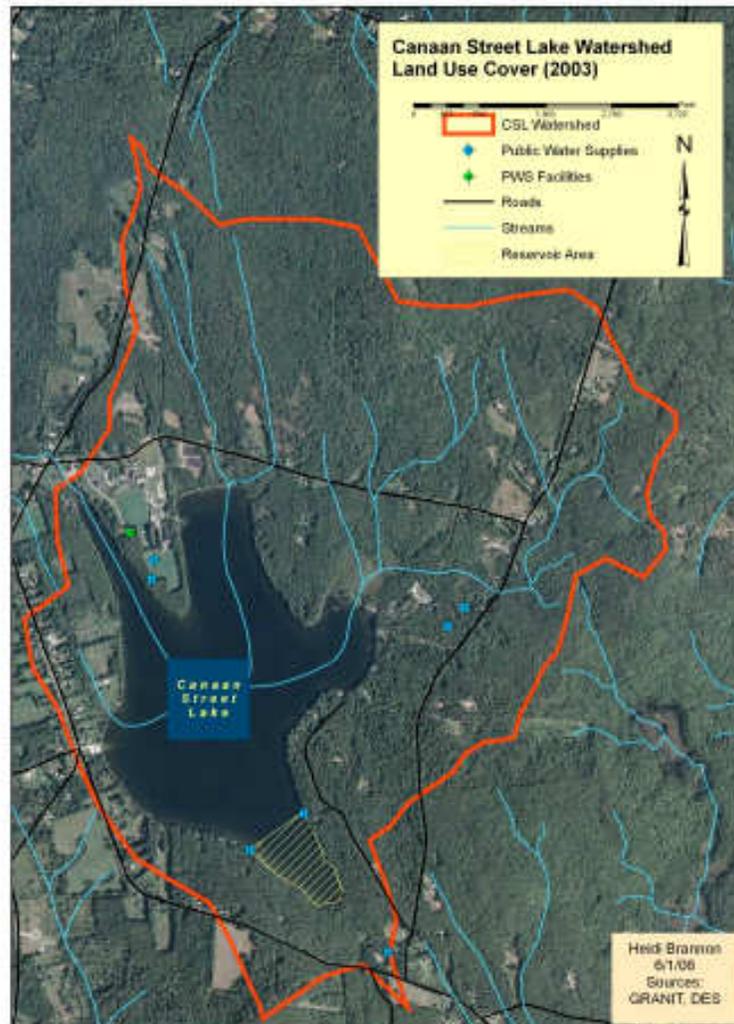
nutrients, and high-quality organic matter. These forests grow at a faster rate and may have about twice as many species of herbs and shrubs as other forest types” (NH Natural Heritage Bureau).

³ Public water supplies are further classified into three categories based upon the level of service provided. System classifications are: Community Water Systems, Non-community non-transient systems, and Non-community transient systems.

from the surface intakes into three slow sand filtration boxes at the water treatment plant. Once the water is filtered, it is disinfected and piped to a 294,000-gallon storage tank for distribution to the system's service connections. The Water Department has a safe yield of one million gallons per day from the Lake (Hoyle, Tanner and Assoc., 2004).

Cardigan Mountain School and Crescent Campsite rely on bedrock wells for their water source. Management activities taken to protect water quality throughout the watershed will benefit groundwater sources, including the numerous private wells present in the watershed. Source protection plans for Cardigan Mountain School and Crescent Campsites can be found in Appendix C.

Figure 4 Aerial Map – Canaan Street Lake watershed



Land Use

For the most part, the Canaan Street Lake watershed remains largely undeveloped. Camp style residences predominate on the eastern shore of the Lake. The western shore was developed in the mid-1800s and has many large homes from that time period. Except for the Historic District, there are no zoning requirements

within the watershed. The Historic District is limited to the area bordering Canaan Street⁴. Within the Historic District, new lots must meet a two-acre minimum and only low-intensity uses that are consistent with stated architectural and environmental criteria are allowed.

The majority of homes around Canaan Street Lake are used seasonally, although some have been converted to full time residences. While it appears that the majority of the shoreline is forested, in places where homes and summer camps are located, vegetative buffers⁵ have been removed. And, in some instances, notably along the Lake's western shore, large areas of lawn cover extend directly to the lakeshore.

Cardigan Mountain School, located on the northwestern peninsula of the lake, occupies a seventy-three acre parcel of lakefront property along with larger landholdings within the watershed. Besides being the largest property holder on the lake, Cardigan Mountain School is also the most intensive land use within the watershed. The School maintains numerous school buildings, dormitories, athletic fields, and open areas. While the greater part of CMS property is developed, the School retains a vegetative buffer along the most of its shoreline.

The second most intensive land use along the lakeshore is Crescent Campsites. Crescent Campsites, located on a twenty-five acre parcel along the northeastern shore of Canaan Street Lake, is open seasonally from May through October. Facilities located at Crescent Campsites include: seventy-six campsites with water, sewer, and electrical hookups, a beach and swimming area on Canaan Street Lake, a boat launch, and other camping amenities. Visitors to Crescent Campsites tend to be seasonal campers who stay at the Campsites for an extended period of time. The owners of Crescent Campsites are in the midst of renovations to their property. Once renovations are complete, they will offer seventy-five seasonal campsites and eight transient tent sites (S. Chiodo, personal communication).

Water Based Recreational Resources

Canaan Street Lake has a long history as recreational resource. The Lake provides many recreational activities, including: swimming, fishing, boating, water-skiing, ice fishing, ice-skating, snowmobiling, and the occasional seaplane landing. Water resources in the watershed are also important for habitat and fisheries, significant natural communities, aesthetics, and drinking water supplies.

The Town Beach, located off Canaan Street, is a frequent destination for Canaan residents and visitors alike. In the summer time, the beach serves as an access point for swimmers and boaters. In the winter time the beach is used to access the lake ice for ice fishing and snowmobiles. Additionally, there are many private beaches around the lake at individual residences and campgrounds that provide access to the lake for recreational purposes.

The boat ramp at the Town Beach that is open to all boaters, except one and two person personal watercraft (jet skis). Typically, during the summer holidays and weekends, there are about six to seven motorboats on the water. Motorboats range from pontoon boats to high-speed powerboats used for waterskiing and tubing activities. From observation, it appears that about fifty percent of residents with waterfront property have a docked motorboat. Additionally, Crescent Campsites, located off Fernwood Farms Road, operates a boat ramp and maintains three boat docks, with a total capacity of fourteen boats, for seasonal campers. Canoes, kayaks, and sailboats are also used with increasing frequency on Canaan Street Lake.

⁴ "The Canaan Historic District... includes properties extending from the Old North Church, southward along Canaan Street, past the Museum and Meeting House, and continuing past the Pinnacle House, to approximately the highest point on Canaan Street. The easterly boundary is Canaan Street Lake, and the westerly boundary is a line 500 feet west of Canaan Street" (Canaan Historical Society).

⁵ Vegetative buffers (also known as riparian buffers) are strips of naturally vegetated land adjacent to streams, rivers, and lakes that help maintain water quality. Research has shown that vegetative buffers: help filter runoff by removing sediment and other pollutants, protect stream banks and shoreline from erosion, and provide wildlife benefits.

The Canaan Water Department's surface intakes are located approximately 3,000 feet southeast of the Town Beach. According to Env-WS 386.18, Protection of the Purity of Canaan Street Lake and Its Watershed, recreational activities are prohibited in the surface intake area. (Appendix D)

Chapter 4 - Water Quality of Canaan Street Lake

The State has collected water quality data for Canaan Street Lake since 1979. Data collection is facilitated through two programs: the New Hampshire Lakes and Ponds Inventory, which classifies lakes and ponds throughout the state based on their trophic level⁶; and the Volunteer Lake Assessment Program (VLAP), which utilizes local volunteers to collect annual water quality samples. The New Hampshire Department Environmental Services (NH DES) collected samples for the Lakes and Ponds Inventory from Canaan Street Lake in 1979, 1991, and 2005⁷. The Canaan Lake Association has collected VLAP data annually since 1988.

According to data collected through both sampling programs, the water quality of Canaan Street Lake has remained relatively stable. Key parameters worth noting are: the trophic level, flushing rate, and the present elevated levels of sodium and chloride.

While the trophic level of the lake has yet to be determined for the 2005 inventory, the 1979 and 1991 inventories classified Canaan Street Lake as oligotrophic. Oligotrophic lakes are characterized by clear water, low levels of nutrient enrichment, low productivity, few aquatic plants, the presence of a cold-water fishery, and a high dissolved oxygen content. It is unlikely that the Lake's trophic level has changed since the 1991 classification, as the majority of its water quality parameters have remained unchanged. The only parameters that have increased since 1991 are sodium, chloride, and the water's apparent color.

The 1991 Lakes and Pond Inventory notes that Canaan Street Lake has a flushing rate of 0.7 times per year, which is significantly lower than the state average⁸. Based upon the calculated flushing rate, it takes approximately seventeen months for the water in Canaan Street Lake to be replaced by new fresh water. The low flushing rate increases the Lake's vulnerability to nutrient and/or pollutant inputs because they are not readily flushed from the Lake by fresh water. Instead, excess nutrients and pollutants have a longer residence time in the lake and may have more significant negative impacts on water quality.

Under certain conditions, the slow flushing rate, combined with the Lake's relatively shallow depths, may make the lake more susceptible to eutrophication. This is especially true if nutrient levels in the lake increase. If the Lake's water quality parameters shift towards those that are more characteristic of a eutrophic lake, it is possible that Lake water will require more intensive treatment or become unsuitable as a drinking water source. Eutrophic lakes are highly productive and often recognizable by an abundance of aquatic plants, mats of algae, or surface scums.

VLAP data also indicates similar issues. Table 1, on page ten, summarizes VLAP data along with selected parameters from the Lakes and Ponds Inventory. For the most part, tested water quality parameters for Canaan Street Lake remain below the state average and are indicative of good water quality. However, annual increases in conductivity and the presence of toxic cyanobacteria are water quality concerns. (For a more in depth analysis of water quality parameters, please see Appendix E.)

⁶ A lake's trophic level is determined by a number of factors including: water transparency; nutrient enrichment; planktonic growth; presence of aquatic plants; type of fishery (cold or warm water species); and dissolved oxygen content. These factors give an indication of the lake's productivity level. Lakes with low levels of productivity are classified as oligotrophic and highly productive lakes are considered eutrophic. Lakes that fall in between the oligotrophic and eutrophic classifications are mesotrophic.

⁷ Although the data to update the 1991 Lakes and Ponds Inventory was collected in 2005, NH DES is in the process of analyzing the data to determine if Canaan Street Lake's classification has changed.

⁸ Average flushing rate for lakes in New Hampshire is 3.0 times per year.

Table 2 Summary of Tested Water Quality Parameters – Canaan Street Lake

<i>Tested Parameter</i>	<i>Lake Average</i>	<i>Comments</i>	<i>State Average</i>
Biological Parameters			
Algal Abundance (<i>Chlorophyll-a</i>)	2.50 mg/m ³	Average indicates “good” water quality. However, annual fluctuations in data make it difficult to discern a trend.	7.02 mg/m ³
Phytoplankton	Most frequently sampled: 1. <i>Dinobryon</i> 2. <i>Asterionella</i> 3. <i>Tabellaria</i>	Species are typical of NH’s less productive lakes and suggest good water quality. Overall, presence of phytoplankton is sparse.	N/A
Cyanobacteria	Sampled species: 1. <i>Anabaena</i> 2. <i>Microcystis</i> 3. <i>Coeleosphaerium</i>	<i>Anabaena</i> and <i>Microcystis</i> are toxic species of cyanobacteria. Relative abundance of either species is sparse and no toxic blooms have been documented.	N/A
Transparency (<i>Secchi Depth</i>)	4.8 meters “Exceptional”	Values fall into either “good” or “exceptional” water clarity categories. Max – 6.3 meters (1999) Min – 3.3 meters (2002)	3.7 meters “Good”
Chemical Parameters			
Total Phosphorous	7.75 ug/L (epilimnion) 8.38 ug/L (hypolimnion)	Levels have fluctuated but trend is not increasing. Averages are considered “ideal” concentrations.	12 ug/L (epilimnion) 14 ug/L (hypolimnion)
Nitrogen ⁹	<i>Nitrate</i> < 0.05 mg/L <i>Total Kjeldhal Nitrogen</i> < 0.25 mg/L (summer) 0.3 mg/L (winter)	Measurements for nitrate and Total Kjeldhal Nitrogen are relatively unchanged from 1991 values	N/A
pH	7.09 (epilimnion) 6.97 (hypolimnion)	Lake pH is approximately neutral.	6.6 – slightly acidic
Acid Neutralizing Capacity	9.09 mg/L Highly Sensitive to Sensitive	Values have fluctuated widely from year to year. Max – 10.95 mg/L (1988) Min – 6.5 mg/L (1998)	6.7 mg/L – Highly Sensitive
Sodium ¹⁰	6.5 mg/L	71% increase from 1991 value (3.8 mg/L) 160% increase from 1979 value (2.5 mg/L)	N/A

⁹ Values for nitrogen are from the NH DES Lakes and Ponds Inventory (2005). Nitrogen concentrations are measured in two forms nitrates and Total Kjeldhal Nitrogen.

¹⁰ Values for sodium are from the NH DES Lakes and Ponds Inventory (2005).

<i>Tested Parameter</i>	<i>Lake Average</i>	<i>Comments</i>	<i>State Average</i>
Chloride ¹¹	11 mg/L	120% increase from 1991 value (5 mg/L) 267% increase from 1979 value (3 mg/L)	N/A
Conductivity	75 uMhos (2005)	While the 2005 value decreased 4.6% from 2004 (78.46 uMhos), the overall trend is increasing.	A value of 100 uMhos is indicative of human impacts.
Apparent Color ¹²	Summer Ave. 20 Winter Ave. 24.5	Water is clear to light tea colored. The color value has increased slightly since the 1991 Inventory when it measured 18 color units.	N/A
Dissolved Oxygen & Temperature	64.9% (hypolimnion) 69° F (hypolimnion)	Values have fluctuated annually. Max – 96.6% (2002) Min – 3.2% (1996)	N/A
Other Parameters			
Turbidity	0.4 NTUs (epilimnion) 0.5 NTUs (hypolimnion)	Sampling indicates that turbidity is low. However, concern exists over effects of motor boating on turbidity.	Max – 22.0 NTUs Median – 1.0 NTUs Min – 0.1 NTUs
Bacteria ¹³ (<i>E. coli</i>)	20 <i>E. coli</i> /100 mL	Samples from designated beach areas are not to exceed 88 <i>E. coli</i> /100 mL.	N/A
Invasive & Exotic Plant Species	Purple Loosestrife	Present in wetland on western shore near Town Beach and near the Lake's outlet.	N/A

Increased conductivity is directly related to human activity within the watershed. Under “natural” conditions, a lake’s conductivity typically remains constant. Any major changes in conductivity over the course of several years, or within a very short period of time, indicates that pollution may be occurring from sources such as: road salt application; faulty septic systems; agricultural runoff; urban runoff; or development activities. Considering that sodium and chloride concentrations have also increased in Canaan Street Lake, the application of road salt to Canaan Street and other paved areas in the watershed is a probable cause for conductivity increases. However, effluent from aging septic systems and runoff from residential land uses around the lake are another potential source of pollutants that contribute to increased conductivity. If nutrient inputs are a factor in the Lake’s increased conductivity, there is the potential for greater algal growth, which includes blooms of cyanobacteria.

While cyanobacteria are naturally present in all NH lakes, they serve as a reminder of a water body’s delicate balance (VLAP, 2003). Typically, as nutrient concentrations in a water body increase, so does the abundance of cyanobacteria. Increased nutrient additions from surrounding land uses, like applying fertilizers to lawns, could create favorable conditions for a cyanobacteria bloom. The toxic cyanobacteria *Anabaena* and *Microcystis* are present in Canaan Street Lake. *Anabaena* produces neurotoxins that can

¹¹ Values for chloride are from the NH DES Lakes and Ponds Inventory (2005).

¹² Value for apparent color is from NH DES Lakes and Ponds Inventory (2005).

¹³ The average given for bacteria reflects only two sampling periods, which took place in 2003 and 2004.

interfere with nerve functions almost immediately upon ingestion and *Microcystis* is a hepatotoxin that attacks liver functions (VLAP, 2003). The ramifications of a toxic algae bloom in Canaan Street Lake would be significant, as prevailing winds push any matter suspended in the lake towards the Water Department's surface water intakes. The water treatment facility is not able to remove such dangerous toxins from the water supply.

The only facet of the Lake's water quality that poses a challenge for water treatment is the presence of organic matter. During water treatment, organic matter, such as algae and plant detritus, combines with chlorine, used to disinfect the water, and forms carcinogenic disinfectant byproducts (DBPs). To address the health risks caused by DPBs, the Environmental Protection Agency (EPA) recently lowered the maximum amount of DBPs allowable in community drinking water supplies. Since the rule change, the Canaan Water Department has not been able to meet the new standard. While lowering DBPs in the water supplied by the treatment plant will require a treatment upgrade, increases in the Lake's turbidity would compound the current treatment problem.

Turbidity is a water quality concern because turbidity measures the amount of suspended materials in the water. If turbidity is not eliminated prior to disinfection, organic matter attached to sediments will combine with chlorine to form carcinogenic DBPs. As a result, increased turbidity will lead to increased treatment costs because sediments and organic matter must be completely removed prior to water disinfection. Although VLAP results indicate that turbidity is low in Canaan Street Lake, studies show that in shallow lakes turbidity increases with motor boating. Boating affects turbidity because movement of the boat across the water's surface, along with action from the prop, stir-up bottom sediments in shallow areas. The re-suspended sediment takes many hours to settle out of the water column and makes the water more turbid (Yousef et al., 1980). Activities that cause erosion and the subsequent sedimentation of surface waters are also sources of turbidity.

While all the data collected for Canaan Street Lake indicates good water quality, it must be noted that testing does not take place frequently enough to accurately determine water quality trends. For example, VLAP sampling takes place once a year in July or August. While the sampling period does help track water quality from year to year, it does not provide enough information to accurately determine seasonal changes in water quality trends. If sampling were completed more frequently, it would be possible to ascertain more accurate trends in seasonal values. For instance, understanding seasonal trends in total phosphorous will help determine if nutrient enrichment¹⁴ is a concern. Accurately identifying water quality trends is critical to understanding lake health and helps identify necessary corrective actions.

Chapter Five – Identified Threats & Management Objectives

A review of potential contamination sources (PCSs) was completed in order to identify areas where corrective and preventative measures in the watershed are necessary. The review included information compiled from a variety of sources including: NH DES source water assessment reports, a database search using NH DES on-line OneStop Database, a review of town documents, and a windshield survey of the watershed.

All identified PCSs threaten not only the environmental health of Canaan Street Lake but also the drinking water supplied by the Canaan Water Department. Any decline in the Lake's water, which is the Town's municipal water source, will eventually increase the Department's treatment costs. Under extreme circumstances, degradation of the Canaan Street Lake's water quality could force the Town of Canaan to

¹⁴ Nutrient enrichment is a water quality concern because under the right conditions, algae and aquatic plants will continue to grow and multiply well beyond the amount needed to support the food web. The excessive growth, and the subsequent die off, of algae and aquatic plants can seriously impact water quality, cause fish kills, and create unpleasant taste and odor problems (Mason, 2002).

change to another drinking water source. New sources of water are costly to develop and come with no guarantee that water quantity or quality will meet Canaan's needs.

5.1 Land Use Threats

Below is a review of land use threats identified within the watershed. Each land use topic is followed by management objectives and corresponding strategies of achievement. While the land use topics are in no order of significance, the listed management objectives and the strategies for achievement are given hierarchically in order of importance. (The Committee's recommendations are also provided in tabular format in Appendix F.)

I. Road Management

Roads allow for the movement of people, goods, and services important to our daily lives. However, road surfaces accumulate pollutants deposited from vehicles during travel. Typical pollutants associated with roads are: nutrients, metals, oils and grease, salts, and volatile organic compounds. Road drainage systems also collect contaminants from atmospheric deposition, soil erosion, street dirt and litter, leaf litter, and animal waste (Jeer et al, 1997). Many of the substances that accumulate on roadways are toxic and have negative health effects on humans and the environment. When a storm event happens, these pollutants are washed from the road surface, especially paved, impervious roads, into nearby surface waters, or infiltrate into groundwater. Potential spills of hazardous materials and fuels during transport or vehicular accidents also represent a high risk to water quality, especially since many transportation routes run alongside surface water resources.

In the Canaan Street Lake watershed, there are approximately 4.7 miles of public roads, maintained by either NH DOT or the Town of Canaan, and many private roads and driveways. Of primary concern is the portion of Canaan Street, which is in close proximity to Canaan Street Lake. Water quality concerns regarding this portion of the road stem from poor drainage and the application of road salt. While road salt is applied to the road for winter safety, it is extremely soluble in water and can contaminate wells and surface waters. At high concentrations salt can impact human and environmental health. (Sodium causes hypertension in humans, while chloride is toxic to fish and aquatic organisms.)

Water quality data collected for VLAP indicates that conductivity levels have significantly increased in Canaan Street Lake since sampling began in 1988. According to NH DES's recent update of its Lakes and Ponds Inventory, sodium and chloride levels have also increased over the last twenty years. Road deicing materials are a known contributor to increased conductivity values. During storm and snowmelt events, runoff from Canaan Street travels towards the Town Beach, where it runs directly into the Lake.

Additionally, dirt roads in the watershed also pose challenges to water quality. For example, the erosion of earthen drainages along Fernwood Farms Road contributes a significant amount of sediment to Sucker Brook, which is Canaan Street Lake's primary inlet. Sediment has negative environmental effects because it buries aquatic habitat, increases water temperature, decreases dissolved oxygen, and increases turbidity (Jeer et al., 1997).

After reviewing the status of public roads within the watershed and their associated potential contaminants, the Committee developed the following objectives to address identified issues.

Objective #1: Resolve drainage issues along Canaan Street with the assistance of New Hampshire Department of Transportation (NH DOT).

Objective #2: Reduce the application of deicing agents along Canaan Street in areas in close proximity to the lake.¹⁵

¹⁵ The Committee is aware of the unsafe road conditions caused in a previous experiment where NH DOT eliminated road salt applications to Canaan Street. The Committee is not suggesting that this experiment be

Objective #3: Remediate drainage issues on town maintained roads.

Objective #4: Establish town road standards for the watershed to ensure that new roads do not negatively impact water quality.

Strategies for Achievement:

- A.** Implement a comprehensive and collaborative town road maintenance management program in the watershed that safeguards public safety, identifies ecologically sensitive areas, identifies corresponding low salt zones, and uses techniques for minimizing the use of de-icing materials.
- **Potential Lead Agency & Partners:** Board of Selectmen, Road Agent, Canaan Water Department, NH DOT, NH DES, University of New Hampshire Stormwater Center
 - **Potential Funding Source:** NH DOT, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program, Town of Canaan
 - **Benchmark:** A comprehensive road maintenance plan is established for roads within the watershed. The plan is well understood and put into action by the Board of Selectmen and the Road Agent and the requirements of the plan are met by the Highway Department.
- B.** Work with NH DOT to identify and resolve drainage issues on sections of Canaan Street in close proximity to Canaan Street Lake.
- **Potential Lead Agency & Partners:** Board of Selectmen, NH DOT, Canaan Road Agent, Canaan Water Department, NH DES
 - **Potential Funding Source:** NH DOT, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Drainage issues are identified and resolved so that road runoff no longer enters Canaan Street Lake.
- C.** Work with NH DOT to reduce winter salt application along the portion of Canaan Street that borders Canaan Street Lake.
- **Potential Lead Agency & Partners:** Board of Selectmen, NH DOT, Road Agent, Canaan Water Department, NH DES
 - **Potential Funding Source:** NH DOT, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program,
 - **Benchmark:** Salt application on state maintained roads in close proximity to Canaan Street Lake is reduced or eliminated.
- D.** Identify appropriate stormwater management methods (e.g. vegetative buffer strips, swales, or ditching) to resolve erosion problems along Fernwood Farms Road that contribute sediment to Sucker Brook.
- **Potential Lead Agency & Partners:** Board of Selectmen, Road Agent, Canaan Water Department, NH DES, University of New Hampshire Stormwater Center
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Road drainages along Fernwood Farms Road are stabilized so that the erosion of sediment no longer impacts Sucker Brook.
- E.** Identify appropriate stormwater management methods to minimize stormwater runoff from the Town Beach parking area from entering Canaan Street Lake.

repeated. However, with improved drainage and a properly engineered road base, it is expected that the applications of de-icing chemicals could be dramatically reduced.

- **Potential Lead Agency & Partners:** Board of Selectmen, Road Agent, Canaan Water Department, NH DOT, NH DES, University of New Hampshire Stormwater Center
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Runoff is prevented from entering Canaan Street Lake at the Town Beach.
- F. Create a road design standard that mitigates stormwater runoff and minimizes the negative environmental effects of any new town roads constructed within the watershed.
- **Potential Lead Agency & Partners:** Planning Board, Board of Selectmen, Road Agent, University of New Hampshire Stormwater Center, NH DOT, NH DES
 - **Potential Funding Source:** Town of Canaan
 - **Benchmark:** Future road design and construction will minimize impact on water quality and the environment by better managing stormwater runoff.

II. Septic System Management

A septic system processes and provides treatment for wastewater generated from flushing toilets, taking showers, doing laundry, and disposing of anything down a sink or other drains. A properly functioning septic system can process household wastewater and destroy disease-producing bacteria. However, when not properly maintained or used, septic systems pose a significant risk to water quality and human health. When functioning improperly or incorrectly sited, septic systems are potential sources of bacteria, viruses, and protozoa, which can cause gastrointestinal illness, cholera, hepatitis A, or typhoid if consumed. Additionally, if improperly used, such as for the disposal of paints, solvents, petroleum products and other household hazardous wastes, septic systems can be a source of chemical compounds (Jeer et al., 1997). All residences and facilities located within the watershed rely on septic systems to process wastewater as the municipal sewer system does not extend into the watershed.

Regular maintenance of septic systems requires that the accumulated wastes in the septic tank be pumped out approximately every three to five years. Unfortunately, once installed, individual systems often receive little attention from homeowners and problems may go unnoticed until system failure occurs. Septic failures can occur if: a septic system is improperly sized and more wastewater is entering the system than it was originally designed to handle, by improperly disposing of household hazardous wastes, and if soils are not suitable for wastewater treatment and the installation of a septic system (EPA).

It is difficult to assess the current status of septic systems in the Canaan Street Lake watershed. Town records provide little information regarding septic system types and installation dates for parcels within the watershed. It is estimated however that approximately fifty percent of parcels¹⁶ in close proximity to the shoreline may have aging septic systems that are not designed to process wastewater and protect water quality. Along with road salt, failing septic system may also be responsible for the Lake's increased conductivity.

Based upon the available information¹⁷, the Committee developed the following objectives for septic system maintenance:

Objective #1: Minimize the negative impacts of existing septic systems in the watershed through proper maintenance and timely replacement.

Objective #2: Minimize the environmental impact of new septic systems within the watershed.

Strategies for Achievement

¹⁶ Estimation is based on an informal windshield survey of the properties around Canaan Street Lake and a review of available town documents.

¹⁷ The Committee is aware that the Town must collect more data regarding the status of septic systems in the watershed in order to fully determine the feasibility of recommendations C – F.

A.Conduct education and outreach about proper use and maintenance of septic systems.

- **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Canaan Water Department, Canaan Drinking Water Protection Committee, Canaan Lake Association, Cardigan Mountain School
- **Potential Funding Source:** Town of Canaan, NH DES Small Outreach and Education Grant program for Nonpoint Pollution, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
- **Benchmark:** Homeowners within the watershed properly use and maintain their septic systems.

B.Conduct a septic system survey to collect information about septic systems within 250 feet of Canaan Street Lake. Collect information regarding system type, installation date, location, and maintenance.

- **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Canaan Water Department, NH DES, Canaan Lake Association
- **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
- **Benchmark:** Pertinent information is collected and on file for septic systems located within 250 feet of Canaan Street Lake.

C.Consider adoption of a Septic System Tracking Program for parcels in the watershed within 250 feet of Canaan Street Lake. A Tracking Program would facilitate the registration of identified septic systems and encourage or require regular inspection and maintenance.

- **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Health Officer, NH DES, NH Department of Health and Human Services
- **Potential Funding Source:** NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
- **Benchmark:** Town adopts a Septic System Tracking Program to improve septic system maintenance.

D.Consider implementing a Municipal Septic System Maintenance Program for properties in the watershed and within 250 feet of Canaan Street Lake. Under a Municipal Septic System Maintenance Program, the Town could assume inspection and maintenance of specified septic systems.

- **Potential Lead Agency & Partners:** Board of Selectmen, Water Department, Health Officer, Municipal Wastewater Treatment Department
- **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
- **Benchmark:** The Town has determined the feasibility of implementing a Municipal Septic System Maintenance Program and is able to make a decision whether or not to proceed towards commencing the program.

E.Establish a minimum set back of 125 feet from Canaan Street Lake and its tributaries, where feasible, for new and replacement septic systems

- **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, NH DES, Upper Valley Lake Sunapee Regional Planning Commission
- **Potential Funding Source:** N/A
- **Benchmark:** Septic system setback from Canaan Street Lake and its tributaries is 125 feet.

F. Consider constructing a municipal sewer system to homes and facilities near Canaan Street Lake in the future.

- **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Canaan Wastewater Department, Cardigan Mountain School
- **Potential Funding Source:** Town of Canaan, undetermined
- **Benchmark:** A feasibility study to serve homes and facilities in close proximity to Canaan Street Lake with a municipal sewer system is complete and the Town has considered whether or not to proceed with extending municipal sewer services.

III. Recreational Management

Canaan Street Lake has a long history as a recreational resource for the Town of Canaan, the surrounding area, and even the greater New England region. Recreational activities that take place on/or in Canaan Street Lake are: boating (both motorized and non-motorized), swimming, fishing, waterskiing, ice fishing, snowmobiling, and occasional seaplane activities. While these activities are beneficial to those that utilize the lake for recreation, recreational activities can have a negative impact on the lake's water quality and jeopardize the lake as a drinking water source.

The American Water Works Association discourages body contact recreation, e.g. swimming, and use of gasoline engines in water sources that supply public drinking water (AWWA, 2004). Swimming and other body contact activities have the potential to introduce pathogens, such as cryptosporidium and other fecal contaminants, into water supplies. Some of these pathogens, like cryptosporidium, are very difficult to treat and are resistant to disinfection.

Gasoline-powered engines, especially carbureted two-cycle engines, pose a significant risk to drinking water resources. Carbureted two-cycle engines exhaust approximately thirty percent of their unburned fuel directly into the water (Correll, 1999). Depending on water and air temperatures, roughly half of the exhausted fuel evaporates immediately while approximately fifteen percent persists in the water column for some amount of time (Kratzenberg, 1997). Gasoline that is directly exhausted to the water column introduces volatile organic chemicals (VOC) into the lake, which are difficult to remove.

Two polluting substances associated with the operation of gasoline-powered engines are the gasoline additive MtBE and motor oil. A small amount of MtBE can render water undrinkable (NH DES). MtBE can cause kidney and liver damage. Once introduced into water supplies, MtBE is extremely difficult to remove and treat. While MtBE is being phased out of gasoline, the environmental effects of other gasoline oxygenates, like ethanol, are unknown (Susca, personal communication). Motor oil also persists in the environment and contains harmful metals and toxins (EPA). One pint of spilled motor oil can cause an oil slick approximately one acre in size, whereas a gallon of motor oil can contaminate up to one million gallons of water (EPA).

Required VOC testing of the Lake¹⁸, proscribed by NH DES Water Supply Engineering Bureau, show that VOCs have not been detected in the Lake. The last VOC sampling took place in July 2005. However, the sampling date occurred mid-week when motorboats are less likely to be using the lake. Depending upon the compound, some chemicals associated with fuels and motor oils will rapidly volatilize into the air, but others will persist in the water column. Additionally, as discussed earlier, motor boating may also increase the turbidity of Canaan Street Lake, which can lead to higher treatment costs and greater health risks.

Seaplane operation on Canaan Street Lake represents less of an environmental risk than lake contact activities and carbureted two-cycle engines. Risk of pollution from seaplanes is lower because seaplane exhaust is discharged to the air, aviation fuel does not contain MtBE or motor oils, and there is a minimal

¹⁸ In order to stay compliant with the Safe Drinking Water Act, the Canaan Water Department must conduct water quality tests to show that it meets water quality standards set by the EPA and NH DES.

amount of contact time with the water surface (Seaplane Association, 2000). Although risks to water quality from seaplanes are significantly lower, the size and layout of Canaan Street Lake requires seaplanes to take off and land near the surface water intakes. If a catastrophic seaplane crash were to occur close to the intakes, the effects could be significant and costly.

Finally, threats to water quality also occur from winter recreational activities when the lake freezes over. The presence of ice on the lake allows for ice fishing and motor vehicle operation on the lake. Operating vehicles on the ice allows for automotive fluids and deicing salts to be deposited on the lake surface. The refueling of snowmobiles, ice augers, and other gasoline-powered engines poses a contamination risk if gasoline is spilled on the lake or in close proximity to it. Fishing activities (in all seasons) may be a source of organics to the lake water if bait or fish parts are left on or disposed of in the lake.

Based upon the above information, the Committee developed the following objectives to address the risks posed to Canaan Street Lake by recreational activities:

Objective #1: Heighten recreational users awareness of potential water quality impacts to Canaan Street Lake.

Objective #2: Reduce impacts of current recreational uses on Canaan Street Lake's water quality.

Objective #3: Conduct more frequent water quality sampling in order to effectively evaluate the impacts of recreational activities.

Objective #4: Assess the impact that motorized boating has on Canaan Street Lake's water quality.

Strategies for Achievement

- A. Maintain and support the New Hampshire Lake Association's Lake Host Program.
 - **Potential Lead Agency & Partners:** Town of Canaan, Canaan Water Department, Canaan Lake Association, NH Lakes Association, NH DES
 - **Potential Funding Source:** NH DES Grants for Exotic Aquatic Plants; NH DES Milfoil and Other Exotic Plant Prevention Grants
 - **Benchmark:** Lake Host Program is supported and maintained.

- B. Conduct an Education & Outreach Campaign that targets recreational users and user groups (e.g. snowmobiling clubs) to inform them of the importance of protecting Canaan Street Lake's water quality.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Lake Association, Cardigan Mountain School, Area Schools, Recreational User Groups, Crescent Campsites, NH DES
 - **Potential Funding Source:** Town of Canaan, NH DES Small Outreach and Education Grant Program for Nonpoint Pollution, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Town is continually informing recreational users about the importance of protecting Canaan Street Lake.

- C. Encourage boaters to properly transport, handle, store, and use fuels and motor oil so that these contaminants are prevented from entering the lake.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Canaan Drinking Water Protection Committee, Canaan Lake Association, Area Schools, Recreational Groups, NH DES, Boating Industry

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- **Potential Funding Source:** Town of Canaan, NH DES Small Outreach and Education Grant Program for Nonpoint Pollution, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Boaters are well educated about the importance of properly handling fuels and oils.
- D.** In winter, limit refueling of gasoline-powered engines to shore and prohibit the use automobiles on lake ice.
- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Canaan Lake Association, Recreational Groups, NH DES, NH Department of Fish & Game
 - **Potential Funding Source:** undetermined
 - **Benchmark:** Gasoline-powered engines are refueled prior to being taken onto lake ice and automobiles are prohibited from traveling on the lake ice, with the exception of transporting bobhouses.
- E.** Continue existing water quality testing (VLAP) and increase the frequency of testing during the summer months.
- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Canaan Lake Association, Cardigan Mountain School, Mascoma Valley High School, Recreational Groups, NH DES
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Water quality testing of Canaan Street Lake continues and is conducted at more frequent intervals.
- F.** Study the effects that recreational activities and gasoline-powered engines have on the lake. Studies should include a survey of recreational activities, including those utilizing gasoline-powered engines (all seasons); types of engines used on the lake; and more frequent volatile organic chemical testing (especially during summer months).
- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Canaan Lake Association, Cardigan Mountain School, Area Schools and Universities, NH DES
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program;
 - **Benchmark:** Town has collected data on the impact that recreational activities have on the water quality of Canaan Street Lake, is able to determine their level of risk, and can develop recommendations to appropriately mitigate recreational impacts.
- G.** Study the effects motorized boating has on turbidity in Canaan Street Lake.
- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, , Canaan Lake Association, Area Schools & Universities, NH DES
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Town has completed a study on the impact motorized boating has on turbidity; can determine the appropriate level of risk to water quality; and develop further recommendations of how to mitigate negative impacts appropriately.
- H.** Consider establishing No Wake Zones in sensitive areas (near protected surface water intake) and shallow waters.

- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Canaan Drinking Water Protection Committee, Canaan Lake Association, NH DES, NH Department of Safety – Marine Patrol
- **Potential Funding Source:** undetermined
- **Benchmark:** No Wake Zones are established to protect sensitive areas and shallow waters.

IV. Land Use Management

Zoning regulation is a tool that allows communities to define and direct future land use by determining what land uses are acceptable in a given area. Without a zoning ordinance, the Town of Canaan has minimal oversight regarding future development and its subsequent land use. The lack of zoning is considered a potential contaminant source because any land use is acceptable in any given area, even those that are disruptive or potentially harmful.

Besides allowing potentially contaminating land uses, unregulated development of the Watershed could lead to its eventual “over-development.” According to a Build-Out Analysis of Canaan, under the current “no zoning” conditions an additional 451 residential units could be built within the watershed (Upper Valley Lake Sunapee Regional Planning Commission, 2004). Increased development also means a relative increase in impervious cover throughout the watershed. As noted earlier in Chapter 2, impervious cover decreases the ability of the watershed to provide valuable ecological services, increases nonpoint pollution loads, and negatively impacts local hydrology. Along with increasing impervious cover, residential development poses threats to water quality from several sources including: storage of household heating fuels; on-site septic systems; improper disposal of household hazardous wastes; and improper application of lawn and garden chemicals and fertilizers.

Presently, the only “zoning” district that exists within Canaan is the Historic District, which is located partially in the watershed. The Historic District encompasses the properties on either side of Canaan Street and dictates some property use restrictions. Lots within the Historic District may have low-impact commercial uses on the property and must meet a minimum two-acre lot requirement.

After careful review of risks that the lack of zoning poses to the quality of Canaan Street Lake the Committee has developed the following objectives:

Objective #1: Establish a Watershed Protection Area encompassing the Canaan Street Lake watershed.

Objective #2: Within the Watershed Protection Area, create a Shoreland Protection District to provide a higher level of protection in the immediate vicinity of Canaan Street Lake.

Strategies for Achievement

- A. Outreach and Education on why establishing a zoning district is critical to protecting the quality of Canaan Street Lake.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Water Board, Canaan Water Department, Canaan Drinking Water Protection Committee, Canaan Lake Association, NH DES
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Community has a better understanding of how a zoning district is beneficial and will help protect the water quality of Canaan Street Lake.
- B. Establish boundaries for the Watershed Protection Area that accurately reflect, and coincide with, the watershed boundary for Canaan Street Lake.

- **Potential Lead Agency & Partners:** Planning Board, Board of Selectmen, Canaan Water Department, NH DES, Upper Valley Lake Sunapee Regional Planning Commission
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** Boundaries of the Watershed Protection Area accurately reflect the watershed boundary for Canaan Street Lake.
- C. Develop lot requirements and land use restrictions within larger Watershed Protection Area. The Watershed Protection Area should include: density controls, prohibit contaminating land uses, address stormwater management, and limit impervious cover.
- **Potential Lead Agency & Partners:** Planning Board, Board of Selectmen, NH DES, Upper Valley Lake Sunapee Regional Planning Commission Canaan Lake Association, Affected Property Owners
 - **Potential Funding Source:** N/A
 - **Benchmark:** A comprehensive set of zoning requirements is established within the watershed to protect Canaan Street Lake.
- D. Delineate a Shoreland Protection District. The District should include the area of land within 250 feet of Canaan Street Lake.
- **Potential Lead Agency & Partners:** Planning Board, Board of Selectmen, Canaan Water Department, NH DES, Upper Valley Lake Sunapee Regional Planning Commission
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** The Shoreland Protection District is accurately mapped and delineated.
- E. Develop lot requirements and land use restrictions within the Shoreland Protection District. Utilize the NH Shoreland Protection Act (RSA 438-B) for guidance. (Appendix G)
- **Potential Lead Agency & Partners:** Planning Board, Board of Selectmen, NH DES, Upper Valley Lake Sunapee Regional Planning Agency, Canaan Lake Association, Affected Property Owners
 - **Potential Funding Source:** N/A
 - **Benchmark:** A comprehensive set of zoning requirements is established to protect the shoreland area of Canaan Street Lake.
- F. Adopt Watershed Protection Area and Shoreland Protection District in Canaan’s zoning ordinance.
- **Potential Lead Agency & Partners:** Planning Board, Board of Selectmen, Canaan Drinking Water Protection Committee, Canaan Water Department, Canaan Lake Association
 - **Potential Funding Source:** N/A
 - **Benchmark:** The Town has adopted the Watershed Protection Area and the Shoreland Protection District.

V. Land Conversion & Site Development

Land conversion and site development has the potential to occur throughout the watershed. When areas of natural cover are converted for development purposes, vegetation is removed, the ground surface is disturbed, and hydrogeological processes are altered (Jeer et al., 1997). If drainage, grading, and re-vegetation are not well planned during site development activities, they can contribute a significant amount

of sediment from soil erosion to surface waters. Forestry operations can also be a significant source of sediment if vegetative buffers are not maintained along water resources and if logging roads are constructed improperly (Jeer et al., 1997).

The sediment that is washed into streams, rivers, ponds and lakes from construction sites is considered to be the greatest single nonpoint pollutant in the United States (Jeer et al., 1997). Impacts of sedimentation on fisheries include reduction in water clarity, increased water temperature, decreased dissolved oxygen levels, and filling in of spawning habitat. Impacts of sedimentation on wetlands include reduction in flood storage capacity. Sedimentation can also have negative impacts on drinking water supplies by damaging water treatment pumps, increasing treatment costs, and increasing the production of carcinogenic disinfection byproducts (Jeer et al., 1997).

Maintaining natural land cover is one of the surest ways to protect water quality. Forests and natural vegetation maintain the hydrogeologic cycle by stabilizing soils, filtering pollutants, and providing water storage. Since natural land cover permits the infiltration of water, and thus filtration of pollutants, it also contributes the lowest pollutant load to water resources.

The committee developed the following objectives to address water quality concerns associated with land conversion and site development:

- Objective #1:* Educate watershed residents about the importance of maintaining buffers and natural vegetation.
- Objective #2:* Conserve key parcels within the watershed, focusing on the following areas: land surrounding surface water intakes; wetlands; steep slopes; and undeveloped waterfront properties.
- Objective #3:* Ensure site plan and subdivision review requirements adequately protect water quality from erosion and sedimentation. Revise requirements where necessary.

Strategies for Achievement

- A. Conduct an education and outreach program for watershed residents, contractors, and developers on the importance of maintaining natural vegetation and controlling erosion. For instance, provide homeowners and contractors with information on maintaining a protected shoreline.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Canaan Drinking Water Protection Committee, Canaan Water Department, Canaan Conservation Committee, Cardigan Mountain School, Canaan Lake Association, Local Contractors and Developers; NH DES
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** An ongoing education and outreach program is established in Canaan to facilitate the use of proper erosion control practices during site development.
- B. Work to place undeveloped properties surrounding the surface water intakes into conservation.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Drinking Water Protection Committee, Canaan Water Department, Canaan Conservation Commission, Canaan Lake Association, NH DES, Affected Property Owners
 - **Potential Funding Source:** NH DES Water Supply Land Grant Program; LCHIP; Town Funds
 - **Benchmark:** Undeveloped properties bordering the “reservoir” area are placed into conservation to protect water quality near surface water intakes.

- C. Identify key parcels in the watershed for conservation (e.g. wetlands, steep slopes, sensitive habitat, shoreland properties).
- **Potential Lead Agency & Partners:** Town of Canaan, Canaan Drinking Water Protection Committee, Canaan Conservation Commission, NH DES, NH Natural Heritage Bureau, Affected Property Owners
 - **Potential Funding Source:** NH DES Water Supply Land Grant Program, LCHIP, Town Funds
 - **Benchmark:** Key parcels for conservation are identified and placed into conservation.
- D. Adopt erosion and stormwater management controls for new development. Incorporate new guidelines into site plan and subdivision review.
- **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Canaan Drinking Water Protection Committee, NH DES, US EPA, Army Corps of Engineers
 - **Potential Funding Source:** N/A
 - **Benchmark:** Local regulation exists to minimize erosion and stormwater runoff from new developments.

VI. Management of Point Sources

Within the watershed there are no sources of pollution that meet the true definition of a point source. However, several potentially contaminating activities exist in the watershed that require state permits. While these activities are not point sources in the traditional sense, they are included in this section due to their known location and their ability to potentially contaminate either surface or groundwater.

The identified sites are associated with the operation of Cardigan Mountain School and include:

5. Three known groundwater hazard sites
 - a. The School's septic leach field. However, the leach field does not pose a threat to the Canaan Street Lake watershed, as it is located just beyond the watershed boundary, is in good condition, and is well maintained.
 - b. The sites of two leaking underground heating oil tanks. Both tanks were removed upon discovery (1991 and 1995) and the sites were completely remediated to NH DES's satisfaction.
6. Five underground storage tanks containing #2 heating fuel.
7. One dual, aboveground storage tank that contains gasoline and diesel fuel for maintenance equipment.
8. Cardigan Mountain School is classified as a "hazardous waste handler" under Resource Conservation and Recovery Act¹⁹ (RCRA).

Upon review of the identified regulated sites, it was determined that Cardigan Mountain School follows regulatory standards and employs best management practices to minimize potential contamination threats.

The operational underground fuel tanks meet current safety and leak protection standards and are monitored annually by NH DES. The aboveground storage tank is located on an impervious surface that allows for spill containment. However, the tank is located within twenty feet of a storm drain that feeds directly to Canaan Street Lake and discharges near the outlet dam. The School has plans to relocate the aboveground tank to a safer location within the next year.

Based upon the available information, the Committee established the following objective:

¹⁹ RCRA sites store, manage, or generate hazardous substances, which may be highly flammable, corrosive, or toxic and require careful handling and/or disposal.

Objective: Maintain communication with Cardigan Mountain School about the status of its regulated storage facilities.

Strategies for Achievement

- A. Keep communication open between Cardigan Mountain School and the Canaan Water Department regarding the status of the Schools regulated storage facilities. One method of maintaining open communication between the School and the Town is to schedule an annual meeting between appropriate School and Town officials.
- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Cardigan Mountain School, Health Officer
 - **Potential Funding Source:** N/A
 - **Benchmark:** Open communication regarding the protection of the Canaan Street Lake watershed between Cardigan Mountain School and the Town continues and an annual meeting date is established.

5.2 Other Concerns

In addition to direct water quality threats caused by surrounding land uses, the Committee has expressed concern regarding non-land use activities in the watershed. These concerns range from improving knowledge of the reservoir area, the need for local enforcement of new and existing regulations, the lack of a detailed Emergency Spill Response Plan, garnering community support in protection activities, and expanding the source protection process.

I. Demarcation of the “Reservoir” Area

The “reservoir” area is established under NH DES Administrative Rule Env-Ws 386.18, Protection of the Purity of Canaan Street Lake and Its Watershed. The Rule states, “A person shall not trespass, boat, bathe, swim, fish or carry on any activity whatever whether of recreational, occupational or other nature, in the waters or on the ice of Canaan Street Lake, south of a line about 1,200 feet northwest of the lake’s southern most part...”

Keeping recreational users out of the reservoir area is critical to protect the surface water intakes as well as limit the potential for contaminants to be introduced in close proximity to the intakes. Signs are posted on the shore at either side of the line to inform users of the lake that the area is restricted. Traditionally, watershed residents have placed buoys in the summer months to visibly demarcate the line. In 2006, the Town assumed responsibility for placing the buoys to mark the reservoir area during the summer. No markers are placed in winter to keep winter enthusiasts out of the area. Based upon this information, the committee has determined the following objective:

Objective: The reservoir area is well marked, in all seasons, and its use restrictions are respected and enforced.

Strategy for Achievement:

- A. Work to place year-round markers to demarcate the reservoir area.
- **Potential Lead Agency & Partners:** Board of Selectmen Canaan Water Department, Canaan Drinking Water Protection Committee, NH DES, NH Department of Fish & Game (Winter Enforcement), NH Department of Safety – Marine Patrol (Summer Enforcement)

- **Potential Funding Source:** Town of Canaan
- **Benchmark:** Year-round markers are placed to demarcate the reservoir area.

II. Local Enforcement

Local enforcement is critical in ensuring protection of drinking water resources. Without consistent enforcement of established regulations, the recommendations identified in this plan will not safeguard Canaan's drinking water resources. Part of developing a local enforcement plan is working with state and regional officials to determine official jurisdiction and enforcement responsibilities. Enforcement of regulation is a necessary requirement to providing access to quality drinking water and maintaining Canaan's quality of life.

Based upon identified issues for local enforcement, the Committee has developed the following objectives:

Objective #1: Regulations for the protection of Canaan's water resources are consistently enforced.

Objective #2: State, regional, and local jurisdiction is clearly defined.

Strategy for Achievement:

- A. Develop a local enforcement plan and identify proper enforcement agents.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Health and Building Inspector, Canaan Water Department, Canaan Drinking Water Protection Committee, NH DES
 - **Potential Funding Source:** N/A
 - **Benchmark:** Canaan has determined who will enforce local regulation, has established set standards for enforcement, and has properly equipped the enforcement officer(s) to carry out their duties. Enforcement actions are taken when necessary, but in a manner that respects individual property rights.

- B. Bring town, county, and state officials together to clarify questions regarding jurisdiction of activities associated with Canaan Street Lake and to investigate issues regarding authority, enforcement, and compliance.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Canaan Drinking Water Protection Committee, NH DES, NH Department of Fish & Game (Winter Enforcement), NH Department of Safety – Marine Patrol (Summer Enforcement)
 - **Potential Funding Source:** Town funds
 - **Benchmark:** Meetings are conducted and questions regarding jurisdiction are resolved.

III. Emergency Spill Response Plan

An Emergency Spill Response Plan is critical for protecting the quality of Canaan Street Lake. Dangerous spills could be the result of a vehicular accident on nearby roads, boating accidents, refueling of recreational equipment, snowmobiling accidents, a sinking vehicle, or a seaplane accident. Developing a detailed Emergency Spill Response Plan will help direct local emergency departments on how to take action and possibly minimize harm to the drinking water supply if a spill ever occurs.

The Committee's objective regarding the Emergency Spill Response in the watershed is:

Objective: Local emergency response departments are prepared for emergencies that may threaten the water quality of Canaan Street Lake.

Strategy for Achievement

Develop a comprehensive Emergency Spill Response Plan to minimize contamination of Canaan Street Lake.

- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, Canaan's Emergency Services, Canaan Drinking Water Protection Committee, NH DES
- **Potential Funding Source:** N/A
- **Benchmark:** An Emergency Spill Response Plan is developed, in effect, and practiced on a regular basis.

IV. Education & Outreach

Education and Outreach is critical to achieving comprehensive protection of the Canaan Street Lake watershed. Outreach and education will help create an awareness of the value of Canaan Street Lake, educate people about what's threatening its water quality, and encourage protective actions and behavioral change. Reaching out to community members also invests them in the process and helps build local support for the implementation of regulations and corrective actions.

Objective: Develop a local awareness of the need to protect Canaan Street Lake and other local water resources.

Strategies for Achievement

- A. Develop a watershed outreach campaign to inform local residents about the importance of protecting Canaan Street Lake. The outreach campaign should educate homeowners about how to reduce risks from potentially contaminating activities at their homes like septic systems, heating fuel tanks, and yard care.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board , Canaan Drinking Water Protection Committee, Canaan Lake Association, Cardigan Mountain School, Local Recreational Groups, UNH Cooperative Extension, NH DES
 - **Potential Funding Source:** Town of Canaan, NH DES Drinking Water Source Protection Program, NH DES Watershed Assistance Grant Program
 - **Benchmark:** An ongoing watershed outreach plan is developed and in effect.

- B. Make information regarding the Watershed Protection Plan easily available at the following locations: on Town website and at the Town Office and Library.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board , Canaan Drinking Water Protection Committee, Canaan Lake Association, Local Recreational Groups,
 - **Potential Funding Source:** Town of Canaan
 - **Benchmark:** Information regarding the plan and its recommendations is available at key locations throughout Canaan.

- C. Post information about how to protect Canaan Street Lake at the Lake's public access points and in local newsletters.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department Canaan Drinking Water Protection Committee, Canaan Lake Association, Cardigan Mountain School, Local Recreational Groups
 - **Potential Funding Source:** Town of Canaan, In-kind donations

- **Benchmark:** Helpful tips on how to protect Canaan Street Lake are posted at the Lake's public access points and circulated in local newsletters.
- D. Take advantage of Project WET in local schools to teach students about the importance of water resource protection. (State Contact: Jessica Morton, Coordinator. NH DES, PO Box 95, Concord, NH 03302. (603) 271-4071)
- **Potential Lead Agency & Partners:** Canaan Drinking Water Protection Committee, Mascoma Valley SAU, Cardigan Mountain School, NH DES
 - **Potential Funding Source:** undetermined
 - **Benchmark:** Project WET curriculum and activities are being utilized in local schools to educate students about water resources.

V. Comprehensive Testing Program

The Committee recognizes that more water quality data needs to be collected prior to the implementation of its recommendations. While VLAP, NH DES, the Town of Canaan, and the Canaan Water Department have conducted a significant amount of testing, the data collected is, at this time, insufficient to scientifically support some recommendations made in this plan. In light of this, the Committee realizes that some of the recommendations made in this plan might be "hard sell." However, the previously collected data does suggest a gradual decline in lake water quality.

Without fully understanding the causes behind degrading water quality, the Town will not be able to appropriately manage and mitigate pollution sources and identified water quality threats. Consequently, absent the data, the Committee has attempted to make the strongest recommendations possible that will result in the full protection of water supplies within the Canaan Street Lake watershed.

Based upon the recognized need for more scientific study of Canaan Street Lake the committee has identified the following objective:

Objective: A comprehensive testing regime and body of data regarding the water quality of Canaan Street Lake exists.

Strategy for Achievement

Hire a qualified, experienced environmental scientist or engineer to prepare a comprehensive testing regime for the Lake.

- **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Water Department, NH DES, UNH, Plymouth State
- **Funding:** NH DES Watershed Assistance Grant Program,
- **Benchmark:** A testing regime is determined and carried out by the Town.

VI. Plan Implementation & Expansion of the Drinking Water Protection Process

While the Committee has accomplished the goal of drafting the Canaan Street Lake Watershed Protection Plan, the next step in the process is for the plan to be adopted and implemented. On way to ensure implementation is reappoint the Committee for another year, so that they can begin the plan's implementation.

Additionally, the process that was applied toward protecting the Canaan Street Lake watershed should also be expanded and applied to the remaining five public drinking water systems located outside the watershed. Each of these water systems will benefit from source protection and should be included in water resource protection efforts. Also, consideration should be given to protecting Canaan's stratified drift aquifer.

The Committee's objectives for plan implementation and the expansion of the drinking water protection process are:

Objective #1: The Canaan Street Lake Watershed Plan is adopted and implemented.

Objective #2: All drinking water resources in Canaan have some level of water quality protection.

Strategies for Achievement

- A. Reappoint the Canaan Drinking Water Protection Committee for an additional year to shepherd implementation of the Canaan Street Lake Watershed Plan.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Canaan Drinking Water Protection Committee
 - **Potential Funding Source:** N/A
 - **Benchmark:** Canaan's Drinking Water Protection Committee is reappointed and the recommendations made in the plan are being implemented.
- B. Extend the Source Protection Process to include all public water supplies in Canaan and other valuable drinking water resources such as local aquifers.
 - **Potential Lead Agency & Partners:** Board of Selectmen, Planning Board, Canaan Drinking Water Protection Committee, NH DES, Granite State Rural Water Association, Upper Valley Lake Sunapee Regional Planning Commission
 - **Potential Funding Source:** N/A
 - **Benchmark:** Canaan's drinking water resources are included in a Town-wide drinking water protection plan.

Chapter 6 – Emergency Response Plans

Emergency Response Plans describe the steps that would be taking if any or all of the sources from these public water systems become contaminated, decline in yield, or were lost for any reason. At this time, the State of New Hampshire only requires that Emergency Response Plans be completed and on file for Community Water Systems. Both the Canaan Water Department and Cardigan Mountain School have completed minimum requirements of an Emergency Response Plan. These plans are on file and can be reviewed at NH DES in Concord, NH. However, despite the fact that the Canaan Water Department has a completed plan on file with NH DES, it is still in the Town's best interest to conduct a detailed Emergency Response Plan for local emergency providers.

Chapter 7 - Conclusion

The Canaan Drinking Water Protection Committee worked with a variety of individuals, groups, and agencies to develop this Watershed Protection Plan. The next step is to share the plan with the community to develop local support for implementation. Additionally, it is important that the Canaan Drinking Water Protection Committee continue to exist in order to shepherd implementation of these recommendations. As evidenced by this plan, the Committee has already played an important role in developing watershed awareness, identifying current concerns, and has begun to plan for the future of the Canaan Street Lake watershed.

The management objectives and strategies identified in this plan represent one step in a multiple stage process to protect water quality. As strategies are implemented and goals and objectives are met, new ones need to be developed and the watershed plan will need to be amended to reflect these changes. No planning process is complete without a review of the benchmarks set forth in a management plan. The benchmarks outlined in Chapter V should be revisited periodically to evaluate whether strategies have been

successfully implemented. In order to keep the plan current and practical, and for this plan to be successful, benchmarks will need to be met or exceeded.

The Committee believes that Canaan Street Lake and all other drinking water sources within the Town should be considered as long-term resources that need to be properly protected for all generations. Preservation of these resources should occur in a manner that maintains water quality so that it is as good, or better, in one hundred years as it is today. Without comprehensive protection, that is adjusted to address future threats, Canaan's drinking water resources run the risk of being contaminated and potentially unusable for future generations.

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Glossary

Algae Bloom: Population explosion of phytoplankton in response to changing environmental conditions, including nutrient over-enrichment from wastewater and non-point sources. Blooms can result in oxygen depletion and biological impacts.

www.wetmaap.org/References/glossary.html.

Atmospheric Deposition: The contribution of atmospheric pollutants or chemical constituents to land or water ecosystems. Deposition results from materials in rain or snowfall, combined with dry dust fallout. Increasingly, atmospheric sources are recognized as a significant source of nutrients and contaminants to coastal systems. www.wetmaap.org/References/glossary.html.

Community Water System: serve at least 25 residents on a year round basis. Examples include municipal water systems and systems that serve mobile home parks, condominiums, and single-family housing developments. (Env-Ws 300)

Disinfectant Byproducts: Pollutants formed when organic materials in a drinking water source react with the disinfectant, such as chlorine or ozone. Trihalomethanes (THMs) are a major group of disinfection byproducts. www.abag.ca.gov/bayarea/sfep/reports/soe/soegloss.htm. Exposure to DBPs in drinking water has been linked to the development of bladder cancers and may cause some risk to reproductive health (EPA).

Ecological Services: services which humans derive from ecological functions such as photosynthesis, oxygen production, water purification and so on. www.eman-rese.ca/eman/reports/publications/rt_biostrat/cbs28.htm.

Epilimnion: Epilimnion is the top-most layer in a thermally stratified lake, occurring above the deeper hypolimnion. It is warmer and typically has a higher pH and dissolved oxygen concentration than the hypolimnion. <http://en.wikipedia.org/wiki/Epilimnion>.

Eutrophic: Having waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content and often causes the extinction of other organisms. Used of a lake or pond. □ www.bbmwd.org/vocabulary.htm

Flushing Rate: represents the volume of water that passes through the lake's outlet in one year and

signifies how often the water in the lake is replaced by fresh water. (Jeer et al., 1997).

Hypolimnion: The hypolimnion is the bottom and most dense layer of water in a thermally stratified lake. It is the layer that lies below the thermocline. Typically, it is non-circulatory and remains cold throughout the year. <http://en.wikipedia.org/wiki/Hypolimnion>

Impervious Cover: Land surfaces with a low capacity for soil infiltration, for example paving, roofs, roadways, or other human structures. The presence of impervious cover increases runoff and affects the quantity and composition of nonpoint source.

□ www.wetmaap.org/References/glossary.html

Non-community Non-transient Water System: serve at least 25 people, for at least 6 months per year. These systems typically serve daycare facilities, schools, and commercial properties.

Typically, non-community non-transient systems serve the same groups of people on a regular basis. (Env-Ws 300)

Non-community Transient Water System: serve at least 25 people, for at least 60 days per year.

These water systems serve restaurants, campgrounds, motels, recreational areas, and service stations.

Nonpoint Source Pollution: Pollution from many diffuse sources that cannot be attributed to one identifiable "point," such as a discharge pipe. NPS pollution is caused by precipitation, atmospheric deposition, percolation, and runoff containing sediments, nutrients, and organic and toxic substances generated by various land uses and human activities. Rainfall can cause soil erosion and create runoff, which carries sediments and pollutants to receiving water bodies.

□ www.scdhec.com/ocrm/html/glossary.html

Oligotrophic: The state of a poorly nourished, unproductive lake that is commonly oxygen rich and low in turbidity. Relatively low amounts of nutrients (phosphorus and nitrogen) in the water column. Refers to an unproductive, nutrient poor lake that typically has very clear water.

□ www.great-lakes.net/humanhealth/about/words_o.html

Point Source Pollution: pollution originating from a single point such as pipes, ditches, wells, vessels, and containers. □ www.nwrc.usgs.gov/fringe/glossary.html

Sanitary Protective Radius: a 75-100 foot radius around a well, which must be controlled by the water supplier through ownership or easement. The extent of the Sanitary Protective Radius is dependent of the permitted production volume of the well. (NH DES)

Source Water: Untreated water (i.e., raw water) used to produce drinking water. □

www.cdc.gov/mmwr/preview/mmwrhtml/ss5108a4.htm

Storm water Runoff: The water, which is not absorbed into the ground during and after a storm which then flows over the land. □ www.cascadelink.org/neigh/ghfl/pcpAppendixB.html

Stratified Drift Aquifer: a geologic formation of predominantly well-sorted sediment deposited by or in bodies of glacial melt water, including gravel, sand, silt, or clay, which contains sufficient saturated permeable material to yield significant quantities of water to wells. (NH DES)

Synthetic Organic Chemicals: Man-made (anthropogenic) organic chemicals. Some SOC's are volatile; others tend to stay dissolved in water instead of evaporating.

□ www.afropa.hq.af.mil/kelly/Terms/sterms.html

Thermocline: the level dividing a lake into two layers, an upper warmer one (epilimnion) and a lower colder one (hypolimnion). The temperature usually drops several degrees centigrade over just a few meters at this level. □ www.unep.or.jp/ietc/publications/short_series/lakereservoirs-3/8.asp

Trophic State: the degree of biological productivity of a water body. Biological productivity generally relates to the amount of algae, aquatic plants, fish and wildlife a water body can produce and sustain. □ www.cityoforlando.net/public_works/stormwater/lakes/glossary.htm

Vegetative Buffers: Vegetated areas adjacent to streams, ponds, etc., that protect those water resources from pollution, prevent erosion of the banks of these water resources, provide wildlife food and cover, and shade the adjacent water, moderating temperatures for aquatic species. □ www.chaddsfordpa.net/glossary.htm

Volatile Organic Chemicals: these are chemicals of an organic nature (containing hydrogen, oxygen, and carbon), which readily volatilize, or travel from the water into the air. Most such substances are industrial chemicals and solvents. These potentially toxic chemicals are used as solvents, degreasers, paints, thinners, and fuels. Because of their volatile nature, they readily evaporate into the air, increasing the potential exposure to humans. Due to their low water solubility, environmental persistence, and widespread industrial use, they are commonly found in soil and water. http://www.nalms.org/glossary/lkword_v.htm

Watershed: The area of land from which rainfall (and/or snow melt) drains into a single point. Watersheds are also sometimes referred to as drainage basins or drainage areas. Ridges of higher ground generally form the boundaries between watersheds. At these boundaries, rain falling on one side flows toward the low point of one watershed, while rain falling on the other side of the boundary flows toward the low point of a different watershed. □

www.soil.ncsu.edu/publications/BMPs/glossary.html

Watershed Imperviousness: the percentage of impervious cover by area within a development site or watershed, often calculated by identifying impervious surfaces from aerial photographs or maps. □ www.epa.gov/watertrain/protection/glossary.html

Wellhead Protection Area: the surface area under which groundwater flows to a producing well. For bedrock wells, a WHPA is typically a fixed circle where the radius is determined by the maximum daily amount of water withdrawn from the well. For gravel wells, the WHPA is calculated from existing hydrogeologic information regarding subsurface flow. (NH DES)

Wetlands: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

□ www.ieca.org/Resources/Reference/DefinitionsTZ.asp

Water Protection Plan APPENDIX A: PUBLIC WATER SUPPLIES

SYSTEM NAME	ADDRESS	SYSTEM TYPE	POPULATION	WELL TYPE	WELL DEPTH	YIELD (Gpm)
CANAAN WATER DEPT	FERNWOOD FARMS RD	Community	600	Surface	--	1 million (gpd)
CARDIGAN MOUNTAIN SCHOOL	BACK BAY RD	Community	300	BRW	540	23
CARDIGAN MOUNTAIN SCHOOL	BACK BAY RD	Community	300	BRW	525	12
COUNTRY VILLAGE MHP	STEVENS RD	Community	50	BRW	0*	30
COUNTRY VILLAGE MHP	STEVENS RD	Community	50	BRW	650	0.00 [‡]
PLEASANT VALLEY MHP	SOUTH RD	Community	73	BRW	335	50
BARKER STEEL CO INC	RTE 4	Non-community Non-transient	35	BRW	490	50
INDIAN RIVER SCHOOL	ROYAL RD, RTE 4	Non-community Non-transient	600	BRW	820	9
MASCOMA VALLEY REG HIGH SCHOOL	27 ROYAL RD, RTE 4	Non-community Non-transient	530	BRW	410	33
CRESCENT CAMPSITES NORTH	FERNWOOD FARM RD	Non-community Transient	211	BRW	500	0.00[‡]
CRESCENT CAMPSITES SOUTH	FERNWOOD FARM RD	Non-community Transient	25	BRW	190	15

Active Public Water Supplies – Canaan, NH

Source: NH DES

(Public water supplies located within the Canaan Street Lake Watershed are denoted in boldface type.)

*0 indicates that well depth is unknown.

[‡]0.00 indicates that the well's yield is unknown.

Water Protection Plan APPENDIX B: KNOWN OCCURANCES RARE & EXEMPLARY SPECIES CANAAN STREET LAKE WATERSHED

New Hampshire Natural Heritage Bureau

Known occurrences of rare species and exemplary natural communities in the Canaan Street Lake Watershed
(HUC 12 code 010801060101)

Name - Occurrence # (unique identifier)	Quality Rank	Precision	Listing Status		LastObs
			State	Federal	
<u>Natural Community</u>					
Rich mesic forest - 037	B-	S	--	--	2000
<u>Plant species</u>					
Ginseng (<i>Panax quinquefolius</i>) - 026		M	T	--	1992
Heart-leaved Twayblade (<i>Listera cordata</i>) - 007	H	M	T	--	1908
Reversed Bladderwort (<i>Utricularia resupinata</i>) - 005		M	T	--	1963
Squirrel Corn (<i>Dicentra canadensis</i>) - 022	B	S	T	--	2000
<u>Vertebrate species</u>					
Common Loon (<i>Gavia immer</i>) - 025		M	T	--	2000
Common Loon (<i>Gavia immer</i>) - 188		S	T	--	2003
Common Loon (<i>Gavia immer</i>) - 216		S	T	--	2003

Ranks

A-D = Excellent (A) to poor (D)
H = Historical (not observed within the last 20 years)
X = Extirpated
T = Threatened

Precision

S = Location known to within ca. 300 feet
M = Location known to within ca. 1.5 mile
M = Location known only to place name (ca.5 miles)

31 May 2006

Water Protection Plan APPENDIX C: SOURCE PROTECTION PLAN CARDIGAN MOUNTAIN SCHOOL & CRESCENT CAMPSITES

In addition to addressing water quality threats to Canaan Street Lake, this plan is also concerned with protecting the water quality of Cardigan Mountain School and Crescent Campsites, which are registered public water supply systems.²⁰

Both Cardigan Mountain School and Crescent Campsites obtain their water from groundwater sources. Like a watershed, it is important to note that groundwater sources also have “land” areas that contribute water to a producing well. Depending on a water system’s classification²¹, each system is required to maintain specific drinking water protection areas. The size and type of the protective areas are dependent upon the type of groundwater source being utilized (bedrock or gravel) and the quantity of water pumped from the well. Between the two systems, the ground water protection areas employed are: Wellhead Protection Areas and Sanitary Protective Radii.

While the recommendations generated in Chapter Five provide protection to all drinking water supplies in the watershed²², including private wells, this Plan specifically addresses Cardigan Mountain School and Crescent Campsites by identifying specific threats to each system’s sources and suggesting management recommendations to mitigate the identified threats.

Cardigan Mountain School

I. Description

Cardigan Mountain School develops its water supply from two bedrock wells located in an athletic field at the southern end of its property. Well #1 has a depth of 540 feet and yields twenty-three gallons per minute. Well #2 has a depth of 525 feet, yields twelve gallons per minute, and is located in a below-grade vault.

Water from the wells is pumped to a pump house where the flow from each well is combined and chlorinated for disinfection purposes and transferred to a 100,000-gallon storage tank. Water is then pumped and distributed to the campus buildings by a hydro-pneumatic system. Also installed on the system, is a fire pump capable of pumping 1,000 gallons per minute at ninety pounds of pressure for approximately one hour. The fire pump pressurizes four municipal fire hydrants located around campus, and charges the sprinkler systems located within campus buildings. The Cardigan Mountain School fire hydrants are frequently tapped by the Canaan Fire Department to rapidly fill truck tankers supporting their fire fighters at off-campus, private property fires.

The system has twenty-three service connections and serves a population of 300 people. Water provided by Cardigan Mountain School has met all the State and Federal Safe Drinking Water Act requirements set for drinking water quality. The School has also established a Wellhead Protection Area (WHPA), over the

²⁰ New Hampshire Drinking Water Rules define a public water system as “a system for the provision to the public of piped water for human consumption if such a system has at least 15 service connections or regularly serves and average of at least 25 individuals daily at least 60 days out of the year.” (Chapter Env-Ws 300)

²¹ Public water supplies are further classified into three categories based upon the level of service provided. System classifications are: Community Water Systems; Non-community non-transient systems; and Non-community transient systems.

²² Due to the fact that the Canaan Water Department develops its drinking water from Canaan Street Lake, the objectives and recommendations in Chapter 5 addresses potential threats to the system’s water supply. For more detail about the Water Department’s delivery system and water quality please see Appendix G.

area of land under which groundwater flows towards the School's wells, and a Sanitary Protective Radii for each well.

Unlike most WHPAs for bedrock wells, the size and shape of the School's WHPA was determined using a fixed radius that was modified based upon groundwater flow. If the watershed boundary did not bisect the WHPA, it would be a circle with a fixed radius of approximately 4,200 feet. However, the western side of the WHPA follows the watershed boundary for Canaan Street Lake because groundwater flows outside of the boundary do not flow towards Cardigan Mountain School's wells. Additionally, due to differences in production volume, each well has a separate Sanitary Radius. Well #1 has a Sanitary Radius of 200 feet and Well #1 has a Sanitary Radius of 175 feet.

II. *Identified Contaminants*

Below is a summary of PCSs identified by a review of NH DES Source Water Assessment Reports, NH DES on-line OneStop Database, NH DES Sanitary Surveys, Cardigan Mountain School's Drinking Water Protection Plan, and a windshield survey of the area.

According to the review of available data, Well #1 has one identified PCSs within its Sanitary Protective Radius. Well #2 also has an identified PCSs within its sanitary radius, although it is not from a land use. Additionally, three other PCSs have been identified within 1,000 feet of the wells. The risks listed below are in no order of priority.

Parking Area

A parking area is within Well #1's Sanitary radius and located approximately 175 feet, upslope of the well. The parking area provides vehicular access to the back entrance of the School's sports complex and its practice fields. Additionally, the School parks buses overnight in the same vicinity.

Since they are impervious, paved parking areas collect nonpoint pollutants, like oil and gas, deposited from vehicles. Nonpoint pollutants that collect on the parking area are likely to be washed from the pavement when storm event or snowmelt occurs and transported onto the fields that house the School's wells. Volatile Organic Chemicals (VOCs), like the gasoline additive MtBE, are just some potential contaminants present in stormwater flows from transportation related surfaces.

Underground Storage Tanks

Cardigan Mountain School has five underground storage tanks in operation, which store heating fuel for the School's facilities. Currently, all underground storage tanks in use at Cardigan Mountain School meet the current standards for tank safety and leak detection. However, in the early 1990s two tanks at the school were found to be leaking heating fuels into the surrounding environment. Upon discovery of the leaks, the School removed the tanks and has since remediated both sites to NH DES's approval. Leaking underground storage tanks can introduce VOCs into the ground and potentially contaminate groundwater supplies.

Lawn Cover

According to the Source Assessment Report conducted by NH DES in 2001 for Cardigan Mountain School more than ten percent of the WHPA has agricultural cover. Due to assessment methods used, open fields and/or lawns are included in the agricultural assessment. Based upon a windshield survey of the School's WHPA, it appears most of the agricultural area counted in the Source Water Assessment are grassed areas associated with the School and surrounding residential development.

In order to protect the quality of their wells Cardigan Mountain School does not apply fertilizers or pesticides to the athletic fields where the wells are located. The School does apply fertilizers and pesticides to its upper fields and grassed areas. A portion of these upper fields is located within 1,000 feet of the Well #1. Fertilizers and pesticides applied to lawns can contaminate groundwater supplies if applied improperly. However, fertilizer application to the School's upper fields does not pose a significant risk to the School's water supply.

Buried Well

Well #2 is housed in a below grade vault, meaning the well is located under the surface level of the ground. According to Sanitary Surveys completed by NH DES, a buried well is subject to contamination if flooding occurs. Additionally, inspection and maintenance of the well is made more difficult as the well is not easily accessible.

On-Site Septic Systems

Three of the School's on-site septic tanks are located within 1,000 feet of well #1. Effluent from these tanks is pumped away from the wells to a larger tank located at the intersection of Back Bay Road and Alumni Drive, where the effluent is pumped to the School's leach field located outside of the Canaan Street Lake watershed. It is unlikely that the School's septic system is a threat to its drinking water supply. While the School's septic system is not a threat, a large portion of the developed areas of the Canaan Street Lake watershed falls within the WHPA for Cardigan Mountain School. With no municipal sewer in the area, each residence must rely on on-site septic systems to treat their household wastewater. As noted earlier in the plan, septic systems can be a source of disease causing pathogens if not properly maintained as well as a source of harmful chemicals if improperly used to dispose of household hazardous wastes.

Hazardous Waste Handler

Cardigan Mountain School is registered with the State under the Resource Conservation and Recovery Act (RCRA). RCRA sites store, manage, or generate hazardous substances, which may be highly flammable, corrosive, or toxic and require careful handling and/or disposal. In researching the RCRA manifests for Cardigan Mountain School on NH DES's One-Stop on-line database, it appears that the School mainly generates waste oils from maintenance activities. The generated wastes are not a threat to the School's water supply, as long as best management practices are followed and the wastes are properly stored and handled.

Figure 1 Cardigan Mountain School

III. Recommendations

Cardigan Mountain School has a Well Head Protection Plan that addresses the identified contaminants listed in Section II above. The plan has been in effect since 1991 and is on file at Cardigan Mountain School. The plan has been reviewed and the recommendations suggested for the identified threats are still valid. Below is a brief summary of the School's water quality management efforts.

- No fertilizers/pesticides applied to fields where water supply wells are located
- Send informational mailings every three years about water quality protection to residences within the School's WHPA

- Underground storage tanks undergo regular inspection by NH DES. Non-compliance issues are repaired.
- Hazardous materials are handled and disposed of properly.

To the extent practical, the School and the Town of Canaan may want to coordinate educational mailings within the watershed to minimize costs.

Crescent Campsites

I. Description

Crescent Campsites obtains its water from two bedrock wells, which are identified by NH DES as separate regulated drinking water systems. The two systems are connected, but only for emergency purposes. During normal system operation, the connection between the two systems is valved off and they run independently of each other. The system descriptions are as follows:

Crescent Campsites – South obtains its water from a single bedrock well, with a reported depth of 190' and yield of fifteen gallons per minute. The well is located approximately twenty-two feet north northeast of the owner's trailer in a below grade, concrete tiled vault. Water is pumped from the well via submersible pump to two Well X-Trol captive air pressure tanks located inside the workshop building. Water from this system is distributed on one line to the trailer and another is metered and distributed to forty campsites. (NH DES Sanitary Survey)

Crescent Campsites – North obtains its water from a single bedrock well, which has a reported depth of 500 feet and yield of three gallons per minute. The well is located approximately seventy feet east of the new pump house. Former overburden water supply sources (dug wells and spring) are not connected with the current system. Water is pumped via submersible pump from the well to three Well X-Trol captive-air pressure tanks located inside the pump house. There is a meter in place and water is distributed to the thirty-five sites served by the system.

At this time there is no continuous water treatment for either system. As the wells sit idle over the winter months, stagnated water in the wells has the ability to develop bacterial activity. In order to remove any bacteria that may have developed over the winter months, both systems undergo shock chlorination treatment prior to the opening of the Campsite for seasonal use. As a non-community transient system, shock treatment is usually effective in eliminating bacteria from the system. However, according to water quality results provided on NH DES's OneStop on-line database, total coliforms were present in samples taken in May 2003 and June 2001. Coliform bacteria are an indicator that disease-causing organisms may be present in the water supply. Bacteria have not been present in water samples collected for either system since June 2003.

As a non-community transient system, Crescent Campsites is not required by NH DES to establish a WHPA for their drinking water source. However the Campground is required to apply a sanitary radius around each well. For *Crescent Campsites – South* the sanitary radius is seventy-five feet. The sanitary radius for *Crescent Campsites – North* is 150 feet.

II. Identified Contaminants

Below is a summary of PCSs identified by a review of NH DES Source Water Assessment Reports, NH DES on-line OneStop Database, NH DES Sanitary Surveys, and a windshield survey of the area. Five potentially contaminating activities have been identified, two of which are located in the sanitary radius for *Crescent Campsites – South*. Due to the close proximity of the two systems the identified PCSs apply to both water sources.

Aboveground Fuel Tanks

The Campsite has two aboveground storage tanks located within 500 feet of *Crescent Campsites – North* and within 250 feet of the *Crescent Campsites – South*. The closer tank stores propane while the second tank stores diesel fuel. The diesel storage tank is located on an impervious surface and is down gradient from both wells. Unlike other fuels, propane does not pose a contamination risk to soil and water (Campbell-Parnell, 2006). While the diesel tank does not pose a significant risk to the water supplies, there is still the possibility of contamination if a leak occurs.

On-Site Septic Systems

As noted previously, on-site septic systems can be a source of harmful pathogens if improperly maintained or sited. The septic systems for *Crescent Campsites* are located approximately 1000 down gradient of both water supplies. Additionally, there is a separate septic system for the owner's home located approximately 200 feet south of the *Crescent Campsite – South* and just outside the well's sanitary radius. Again, septic systems can be a source of harmful pathogens and chemicals if improperly maintained or used.

Minor Road

Both Fernwood Farms Road and the Campsite's private road pass in close vicinity of either water source. Fernwood Farms Road is within 250 feet of the *Crescent Campsite - South*, while the private road passes directly through the well's sanitary protective radius. For *Crescent Campsite – North*, Fernwood Farms Road is approximately 500 feet from the water source and the private road passes within 150 feet of the source. Roads are considered a potential contamination source because of the potential for spill from vehicles along with their ability to contribute to nonpoint pollution. VOCs are just some potential contaminants.

Home Parking Area

The parking area for the owner's residence is located within the sanitary protective radius of *Crescent Campsite – South*. According to NH DES, the only activities to take place within the sanitary protective radius are those directly related to the functioning of a well or those that are non-threatening to water quality. The presence of vehicles parked within the sanitary protective radius does pose a risk to the well's water quality. Vehicles are known source of VOCs that pollute water supplies.

Dumpster

According to NH DES Sanitary Survey for *Crescent Campsites*, the Campsite's dumpster is listed as a PCSs. While the dumpster is mostly used to dispose of general wastes, it could potentially cause contamination if it is used to dispose of hazardous materials, such as batteries, motor oils, or cleaning products. If hazardous materials are disposed of in the dumpster, they may accumulate and be released onto the ground through holes in the dumpster or when the dumpster is emptied. The dumpster is located down gradient and within 500 feet of either source and is not a significant threat to either water source. However, it still poses a minimal contamination risk.

III. Recommendations

After reviewing the potential source of contamination for the *Crescent Campsite* systems, the following management priorities were developed.

Source Protection Education

Produce and distribute a source protection brochure describing the sources of the Campsites's water, the necessity for protecting these sources, and tips to protect the Campsites drinking water supplies.

Management of Diesel Fuel Tank

Install a secondary containment structure adequate to contain a spill equal to 110 % of the container's total capacity. The containment structure may be a berm made from an impervious surface, such as concrete, as long as no unsealed cracks or holes are present. (NH DES)

Septic System Maintenance

Appropriate maintenance and use of the septic systems located on the Campsite's property is key to their proper functioning. Generally, septic tanks should be cleaned out every three to five years, depending on the size of the tank and the amount and quality of solids entering the tank. Checking the sludge and scum build-up within the tank can also help determine when maintenance needs to occur. Tank cleaning should be done by a commercial septic tank cleaning service at regular intervals (Jemison 2004).

Relocation of Parking Area

Parking next to the well for *Crescent Campsite – South*, makes the source vulnerable to contamination from spills or leaks associated with the vehicles. Ideally, parking should be relocated away from the well and outside of its sanitary protective radius. However, if relocation is not a possibility, vehicles should be well maintained to minimize any fluid leaks. Additionally, the Campsite may want to monitor *Crescent Campsite – South* for VOCs.

Management of Dumpster

Potential contamination threats from the dumpster can be minimized by: relocating the dumpster a safe distance away from the Campsite's water sources or locating the dumpster on an impervious surface, such as a concrete slab, that prevents spills from leaching into surrounding soils

Water Protection Plan APPENDIX D: Env-Ws 386.18 Protection of the Purity of Canaan Street Lake and Its Watershed.

(a) The purpose of this rule is to protect the purity of water of Canaan Street Lake which is the principle drinking water supply for the town of Canaan.

(b) This section shall be effective within the Canaan Street Lake watershed above the outlet dam which is located at approximate latitude 43° 39'30", longitude 72° 01'45", in the town of Canaan.

(c) Any person violating these rules shall, in accordance with RSA 485:26, be guilty of a misdemeanor if a natural person or guilty of a felony if any other person.

(d) Under the provisions of RSA 485:24, the town of Canaan and its agents may enter at reasonable times any land or property within the drainage areas tributary to the Canaan Street Lake public water supply in the town of Canaan for the purpose of investigating sanitation within the watershed and other sources of potential water contamination.

(e) Where any provision of these rules is in conflict with state law or other local ordinances, the more stringent provision shall apply. These rules shall not amend or alter any federal or state law or rule or local ordinance or rule.

(f) Any deviations from these rules shall be by written consent of the division in accordance with Env-Ws 386.03 and the town of Canaan. These provisions shall not apply to employees of the board of water commissioners engaged in the performance of necessary duties for the protection and control of said pond.

(g) The town of Canaan shall post a summary of the prohibitions contained in (h) below at all public access locations where persons might reasonably be expected to access Canaan Street Lake or its tributaries. This posted summary may also contain any prohibitions enacted by local ordinance.

(h) These restrictions shall include:

- (1) A person shall not build, continue or maintain a building or structure of any kind in which animals or fowl are kept, within 75 feet of Canaan Street Lake or within 75 feet of any inlet or tributary thereto, except in such cases as the board of water commissioners may allow, and under such rules as it may require;
- (2) A person shall not permit wastes, or waters that have been used for washing or cleansing either materials, persons, or food, to run into said lake, or into any inlet or tributary thereto;
- (3) A person shall not throw or deposit any dead animal, fish, or parts thereof, or any food or article perishable or decayable, or any dung either human or animal, into said lake, or permit any above wastes to remain within 75 feet of any inlet or tributary thereto, or on the ground surface within 75 feet of any inlet tributary thereto;
- (4) A person shall not throw any sawdust or allow any sawdust to fall into said lake, or into any inlet or tributary thereto;
- (5) A person shall not trespass, boat, bathe, swim, fish or carry on any activity whatever whether of recreational, occupational or other nature, in the waters or on the ice of Canaan Street Lake, south of a line about 1,200 feet northwest of the Lake's southern most part, beginning at a point on the westerly shore at the center line of the road which exists adjacent to the present property line between Gorand and Lamson, and extending across said Lake to the stone jetty on the easterly shore. The 2 extremities of such a line to be properly marked by the local water works authority so that they can be readily identified and observed by the general public;
- (6) These provisions shall not apply to employees of the board of water commissioners engaged in the performance of necessary duties for the protection and control of said pond; and
- (7) A person shall not throw, deposit or allow to remain upon the ice of the waters of said pond, or upon that of any inlet or stream tributary thereto, any matter, waste, or materials such as are described in (2), (3) and (4) above.

Source. #6521, eff 6-4-97 (See Revision Note at
chapter heading for Env-Ws 300)

Water Protection Plan APPENDIX E: WATER QUALITY RESULTS CANAAN STREET LAKE

Algal Abundance

Chlorophyll-a concentration is used as an indicator of algae abundance. Since algae contain the green pigment chlorophyll, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae. Although algae is naturally present in all lakes and ponds, an excessive amount of any type is not beneficial. Algal concentrations can increase with additional phosphorus inputs from nonpoint sources in the watershed.

Generally a concentration of chlorophyll-a of less than 4 mg/m³ indicates that water quality conditions are “good” and representative of oligotrophic lakes. NH DES classifies chlorophyll-a concentrations of 5.1-15 mg/m³ as “more than desirable,” and a concentration greater than 15 mg/m³ as “nuisance amounts” indicative of eutrophic conditions. The mean chlorophyll-a concentration for New Hampshire lakes is 7.02 mg/m³.

Since VLAP monitoring began at Canaan Street Lake in 1988, chlorophyll-a measurements have fluctuated between 1.80 mg/m³ and 6.92 mg/m³. Fluctuations in the data make it difficult to discern whether the overall amount of chlorophyll-a is increasing or decreasing. A trend line on the graphed data by NH DES implies that the presence of chlorophyll-a in the lake water is slightly increasing (VLAP 2003). However,

both the trend line and annual results remain well below the state average. The presence of chlorophyll-a in 2004 was measured at 2.50 mg/m³.

Phytoplankton

Phytoplankton serve as indicator species of general lake quality. An abundance of cyanobacteria (blue-green algae), such as *Anabaena*, *Aphanizomenon*, *Oscillatoria*, or *Microcystis* may indicate excessive phosphorus concentration or that the lake ecology is out of balance. On the other hand diatoms such as *Asterionella*, *Melosira*, and *Tabellaria* or golden-brown algae such as *Dinobryon* or *Chrysoisphaerella* are typical phytoplankton of New Hampshire's oligotrophic lakes. In shallow warm waters with minimal wave action (such as a cove), filamentous green algae, may grow in a form that looks like a mass of green cotton candy (VLAP 2003).

Phytoplankton populations go through a natural succession over the course of the growing season. For example, in the spring diatom algae are most abundant. During the months of May and June green algae are typically the dominant species. From mid to late summer, blue green algae often dominate. Many factors influence this succession including light, nutrients, water temperature, and the amount of grazing from zooplankton.

At Canaan Street Lake, phytoplankton data is readily available for the period from 1988- 2004. Ten of these sampling events took place during the month of July when green algae are typically most abundant. Over the course of the seventeen-year sampling history, the golden-brown algae, *Dinobryon*, were most frequently encountered followed by diatoms *Asterionella*, and *Tabellaria*, which occurred with equal frequency. All of these algae species are typical of New Hampshire's less productive lakes, suggesting good water quality. There are, however, several recorded samplings of toxic blue-green algae (i.e. *Anabaena* and *Microcystis*). Overall, the presence of all phytoplankton in the lake is relatively sparse (VLAP, 2004).

Cyanobacteria

Cyanobacteria are a type of blue-green algae and have been identified in some of the oldest fossils known on Earth (3.5 billion years old). Today, they are one of the largest, most important groups of bacteria and are rich in chemical diversity. For example, the cyanobacterium *Spirulina* has long been valued for its protein content. However, some species of cyanobacteria are toxic to humans and animals.

Cyanobacteria naturally occur in all New Hampshire lakes and ponds and are part of the aquatic food web. In New Hampshire, the four most common cyanobacteria include: *Anabaena*, *Aphanizomenon*, *Oscillatoria*, and *Microcystis*. Although they are the most common cyanobacteria found in our lakes, they are also toxic to animals and humans. *Anabaena* and *Aphanizomenon* produce neurotoxins that can interfere with nerve function almost immediately upon ingestion. *Oscillatoria*, and *Microcystis* are best associated with producing hepatotoxins, which attack liver function.

Cyanobacteria typically form in shallow, warm, slow moving or still water. Typically, as nutrient concentrations in a water body increase, so does the abundance of cyanobacteria. A large mass of cyanobacteria in a body of water is called a bloom. When a bloom rises to the surface of the water, it is known as surface scum or a surface water bloom.

As mentioned in the previous section, *Anabaena* and *Microcystis* have been present in water samples from Canaan Street Lake. Although no blooms have been documented, the presence of toxic cyanobacteria serves as a reminder of a water body's delicate balance. The non-toxic cyanobacteria *Coeleosphaerium* has also been present in water samples.

To reduce the potential of a toxic bloom, watershed residents should continue to act to reduce nutrient loading into the lake by eliminating fertilizer use on lawns, keeping a natural buffer along the lake shoreline, revegetating cleared areas along the shoreline, and properly maintaining septic systems and roads.

In addition, NH DES recommends that residents observe the lake in September and October during fall lake turnover to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing will affect their buoyancy and cause them to rise to the surface and bloom. Wind and current tend to “pile” cyanobacteria into scums that accumulate in downwind sections of a lake. The ramifications of a toxic algae bloom in Canaan Street Lake could be significant as the wind typically blows any matter suspended in the lake towards the surface water intakes of the Canaan Water Department. If a bloom occurs, the NH DES VLAP coordinator should be contacted.

Transparency

Transparency is a function of water clarity and is influenced by water color and the quantity of algae or particulate matter present in a waterbody. Transparency measurements are taken using a Secchi disk, which is a twenty-centimeter disk with alternating black and white quadrants. The Secchi disk is lowered into the water to the limit of visibility, at which point its depth is recorded. Lakes with “exceptional” clarity have a Secchi depth reading greater than 4.5 meters. “Good” water clarity ranges between 2 - 4.5 meters and water with poor clarity has a transparency measurement of less than 2 meters. The mean transparency of New Hampshire lakes is 3.7 meters.

Canaan Street Lake’s water clarity has varied between “exceptional” and “good” during the past seventeen years of sampling. According to the VLAP data, the trend in water clarity has not significantly changed since monitoring began in 1988, although measurements do fluctuate from year to year. The maximum Secchi depth measured for the lake was 6.3 meters in 1999 and the minimum depth measured was 3.3 meters in 1992. In 2003, the Secchi depth was 4.5 meters.

Total Phosphorous

Total phosphorus is a measure of all the forms of phosphorus (organic and inorganic) found in lake water. Phosphorus is a plant-limiting nutrient in fresh water systems –meaning that the amount of available phosphorus influences the amount of plant and algae growth. Plants require phosphorous to grow. However, under natural conditions, phosphorous is not readily available in the environment. Since phosphorus is necessary for plant growth, phosphorous concentrations relate directly to the lake’s trophic state. Lakes with higher concentrations of total phosphorous have greater amounts of plant growth and may be classified as a eutrophic lake.

Total Phosphorous Values & Corresponding Trophic Status

<u>Total Phosphorous Value</u>	<u>Typical Trophic Status</u>	<u>Amount is Considered:</u>
TP < 10 ug/L	Oligotrophic	Ideal
TP > 20 ug/L	Eutrophic	More than desirable
TP > 40 ug/L	Eutrophic	Detrimental

In New Hampshire’s lakes and ponds, total phosphorous concentrations occur at such low levels that most increases are attributed to human activities within the watershed. During the summer, the median total phosphorus concentration in the epilimnion of New Hampshire’s lakes and ponds is 12 ug/L. The median summer total phosphorus concentration in the hypolimnion of New Hampshire lakes and ponds is 14 ug/L. Increased phosphorous levels encourage excessive plant growth and algal blooms. Phosphorous sources around a lake can include septic systems, animal wastes, fertilizer, road and construction erosion, and natural wetlands (VLAP 2003).

The average total phosphorous concentration for Canaan Street Lake from 1988 – 2003 is 7.75 ug/L in the epilimnion and 8.38 ug/L in the hypolimnion. Total phosphorous values have fluctuated some over the sixteen year period, but the overall trend has remained relatively stable and below the state average (12 ug/L) for surface water. Concentrations of total phosphorous in the deeper waters of the lake are also below the state average (14 ug/L) and showing declining trends over the sixteen-year sampling period (VLAP 2003).

Total phosphorous readings taken at the inlet to Canaan Street Lake have fluctuated widely during sampling dates. Fluctuations at the inlet most likely correspond with land use changes upstream that may be introducing sediment or other phosphorous containing substances to the lake during storm events. NH DES recommends that streams be sampled at points where phosphorous may be entering the system, for instance above and below a road crossing, in order to pinpoint pollution sources.

Nitrogen

Data for Nitrogen concentrations in the lake is limited to data collected during the various NH DES Lakes and Ponds Inventory surveys. The Inventory, measures Nitrogen as Nitrate and total Kjeldhal Nitrogen. Nitrate measurements were less than 0.05 mg/L and Total Kjeldhal Nitrogen was measured at 0.43 mg/L and .34 mg/L in 1991. Additionally, in 2005, DES collected water samples from Canaan Street Lake to update the Inventory report. The 2005 data indicates that nitrates still measure less than 0.05 mg/L and total Kjeldhal nitrogen measured below 1991 levels at less than 0.25 mg/L and 0.30 mg/L (Estabrook, personal communication).

pH

pH measures acidity on a logarithmic scale of 0 to 14. Low pH values indicate higher levels of acidity while high pH values are non-acidic or basic. A pH value of seven is considered neutral. pH essentially measures the amount of hydrogen ions present in a substance. As the number of hydrogen ions increases so does its acidity. The pH of lake water is important to the survival and reproduction of fish and other aquatic organisms. For fish, a pH below 5.5 severely limits their growth and reproduction. Fish typically thrive in water where the pH is between 6.5 and 7.0 (VLAP, 2003).

Most lakes exhibit lower pH in the hypolimnion than they do at the surface. Decomposition carried out by bacteria on the bottom of the lake causes pH to drop while photosynthesis by phytoplankton in the upper layers of the water column increases pH (VLAP, 2003). The pH of a lake may be influenced by wetlands where tannic and humic acids are released to the water by decaying plants, thereby creating more acidic waters (VLAP, 2003). Stormwater runoff and snowmelt are also acidic. After a significant storm or melt event, the surface water of a lake may be more acidic than the water at the bottom. It takes a lake many weeks to recover from an acid input from stormwater runoff.

The mean pH for New Hampshire lakes is 6.6, which is slightly acidic. Due to the presence of granite bedrock in the state and the deposition of acid rain, many lakes throughout the state have slightly acidic waters. Annual sampling data for Canaan Street Lake shows that the lake has an average pH of 6.97 in the hypolimnion and 7.09 in the epilimnion, which makes the lake water approximately neutral.

Acid Neutralizing Capacity

Acid neutralizing capacity (ANC) is often referred to as alkalinity. ANC is the measure of a lake's capacity to neutralize acid inputs. New Hampshire lakes historically have low alkaline waters due to the State's granitic bedrock. However in recent years, the overall alkalinity, or buffering capability, of New Hampshire lakes is decreasing. If the buffering capacity of a lake is lost, aquatic life will be adversely affected by acid inputs (NH DES, 2004).

The mean ANC for New Hampshire lakes is 6.7 mg/L. For the past seventeen years, the average ANC for Canaan Street Lake measured above the state average at 9.09 mg/L. However, the value has fluctuated from year to year with the median ANC value for Canaan Street Lake being 9.3 mg/L. The minimum value recorded was 6.5 mg/L in 1998 and the maximum value recorded was 10.95 mg/L in 1988. The ANC value reported in the 2004 VLAP report is 6.6 mg/L.

Acid Neutralizing Capacity Ranges for NH Lakes & Ponds

Category	ANC (mg/L)
Acidified	<0
Critical	0-2

Endangered	2-5
Highly Sensitive	5-10
Sensitive	10-20
Not Sensitive	>20

Sodium

The median value for Sodium concentration in New Hampshire Lakes is 3.1 mg/L. Data for Sodium concentrations in Canaan Street Lake is limited to data for the NH DES Lakes and Ponds Inventory. In 1979, sodium measured 2.5 mg/L and in 1991 the concentration of sodium increased to 3.8 mg/L. Since 1991, the sodium concentration in the lake has increased. According to the data collected in 2005 for the Lakes and Ponds Inventory, Canaan Street Lake's sodium concentration has increased to 6.5 mg/L (Estabrook, personal communication).

Chloride

Typically the chloride content in New Hampshire lakes is naturally low. Water bodies located in remote areas away from development generally have Chloride concentrations less than 2 mg/L. Higher values are generally the result of salt inputs from road corridors and septic systems. The median value for chloride for New Hampshire lakes is 4mg/L. The maximum value is 198 mg/L. Chloride levels in Canaan Street Lake were measured as part of the NH DES Lakes and Ponds Inventory in 1979, 1991, and 2005. The initial value recorded for the lake in 1979 was 3 mg/L. By 1991, chloride had increased to 5 mg/L. Measurements taken in 2005 show that chloride continues to increase and is now at 11 mg/L.

Conductivity

Conductivity measures water's ability to conduct an electrical current and is directly related to the number of ionic particles present. As the number of ions in the water increase so does its conductivity. New Hampshire's waters typically have low conductivity values (NH DES 2004). High conductivity values, or conductivity values that are increasing, may indicate that pollution is occurring from sources such as road salt, faulty septic systems, agricultural runoff, or urban runoff (VLAP 2003).

Due to variations in watershed geology, conductivity values are not easily classified as being good or bad (VLAP Report 2003). However, values in New Hampshire lakes that exceed 100 uMhos/cm are generally indicative of anthropogenic effects. A lake's conductivity typically remains constant throughout the seasons. Any major changes in conductivity over the course of several years, or within a very short period of time, may indicate significant human impacts. For example, if conductivity values suddenly increase within a six-month period, land-clearing activities with no erosion controls, may be the source of increased conductivity values.

In New Hampshire, conductivity values less than 50 uMhos/cm are typical of oligotrophic lakes. The mean conductivity value for New Hampshire lakes is 62.1 uMhos/cm. Conductivity has been measured for Canaan Street Lake since 1988. Over the last sixteen years, values for specific conductance have increased annually. In 1988, conductivity measured at 48.0 uMhos/cm. In 2004, conductivity values measured 78.46 uMhos/cm, which is a 63.5 percent increase. Increased conductivity is typically directly related to human activity within the watershed. However in 2005, conductivity values dropped 4.6 percent to 75 uMhos. Further testing needs to be completed to understand if the drop in conductivity is sustained or a random occurrence.

Apparent Color

Apparent color is a visual measure of the color of the water. Water becomes colored by decaying organic matter or by naturally occurring metals, such as iron or manganese, in soils. A lake with highly colored water generally has extensive wetlands along the shore, or within its watershed, and often a mucky bottom. Often, eutrophic lakes tend to have highly colored water. Water color is measured in color units and classified into the following categories:

Measurement	Color Classification
0 – 24	Clear
25 – 40	Light Tea Color
40 – 80	Tea Color
>80	Highly Colored

The State median for apparent color is 28 color units. Canaan Street Lake has been gaining in color since measurements were first taken for the 1979 Lakes and Ponds Inventory. In 1979, the water had 10 color units and the 1991 Inventory reported that Canaan Street Lake has 18 color units, classifying the water as clear. In 2005, the lake had an average of 20 color units in the summer and 24.5 in the winter, indicating that the water is taking on a sight tea color. The cause behind the change in water color is unknown.

Dissolved Oxygen and Temperature

The presence of dissolved oxygen is critical to bottom-dwelling organisms as well as fish and amphibians. Many species, such as trout, are intolerant of low oxygen conditions. The concentration of dissolved oxygen found in water is closely tied to water temperature as cold water holds more oxygen than warm water. As a result, the concentration of dissolved oxygen fluctuates with the seasons and lakes will have higher dissolved oxygen concentrations during the winter, spring, and fall.

In the summer, dissolved oxygen concentrations decrease. Lower oxygen concentrations are due in part to warmer water temperatures and lake stratification. As a lake stratifies colder water sinks to the bottom and warm water rises to the surface. A layer known as the thermocline forms between the warm surface water and colder depths that impedes lake mixing and the diffusion of dissolved oxygen. After a lake has stratified, the dissolved oxygen in the hypolimnion is not typically replenished until lake turnover in the fall.

As no new oxygen is available in the hypolimnion, the diffused oxygen is gradually used up by bottom dwelling organisms and the process of decomposition. In some cases, the diffused oxygen may be completely depleted. Extremely low levels of dissolved oxygen, or in cases where there is no oxygen at all (anoxic conditions), are detrimental to living biota. When dissolved oxygen concentrations in the hypolimnion fall below 1 mg/L, phosphorus which was previously unavailable and trapped in sediments is released and made available for plant growth.

The dissolved oxygen concentration for Canaan Street Lake is relatively high at all depths. From 1988 – 2003 the average concentration of dissolved oxygen in the hypolimnion (deep water) is 64.9 percent. However, dissolved oxygen values in the hypolimnion have fluctuated between 3.2 percent in 1990 and 96.6 percent in 2002. The relatively high dissolved oxygen concentration in the hypolimnion is due to the shallow nature of Canaan Street Lake and not to cold temperatures. The average water temperature during the sampling period was 20.6° Celsius (69° Fahrenheit). Shallow lakes weakly stratify and do not form a thermocline. Instead, they are continually mixed by wind and wave action, which diffuses oxygen throughout the water column (VLAP).

Turbidity

Turbidity measures the amount of suspended matter such as clay, silt, and algae, which scatter and absorb light rather than allowing it to travel through water in straight lines. Turbid conditions have negative impacts on aquatic species, increase public health risks in drinking water supplies, and pose challenges to the drinking water resource manager during water treatment. High turbidity readings are often found in water adjacent to construction, logging, and other sites where vegetation is removed and soil is left exposed. In such situations, storm events erode unstable soils and cause turbid conditions downstream.

In New Hampshire, the median value for turbidity in lakes and ponds is 1.0 NTUs. The minimum value recorded for New Hampshire lakes is less than 0.1 NTUs and the maximum value is 22.0 NTUs. VLAP monitors began taking turbidity measurements for Canaan Street Lake in 1997. The average turbidity for water in the epilimnion (surface) is 0.4 NTUs and the average turbidity for water in the hypolimnion (deep water) is 0.5 NTUs. Both measurements are below the state average.

Bacteria

Surface waters contain a variety of microorganisms including bacteria, fungi, protozoa, and algae. Most of these occur naturally and have no impact on human health. However, where warm-blooded animals such as humans, ducks, geese, beaver, or pets are present, health risks from water contact are present. Warm-blooded animals contribute bacteria to surface water bodies through fecal waste. Sources of fecal waste may be from leaky septic systems or sewer pipes, runoff from wildlife areas, or heavily used swimming and beach areas (VLAP 2003).

Certain types of bacteria serve as indicators of the presence of fecal contamination and may also be used as an indicator species for the presence of other pathogens, such as viruses or protozoa like *Giardia* or *Cryptosporidium*. Some pathogens, particularly the protozoans, such as *Cryptosporidium*, are difficult to treat because they are so small that they often pass through filters and are resistant to chlorine treatment. Currently, reliable methods are not available to water system operators to readily test for these pathogens. Fecal coliform analysis supplemented with analysis for *Escherichia coli* (*E. coli*) are the most reliable indicators available for identifying fecal wastes.

Invasive and exotic plant species

Purple loosestrife (*Lythrum salicaria*) is present in the wetland on the western shore of the lake near the Town Beach as well as in the shallow cove near Cardigan Mountain School's maintenance building. Purple loosestrife adapts readily to natural and disturbed wetlands. Once established, purple loosestrife forms dense homogeneous stands and replace native grasses, sedges, and other flowering plants that serve as important food sources for wildlife. Purple loosestrife also reduces wildlife habitat (Swearingen).

Mercury

New England reportedly has the highest deposition rates of Mercury in the country (10-30 micrograms per square meter). Major sources of Mercury deposition in New England are from the emissions of municipal waste incinerators, coal and oil boilers, and medical waste incinerators (USGS 2003). Studies conducted by the New Hampshire Department of Health and Human Services (DHHS) indicate that some freshwater fish in the state contain varying levels of Mercury and pose a potential health risk. A statewide advisory is in effect which recommends that people limit their fish consumption. The advisory is based on a thorough review of more than 1,200 freshwater fish sampled from 150 water bodies throughout the state.

**Water Protection Plan APPENDIX F:
Table of Management Objectives and Strategies for Achievement**

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
Road Management	Resolve drainage issues along Canaan Street near the Lake.	Work with NH DOT to identify and resolve drainage issues along Canaan Street near the Lake.	Board of Selectmen, NH DOT Canaan Road Agent NH DES Canaan Water Department	NH DOT NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Runoff from Canaan Street no longer drains into Canaan Street Lake.	
	Reduce application of deicing chemicals along Canaan Street near the Lake.	Work with NH DOT to reduce salt application to the portion of Canaan Street that is in close proximity to the Lake.	Board of Selectmen NH DOT Canaan Road Agent NH DES Canaan Water Department	NH DOT NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	The application of deicing chemicals is reduced.	
	Remediate drainage issues on Town maintained roads.	Identify appropriate storm water management methods to resolve drainage and erosion problems along Fernwood Farms Road.	Board of Selectmen Road Agent Canaan Water Department NH DES UNH Storm water Center	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Road drainages along Fernwood Farms Road are stabilized and erosion problems are resolved.	
		Identify appropriate storm water management method to minimize runoff from the Town Beach from draining into Canaan Street Lake	Board of Selectmen Road Agent Canaan Water Department NH Dot NH DES	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Runoff from the Town Beach no longer enters Canaan Street lake	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Implement a comprehensive Town road management program in the watershed that safeguards public safety, identifies ecologically sensitive areas, and determines low salt zones.	Board of Selectmen Road Agent Canaan Water Department NH DOT NH DES UNH Storm water Center	Town of Canaan NH DOT NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	A comprehensive road maintenance program is established for roads within the watershed.	
	Establish town road standards for the watershed to ensure that new roads do not negatively impact water quality.	Create road design standard that mitigates for storm water runoff and minimizes the negative environmental effects of any new town roads.	Planning Board Board of Selectmen Road Agent UNH Storm water Center	Town of Canaan	Future road design and construction will minimize impact on water quality and the environment by better managing storm water runoff.	
Septic System Management	Minimize the negative impacts of existing septic systems in the watershed.	Conduct education and outreach about the proper use and maintenance of septic systems.	Board of Selectmen Canaan Water Department Drinking Water Protection Committee Cardigan Mountain School Canaan Lake Association	Town of Canaan NH DES Small Outreach and Education Grants NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Homeowners within the watershed properly use and maintain their septic systems.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Conduct a septic survey to collect information about septic systems within 250 feet of Canaan Street lake.	Board of Selectmen Planning Board Canaan Water Department	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Pertinent information is collected and on file for septic systems located within 250 feet of Canaan Street Lake.	
		Consider implementing a septic system-tracking program for parcels within 250 feet.	Board of Selectmen Planning Board NH DES NH Department of Health and Human Services	Town Funds NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Septic system tracking program is adopted to help facilitate proper maintenance.	
		Consider implementing a municipal septic system maintenance program for properties within 250 feet of Canaan Street Lake.	Board of Selectmen Planning Board Municipal Waste Water Treatment Department NH DES	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	The town has determined the feasibility of implementing a municipal septic system maintenance program.	
	Minimize the environmental impacts of new septic systems within the watershed.	Establish a minimum septic system setback of 125 feet from Canaan Street Lake and its tributaries where feasible.	Board of Selectmen Planning Board NH DES Upper Valley Lake Sunapee Regional Planning Agency	N/A	Septic system setback from Canaan Street Lake and its tributaries is 125 feet.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Consider constructing a municipal sewer system to homes and facilities near Canaan Street Lake in the future.	Board of Selectmen Planning Board Canaan Wastewater Department Cardigan Mountain School NH DES	Town of Canaan	A feasibility study is constructed to determine the practicality of building a municipal sewer system within the watershed.	
Recreational Management	Heighten recreational users awareness of potential water quality impacts to Canaan Street Lake.	Maintain and support the NH Lake Association’s Lake Host Program.	Board of Selectmen Canaan Water Department Canaan Lake Association NH Lakes Association NH DES	NH DES Grants for Exotic Aquatic Plants NH DES Milfoil and other Exotic Plant Prevention Grants	The Lake Host Program is supported and maintained.	
		Conduct education and outreach campaign that targets recreational users and user groups to inform about protecting the Lake’s water quality	Board of Selectmen Water Department Drinking Water Protection Committee Canaan Lake Association Cardigan Mountain School Area Schools Recreational Groups Crescent Campsites NH DES	Town of Canaan NH DES Small Outreach and Education Grants NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Town is continually informing recreational users about the importance of protecting Canaan Street Lake.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
	Reduce impacts of current recreational uses on Canaan Street Lake's Water quality.	Encourage boaters to properly handle, store, and use fuels and motor oils.	Board of Selectmen Canaan Water Department Drinking Water Protection Committee Canaan Lake Association Recreational Groups Crescent Campsites NH DES Boating Industry	Town of Canaan NH DES Small Outreach and Education Grants NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Boaters are well educated about properly handling fuels and oils.	
		In winter, limit refueling of gasoline-powered engines to shore and prohibit the use of automobiles on lake ice	Board of Selectmen Canaan Water Department Canaan Lake Association Recreational Groups NH DES NH Department of Fish and Game	Undetermined	Gasoline powered engines are refueled prior to being taken on the ice and vehicles are prohibited from traveling on the lake ice.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
	Conduct more frequent water quality testing to effectively evaluate the impacts of recreational activities.	Continue existing VLAP testing and increase its frequency during summer months.	Board of Selectmen Canaan Water Department Canaan Lake Association Cardigan Mountain School Mascoma High School Recreational Groups NH DES	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Water quality testing of Canaan Street Lake continues and is conducted more frequently.	
	Assess the impact that motorized boating has on Canaan Street Lake.	Study the effects that recreational activities have on the lake, especially motor boating.	Board of Selectmen Canaan Water Department Drinking Water Protection Committee Canaan Lake Association Area Schools and Universities NH DES	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Town has collected data on the impact that recreational activities have on the water quality of Canaan Street Lake.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Study the effects that motorized boating has on turbidity in Canaan Street Lake.	Board of Selectmen Canaan Water Department Canaan Lake Association Area Schools & Universities NH DES	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Town has completed a study on the impact that motorized boating has on turbidity, determine its level of risks, and decide on the appropriate management activity.	
		Consider establishing a no wake zone in sensitive areas (near surface intakes) and shallow waters.	Board of Selectmen Canaan Water Department Drinking Water Protection Committee Canaan Lake Association NH Department of Safety – Marine Patrol.	Undetermined	No wakes zones are established to protect sensitive areas.	
Land Use Management	Establish a Watershed Protection Area	Conduct outreach and education on why establishing a zoning district is critical to protecting the quality of Canaan Street Lake.	Board of Selectmen Planning Board, Canaan Water Department Drinking Water Protection Committee NH DES	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Community has a better understanding of how a zoning district is beneficial and will help protect water quality.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Establish boundaries for the Watershed Protection Area that accurately reflects the watershed boundary.	Planning Board Board of Selectmen Canaan Water Department NH DES Upper Valley Lake Sunapee Regional Planning Agency	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Boundaries for the Watershed Protection Area accurately reflect the watershed boundary for Canaan Street Lake.	
		Develop lot requirements and land use restrictions within the Watershed Protection Area.	Planning Board Board of Selectmen Canaan Water Department NH DES Upper Valley Lake Sunapee Regional Planning Agency Affected Property Owners	N/A	A comprehensive set of zoning requirements is established within the watershed.	
	Within the Watershed Protection Area, create a Shoreland Protection District to provide a higher level of protection in the immediate vicinity of Canaan Street Lake.	Delineate the Shoreland Protection District to include the area of land within 250 feet of Canaan Street Lake.	Planning Board Board of Selectmen Canaan Water Department NH DES Upper Valley Lake Sunapee Regional Planning Agency	Town of Canaan NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	The Shoreland Protection District is accurately mapped and delineated.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Develop lot requirements and land use restrictions within the Shoreland Protection District.	Planning Board Board of Selectmen Canaan Water Department NH DES Upper Valley Lake Sunapee Regional Planning Agency Affected Property Owners	N/A	A comprehensive set of zoning requirements is established to protect the shoreland area of Canaan Street Lake.	
Land Conversion & Site Development	Educate watershed residents about the importance of maintaining buffers and natural vegetation	Conduct an education and outreach program for watershed residents, contractors, and developers about the importance of maintaining vegetative buffers and managing erosion.	Board of Selectmen Planning Board Drinking Water Protection Committee Canaan Water Department Canaan Conservation Commission Local contractors and developers Watershed Residents NH DES	Town of Canaan NH DES Small Outreach and Education Grants NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	An ongoing education and outreach program is established.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
	Conserve key parcels in the watershed focusing on the following areas: the land around the “reservoir area”, wetlands, steep slopes, and undeveloped parcels.	Work to place property surrounding the “reservoir area” into conservation.	Board of Selectmen Planning Board Drinking Water Protection Committee Canaan Water Department Canaan Conservation Commission NH DES	Town of Canaan LCHIP NH DES Water Supply Land Grant Program	Undeveloped properties bordering the “reservoir area” are placed into conservation to protect water quality near the surface water intakes.	
		Identify key parcels in the watershed for conservation (e.g. steep slopes, wetlands, sensitive habitats, and shoreland properties.)	Board of Selectmen Planning Board Drinking Water Protection Committee Canaan Water Department Canaan Conservation Commission NH DES	Town of Canaan LCHIP NH DES Water Supply Land Grant Program	Key parcels are identified and placed into conservation.	
	Ensure site plan and subdivision review requirements adequately protect water quality from erosion and sedimentation.	Adopt erosion and stormwater management controls for new development and incorporate new guidelines into site plan and subdivision review.	Board of Selectmen Planning Board Drinking Water Protection Committee NH DES US EPA Upper Valley Lake Sunapee Regional Planning Agency	N/A	Local regulation exists to minimize erosion and stormwater runoff from new development.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
Management of Point Sources	Maintain communication with Cardigan Mountain School regarding its regulated facilities.	Keep communication open between Cardigan Mountain School and the Town by scheduling an annual meeting between appropriate officials.	Board of Selectmen Canaan Water Department Cardigan Mountain School Health Officer	N/A	Open communication between the School and the Town continues.	
Demarcation of the Reservoir Area	The reservoir area is well marked and its use restricts are reported and enforced.	Work to place year-round markers to demarcate the reservoir area.	Board of Selectmen Canaan Water Department Drinking Water Protection Committee NH DES NH Department of Fish & Game NH Department of Safety – Marine Patrol	Town of Canaan	Year-round markers are placed to demarcate the reservoir.	
Local Enforcement	Regulations for the protection of Canaan’s water resources are consistently enforced.	Develop a local enforcement plan and identify proper enforcement agents.	Board of Selectmen Planning Board Health Officer Canaan Water Department NH DES	Town of Canaan	Canaan has determined who will enforce local regulation and has established set standards for enforcement.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Bring town, county, and state officials together to clarify questions regarding jurisdiction over activities associated with Canaan Street Lake.	Board of Selectmen Canaan Water Department Health Officer NH DES NH Department of Safety NH Fish and Game	Town of Canaan	Meetings are conducted and questions regarding jurisdiction are resolved.	
Emergency Spill Response Plan	Local emergency response departments are prepared for emergencies that may threaten the water quality of Canaan Street Lake.	Develop a comprehensive Emergency Spill Response Plan to minimize risks to Canaan Street Lake.	Board of Selectmen Canaan Water Department Canaan’s Emergency Services NH DES	Undetermined	A comprehensive spill response plan is developed, in effect, and practiced on a regular basis.	
Education and Outreach	Develop a local awareness of the need to protect Canaan Street Lake.	Develop a watershed outreach campaign to inform local residents about how they can help protect the Lake.	Board of Selectmen Planning Board Canaan Water Department Drinking Water Protection Committee Cardigan Mountain School Crescent Campsites Recreational Groups NH DES UNH Cooperative Extension	Town of Canaan NH DES Small Outreach and Education Grants NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	An ongoing watershed outreach plan is in effect.	

Identified Threats	Objective	Strategies	Lead Agency(s)	Funding Source	Bench Mark	Date Initiated
		Make information regarding the Watershed Protection Plan easily available online and at the Town offices.	Board of Selectmen Planning Board Drinking Water Protection Committee Canaan Lake Association	Town of Canaan	Information regarding the plan and its recommendations is available at key locations.	
		Post information about how to protect Canaan Street Lake at the Lake’s public access points.	Board of Selectmen Planning Board Drinking Water Protection Committee Canaan Water Department Canaan Lake Association Crescent Campsites	Town of Canaan NH DES Small Outreach and Education Grants NH DES Watershed Assistance Grant NH DES Drinking Water Source Protection Grant	Helpful times on how to protect Canaan Street Lake are posted at the Lake’s public access points and circulated in local newsletters.	
		Take advantage of Project WET in local schools. (Contact: Jessica Morton, Coordinator. NH DES 603-271-4071)	Drinking Water Protection Committee Mascoma Valley SAU Cardigan Mountain School NH DES	Undetermined	Project WET curriculum and activities are being utilized in local schools to educate students.	
Comprehensive Testing Program	A comprehensive testing regime and body of data regarding the water quality of Canaan Street Lake exists.	Hire a qualified and experienced environmental scientist to prepare a testing regime for Canaan Street Lake	Board of Selectmen Canaan Water Department NH DES Local Universities	NH DES Watershed Assistance Grant Program	A testing regime is determined and carried out by the Town.	

Water Protection Plan APPENDIX G: MINIMUM RESTRICTIONS NH SHORELAND PROTECTION ACT

Minimum Shoreland Protection Standards, RSA 483-B

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SP-6 1997 Minimum Shoreland Protection Standards, RSA 483-B

LIMITS WITHIN THE PROTECTED SHORELAND

Prohibited Uses (RSA 483-B:9, II) **250 ft**

- Establishment/expansion of salt storage yards, auto junk yards, solid waste & hazardous waste facilities.
- Use low phosphate, slow release nitrogen fertilizer from 250 feet to 25 feet.

Uses Requiring State Permits

- Public water supply facilities (RSA 483-B:9, III)
- Public water & sewage treatment facilities (RSA 483-B:9, IV)
- Public utility lines (RSA 483-B:9, IV-b)
- Existing solid waste facilities (RSA 483-B:9, IV-c)
- All activities regulated by the DES Wetlands Bureau per RSA 482-A (RSA 483-B:9, II(c))

Other Restricted Uses

- All new lots, including those in excess of 5 acres, are subject to subdivision approval by DES. (RSA 483-B:9, V(b)(1))
- Setback requirements for all new septic systems are determined by soil characteristics. (RSA 483-B:9, V(b)(2))
- Minimum lot size in areas dependent on septic systems determined by soil type. (RSA 483-B:9, V(e)(1))
- Alteration of Terrain Permit standards reduced from 100,000 square feet to 50,000 square feet. (RSA 483-B:6, I(d))
- Total number of residential units in areas dependent on on-site sewage & septic systems, not to exceed 1 unit per 150 feet of shoreland frontage. (RSA 483-B:9, V(e)(2))

NATURAL WOODLAND BUFFER RESTRICTIONS (RSA 483-B:9, V(a))

150 ft

- Where existing, a natural woodland buffer must be maintained.
- Tree cutting limited to 50% of the basal area of trees, and 50% of the total number of saplings in a 20 year period. A healthy, **well-distributed stand** of trees, saplings, shrubs, and ground covers must be maintained.
- Stumps and their root systems must remain intact in the ground within 50 feet of the reference line.
- The opening for building construction is limited to 25 feet outward from the building, septic system, and driveway.
- The opening for accessory structures is limited to 10 feet outward from the footprint.

NEW SEPTIC SYSTEM LEACHFIELD SETBACKS (RSA 483-B:9, V(b)(2))

- 125 feet where soil down gradient of leachfield is porous sand & gravel. **125 ft**
- 100 feet where soil maps indicate presence of soils with restrictive layers within 18 inches of natural soil surface. **100 ft**
- 75 feet where soil map indicates presence of all other soil types. **75 ft**
- 75 feet minimum setback from rivers.

PRIMARY BUILDING LINE*

- Primary structure setback 50 feet from the reference line. (RSA 483-B:9, II(B)) **50 ft**

- Fertilizer use is prohibited within 25 feet of reference line. (RSA 483-B:9, II(d))
- Accessory structure setback 20 feet from the reference line. (EnvWs 1405.04)

25 ft
20 ft

REFERENCE LINE (RSA 483-B:4, XVII)

- For coastal waters = highest observable tide line
 - For rivers = ordinary high water mark
 - For natural fresh waterbodies = natural mean high water level
 - For artificially impounded fresh waterbodies = water line at full pond
- * If a municipality establishes a shoreland setback for primary buildings, whether greater or lesser than 50 feet, that defines the Primary Building Line for that municipality.

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