

# NEW HAMPSHIRE COMPREHENSIVE LAKE INVENTORY

The purpose of the New Hampshire Comprehensive Lake Inventory is to establish “baseline” information that objectively characterizes the watershed. It guides the collection of information to assess the status of the watershed. The Inventory creates a foundation that facilitates a common understanding of watershed characteristics. And it also serves as a planning and educational tool.

The New Hampshire Comprehensive Lake Inventory is organized into 10 primary Attributes. Each Attribute is intended to address a specific characteristic commonly evaluated when developing a watershed management plan. Within each Attribute there is a series of questions with a listing of multiple choice answers for each question. The answers are then scored on a 1-5 basis.

There are three categories in which the Attributes are split in to:

**Unique or Outstanding Value:** A lake scoring high in this category will have many unique or outstanding, natural or cultural features.

**Recreational Value:** A lake that scores high provides and/or supports a variety of passive and active recreational activities

**Susceptibility to Impairment:** A high score indicates the vulnerability to detrimental changes or impacts or is threatened or stressed by one or more factors.

Our class of twelve students was divided up into three groups. Each group was given a category of the Inventory. We then, depending on the agenda of the groups, split the questions so that each student had roughly 9 to 10 questions. Extended research was done by each of us to obtain the information necessary.

The overall score is determined by adding up the scores from each of the questions under each category. These scores can then be compared to the total amount of points possible (100). Lake Sunapee scored as follows:

**Unique or Outstanding Value: 83/100**

**Recreational Value: 75/100**

**Susceptibility to Impairment: 48/100**

It is important for a Lake to have high scores in both Unique or Outstanding Value as well as in Recreational Value, because the area around a lake needs these aspects to keep the lake active. It is also important for a lake to have a low score in Susceptibility to Impairment because this means the lake is less vulnerable to potential damage.

A few areas of concern that we have found throughout our research of the Inventory may need further investigation. In the Unique or Outstanding Value category we found that currently, there are only a few historical features in the Watershed of Lake Sunapee. For Recreational Value we found that angler usage and average watercraft density scored low. And finally, for the Susceptibility to Impairment category we found the presence of aquatic invasive species (i.e.: milfoil), and also a high level of shore land development.

We have faced many challenges while doing research for the Inventory. GIS gave us a few difficulties as some of the information was not up to date. A few of the

questions were difficult to interpret, and some of the information was not available. Three questions of the Inventory gave us a hard time to find the information needed. The rate of development question was a challenge since the six towns that surround Lake Sunapee do not follow the same recordkeeping for development. An interpretation and a standard methodology had to be developed by the class. Answering the soils question was difficult as current data for Merrimack County was not readily available. And finally, answering the impervious surface question proved difficult as there was neither a clear protocol for handling the data nor a methodology for analyzing the findings.

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**The Inventory was developed and is managed by:**

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**Attribute 1:** Geographical, Spatial, and Demographic Information

**Category:**

**Question A:** Waterbody Location in the State

**Directions:** The information for the majority of this question can be obtained by consulting a map with detailed information about the waterbody's location in the state and classification of the surrounding land. Note the scale of the map used.

**Rationale:** The relative geographic location of the waterbody forms the foundation necessary to complete a comprehensive inventory.

**Process Followed:** Referred to a map of Lake Sunapee as well as Department of Environmental Services (DES) New Hampshire Lake and Ponds Inventory: Volume IV.

**Findings and Analysis:**

Towns Surrounding Lake- Sunapee, New London and Newbury

Towns also within Watershed- Sutton, Goshen and Springfield

Counties- Merrimack County, Sullivan County

River Basin- Connecticut River Basin

Public Lands in Lake Sunapee- Mt. Sunapee Stake Park Beach, Newbury Public Dock, John Hay National Wildlife Refuge (The Fells), Blodgett Landing, Georges Mills Public Dock, Sunapee Harbor Public Dock

Public Lands in Watershed- Bucklin Beach, Pleasant Lake Beach, Mt. Sunapee State Park

Within or Adjacent to Public Lands- Adjacent

State- New Hampshire

Straddles State Line- No

Latitude- 43° 23' 52" N

Longitude- 72° 03' 03" W

**Sources:**

Lake Sunapee Protective Association: 2002 Navigation Chart of Lake Sunapee (scale 1:24000 1 inch equals 2000 feet (.38 statute mile))

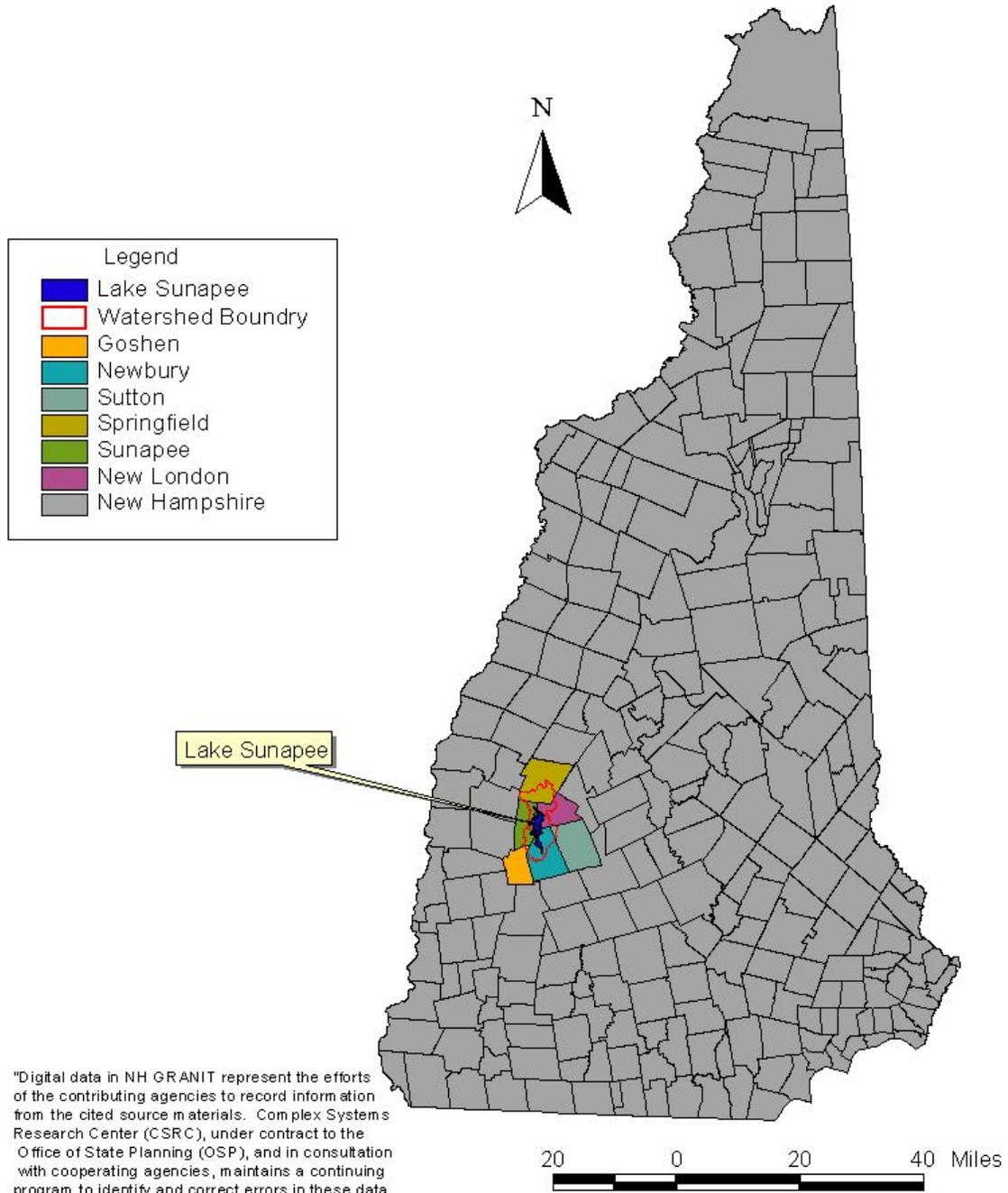
State of New Hampshire Department of Environmental Services: Water Supply and Pollution Control Division- Biology Bureau. New Hampshire Lakes and Ponds Inventory, Vol 4

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** September 2003

**Investigator:** Emily Goodrich

# Lake Sunapee, New Hampshire



"Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."

**Attribute 1:** Geographical, Spatial, and Demographic Information

**Category:** Unique or Outstanding Values

**Question B:** Waterbody Elevation

**Directions:** Consult the New Hampshire Lakes and Ponds Inventory or an alternate reliable source.

**Rationale:** Elevation is a relative indicator of the waterbody uniqueness. There are fewer high elevation lakes and ponds in New Hampshire than low elevation lake and ponds.

**Process Followed:** Referenced Department of Environmental Services (DES) New Hampshire Lakes and Ponds Inventory Volume IV.

**Findings and Analysis:** 1,092 feet above sea level

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) <500 feet	1
2) 500-1000 feet	2
3) 1001-1750 feet	3
4) 1751-2500 feet	4
5) >2500 feet	5

**Sources:**

State of New Hampshire Department of Environmental Services: Water Supply and Pollution Control Division- Biology Bureau. New Hampshire Lakes and Ponds Inventory, Vol 4

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** September 2003

**Investigator:** Emily Goodrich

**Attribute 1:** Geographical, Spatial, and Demographic Information

**Category:** Recreation

**Question C:** Proximity to major transportation corridors.

**Directions:** Identify the nearest major transportation corridor to the water body. Determine the approximate distance, utilizing the most direct roadway route available to the general public, from the identified transportation corridor to the waterbody.

**Rationale:** The distance to a major transportation corridor provides an indicator of water body accessibility. Water bodies in relatively close proximity to a major transportation corridor tend to receive heavier usage than water bodies that require a higher level of travel effort to reach. In addition, for lakes or ponds that currently have a low level of development, their proximity to major roadways provides an indication of the potential for future development.

**Process Followed:** Located a US Geological Survey (USGS) Topographical Map, and measured the closest distance between Interstate 89 and Lake Sunapee with a ruler or other means of measuring distance.

**Findings and Analysis:** The closest distance between Interstate 89 and Lake Sunapee is found to be one eighth of a mile. Lake Sunapee receives a heavy usage compared to other bodies of water in the surrounding area. This is both because of its close proximity to the Interstate, and because of its heavily developed shoreline.

**Evaluation Criteria:**

**Score:**

- |  |   |
|--|---|
| 1) >30 miles from interstate highways  | 1 |
| 2) W/in 30 miles of interstate highways  | 2 |
| 3) W/in 20 miles of interstate highways  | 3 |
| 4) W/in 10 miles of interstate highways  | 4 |
| 5) W/in 5 miles of I-89, I-91, I-93, I-95, I-293, SR-9 (from I-91 to I-89), SR-101 (from I-93 to I-95), SR-16 (from Dover to Conway), SR3 (north of the notches), SR-28 Allenstown to Ossipee), SR-4 (Concord to Durham) | 5 |

**Sources:**

“GRANIT.” Complex Systems Research Center, Institute for the Study of Earth, Oceans, and Space, and University of New Hampshire. 22 Oct 2003  
<<http://www.granit.sr.unh.edu/>>

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 1:** Geographical, Spatial, and Demographic Information

**Category:** Recreation

**Question D:** Total resident population within a thirty (30) mile radius (year round).

**Directions:** Consult DES Lakes Program staff to estimate the total year round resident population within a 30-mile radius\* of the waterbody’s perimeter. In cases where the city, town, village, ect. does not fall entirely within the 30-mile radius (e.g. the 30-mile boundary splits a town in half), include that municipality’s entire population.

\* 30-mile radius – The direct distance from the waterbodies edge to the edge of the boundary.

**Rationale:** This question identifies the population base that could reach the waterbody within approximately 1-hour of travel. One hour is considered to be a conservative estimate of the amount of time people are willing to regularly travel to enjoy a lake or pond.

**Process Followed:** Used ArcView mapping program to determine what towns are included in a 30-mile radius from waterbody’s edge. With in these 30 miles we found ninety-one New Hampshire towns and twenty-two Vermont towns. Searched the NH Office of State Planning website and found 2002 population estimates. Searched the VT census bureau website, and found 2002 population totals through the University of Vermont (UVM) Center for Rural Studies. Matched town with corresponding population estimate. Used Microsoft Excel to construct charts of town and population estimates \*(see charts). Totaled both states’ estimated population, and arrived at 30-mile radius population.

**Findings and Analysis:** Found the population of NH towns within 30-mile radius to be 353,753; and VT to be 64,123. This totals an estimated population of 417,876. \*Please note that these are 2002 population estimates. These numbers cannot be considered up-to-date, nor one-hundred percent accurate, as they are based off estimates.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) <100,000 people	1
2) 100,000 – 250,000 people	2
3) 250,000 – 500,000 people	3
4) 500,000 - 1,000,000 people	4
5) >1,000,000 people	5

**Sources:**

<http://crs.uvm.edu/census/estimates/town/data/McS.xls>

[http://www.state.nh.us/osp/sdc/2002\\_Population\\_Estimates.doc](http://www.state.nh.us/osp/sdc/2002_Population_Estimates.doc)

**Assessment of Questions:** By addressing the populations of the towns within a 30-mile radius we are able to see how many people live within an hours drive from the waterbody. This is used as a base from which the number of people that would use the lake. The only issue that we see with this question is that many towns are much closer to other waterbodies, it would make more sense for the people in those towns would visit these waterbodies before visiting Lake Sunapee. Thus smaller and more localized radiuses would make more sense. For example of you only include the towns within Lake Sunapee's Watershed, Goshen, Newbury, New London, Springfield, Sunapee, and Sutton; these towns have a total population of 10,183 people. This make more sense for these are the people that would be more likely to use Lake Sunapee rather then the people that live next to Lake Winnepesaukee that were include in the 30-mile radius.

**Date Completed:** November 2003

**Investigator:** Micah Mitchell and Paul Barrile

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

**Vermont**

2002 Population Estimates by  
UVM Center for Rural Studies

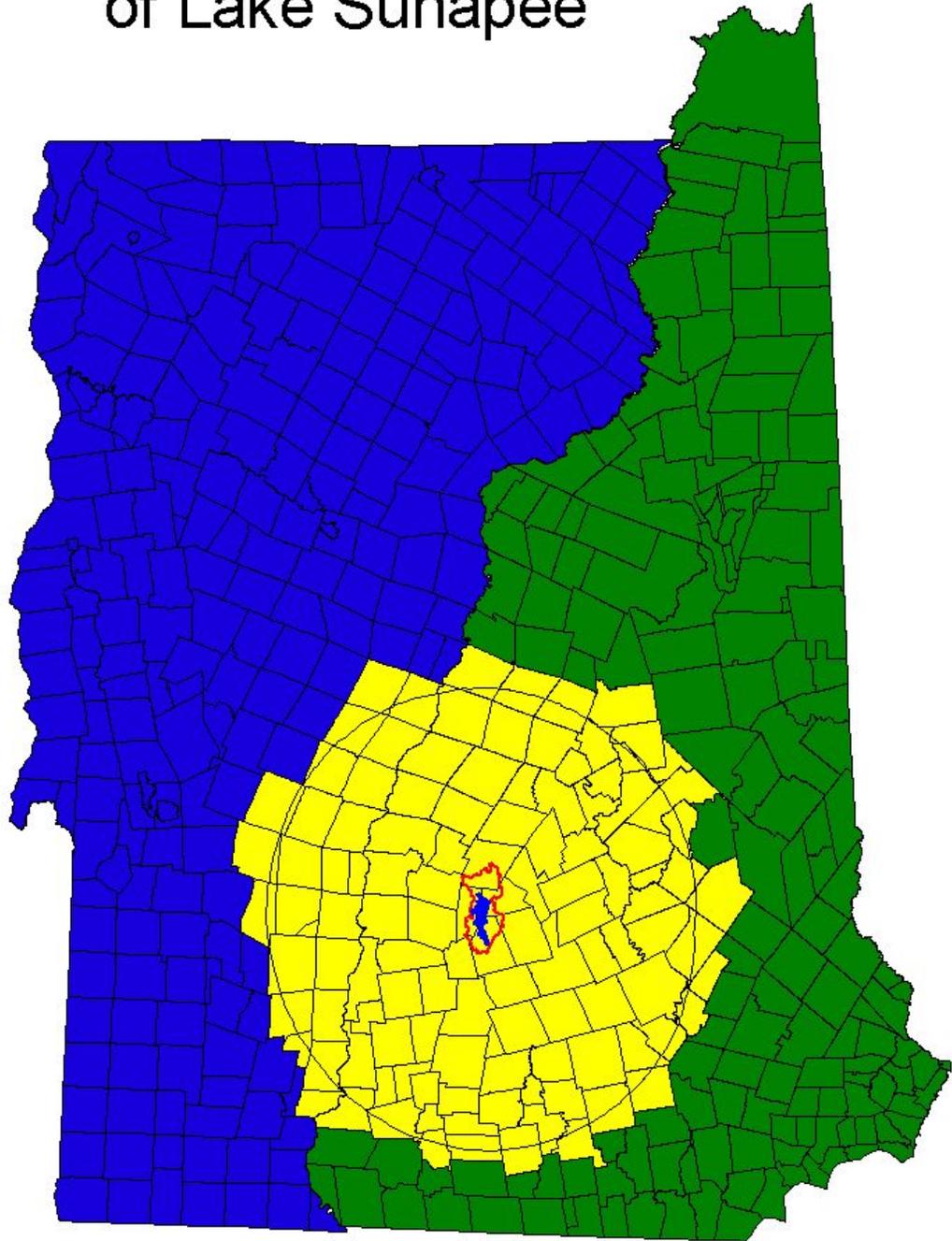
Athens	340
Baltimore	260
Bridgewater	975
Cavendish	1462
Chester	3091
Grafton	645
Hartford	10459
Hartland	3224
Ludlow	2555
Norwich	3593
Plymouth	570
Pomfret	976
Putney	2659
Reading	723
Rockingham	5248
Sharon	1413
Springfield	9056
Strafford	1067
Thetford	2707
Weathersfield	2861
Westminster	3240
Windsor	3766
Woodstock	3233
<b>Column Total</b>	<b>64123</b>

**New Hampshire**

2002 Population Estimates by NH OSP

Acworth	847	Hopkinton	5524
Alexandria	1412	Keene	22837
Alstead	1977	Laconia	16755
Andover	2174	Langdon	599
Antrim	2484	Lebanon	13011
Ashland	1984	Lempster	1015
Belmont	7006	Loudon	4759
Bennington	1440	Lyme	1705
Boscawen	3771	Lyndeborough	1701
Bow	7345	Marlborough	2064
Bradford	1514	Marlow	773
Bridgewater	1013	Meredith	6121
Bristol	3097	Nelson	647
Campton	2803	New Boston	4554
Canaan	3414	New Hampton	4464
Canterbury	2067	New London	4286
Central Harbor	1033	Newbury	1790
Charlestown	4878	Newport	6337
Chichester	2406	Northfield	4730
Claremont	13211	Orange	301
Concord	41380	Orford	1134
Cornish	1683	Pembroke	7125
Croydon	722	Peterborough	5988
Danbury	1102	Plainfield	2331
Deering	1944	Plymouth	6193
Dorchester	374	Roxbury	234
Dublin	1508	Rumney	1557
Dunbarton	2363	Salisbury	1188
Enfield	4750	Sanbornton	2726
Fracestown	1539	Springfield	961
Franklin	8512	Stoddard	952
Gilmanton	3222	Sullivan	792
Gilsum	811	Sunapee	3146
Goffstown	17219	Surry	692
Goshen	777	Sutton	1629
Grafton	1162	Tilton	3504
Grantham	2265	Unity	1606
Greenfield	1726	Walpole	3652
Groton	477	Warner	2883
Hancock	1793	Washington	905
Hanover	10863	Weare	8225
Harrisville	1096	Webster	1673
Hebron	513	Wentworth	835
Henniker	4763	Westmoreland	1825
Hill	1037	Wilmot	1190
Hillsborough	5132	Windsor	232
Holderness	1993		
<b>Column Totals</b>	<b>186602</b>		<b>167151</b>

# Towns Within 30-Mile Radius of Lake Sunapee



**Attribute 1:** Geography, Spatial and Demographic Info.

**Category:** Susceptibility to Impairment

**Question D:** Total year round resident population within 30-mile radius

**Directions:** Consult DES Lakes program staff to estimate the total year round resident population within a 30-mile radius\* of the waterbody's perimeter. In cases where the city, town, village, etc. does not fall entirely within the 30-mile radius, include the municipality's entire population.

\* 30 mile radius – The direct distance from the waterbody's edge to the edge of the boundary.

**Rationale:** This question identifies the population base that could reach the waterbody within approximately 1-hour of travel. One hour is considered to be a conservative estimate of the amount of time people are willing to regularly travel to enjoy a lake.

**Process Followed:** Used ArcView mapping program to determine what towns are included in a 30-mile radius from waterbody's edge. Found ninety-one (91) NH towns and twenty-two (22) VT towns within this radius. Searched the NH Office of State Planning website and found 2002 population estimates. Searched the VT census bureau website, and found 2002 population totals through the University of Vermont (UVM) Center for Rural Studies. Matched town with appropriate population estimate. Used Microsoft Excel to construct charts of town and population estimates \*(see attachments). Totaled both states' estimated population, and arrived at 30-mile radius population.

**Findings and Analysis:** Found the population of NH towns within 30-mile radius to be 353,753; and VT to be 64,123. This totals an estimated population of 417,876. \*Please note that these are 2002 population estimates. These numbers cannot be considered up-to-date, nor one-hundred percent accurate, as they are based off estimates.

**Evaluation Criteria:**

**Score:**

1) <100,000 people	1
2) 100,000 – 250,000 people	2
3) 250,000 – 500,000 people	3
4) 500,000 - 1,000,000 people	4
5) >1,000,000 people	5

**Sources:**

<http://crs.uvm.edu/census/estimates/town/data/McS.xls>

[http://www.state.nh.us/osp/sdc/2002\\_Population\\_Estimates.doc](http://www.state.nh.us/osp/sdc/2002_Population_Estimates.doc)

**Assessment of Question:** This is an important question to look at when completing a Lakes Inventory project. Population is an indicator of the number of people who use the waterbody. The 30-mile radius is a good indicator, because it is within an hour of travel from the lake. However, some of the towns within this 30-mile radius are closer to other

waterbodies, some of which are larger and much more popular, such as Lake Winnepesaukee or the New Hampshire Lakes Region in general. A smaller, more centralized radius might be a better indicator of the amount of usage the waterbody endures. A look at surrounding towns, or towns within the watershed might be enough of a population to get an accurate reading on the intensity of usage. For example, the six towns of the watershed; Goshen, Newbury, New London, Springfield, Sunapee, and Sutton have a total population of 10,183 people. This is according to 2002 New Hampshire Office of State Planning estimates, and seems like a more relevant measurement of population due to the location of the towns in relation to the waterbody and watershed.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

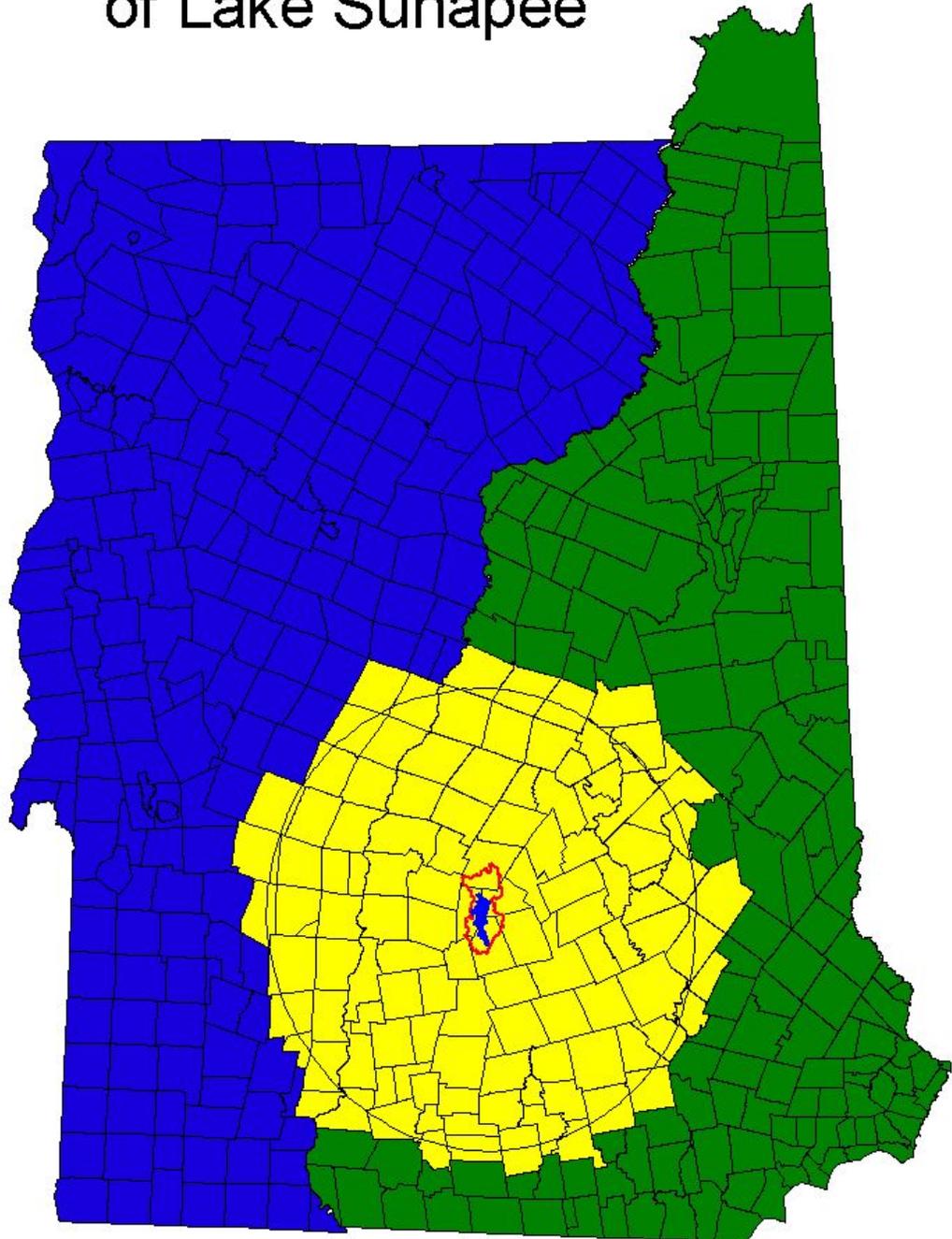
**Vermont**  
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Holderness	1993		
<b>Column Totals</b>	<b>186602</b>		<b>167151</b>

# Towns Within 30-Mile Radius of Lake Sunapee



**Attribute 2:** Physical Water Body Characteristics

**Category:** Recreational Value

**Question A:** Surface water area

**Directions:** The *New Hampshire Lakes and Ponds Inventory* provides the best and the most comprehensive source of information to answer this and many of the other questions for the section. The user(s) should contact NH DES Watershed Management Bureau to obtain a copy that has the most recent information for the water body

**Rationale:** Surface water area is an important consideration when developing a management plan, as larger water bodies will often require more complex strategies and innovative solutions for long-term protection or restoration of its natural resources. Also, it is important to recognize the water body's relative size as compared to other New Hampshire lakes and ponds.

**Process Followed:** Located a copy of the *New Hampshire Lakes and Ponds Inventory*

**Findings and Analysis:** The surface water area of Lake Sunapee is 4,090 acres or 6.39 square miles. As a fairly large lake, Lake Sunapee offers a challenge to those trying to maintain it, but it is the size and location of its watershed that poses problems especially when considering it occupies six towns with different zoning ordinances.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 10 – 50 acres	1
2) 51 – 100 acres	2
3) 101 – 250 acres	3
4) 251 – 1,000 acres	4
5) >1,000 acres	5

**Sources:**

Map of Lake Sunapee Watershed created by the Upper Valley Lake Sunapee Regional Planning Commission (January 2003)

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 2:** Physical Waterbody Characteristics

**Category:** Unique Outstanding Values

**Question B:** Maximum Water Depth.

**Directions:** Consult the New Hampshire Lakes and Ponds inventory or an alternative reliable source to determine the maximum water depth.

**Rationale:** Knowing the lake or pond's maximum depth will provide an initial sense of its hydraulic cycle (i.e. water budget) and potential capacity to absorb excess nutrients.

**Process Followed:** Information was found in the Department of Environmental Services Water and Pollution Control Division – Biology Bureau Lake Tropic Data.

**Findings and Analysis:** According to the Lake Tropic Data the maximum water depth is 31.9 meters.

**Evaluation Criteria:**

- 1) 0-7 meters
- 2) 7.1-15 meters
- 3) 15.1-30 meters
- 4) 30.1-45 meters
- 5) > 45 meters

**Score:**

- 1
- 2
- 3
- 4
- 5

**Sources:**

Water Supply & Pollution Control Division-Biology Bureau of Department of Environmental Services. Lake Tropic Data. Department of Environmental Services, 1997.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** September 2003

**Investigator:** Gordon Krantz

**Attribute 2:** Physical Waterbody Characteristics

**Category:** Susceptibility to Impairment

**Question C:** Mean water depth.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory* or an alternative reliable source to determine the mean water depth.

**Rationale:** A corollary to *Question B*. Some lakes and ponds may have a single deep spot but are relatively shallow otherwise. Other lakes and ponds might be deep throughout the entire waterbody. It is important to recognize the overall depth characteristics of the waterbody, as it is an important attribute of the lake productivity, water circulation, and extent of light penetration.

**Process Followed:** Used the 1997 version of the Department of *Environmental Services Water Supply & Pollution Control Division- Biology Bureau: Lake Trophic Data*.

**Findings and Analysis:** The mean water depth was estimated to 11.4 meters.

**Evaluation Criteria:**

	<b>Score:</b>
1) >18 meters	1
2) 9.1 – 18 meters	2
3) 5.1 – 9 meters	3
4) 1 – 5 meters	4
5) <1 meter	5

**Sources:**

Water Supply & Pollution Control Division- Biology Bureau of Department of Environmental Services. Lake Trophic Data. Department of Environmental Services, 1997.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** February 2004

**Investigator:** Sarah M. Young

**Attribute 2:** Physical Waterbody Characteristics

**Category:** Susceptibility to Impairment

**Question D:** Percent shoal area/littoral zone (water depth <15 feet)

**Directions:** Consult the DES Lakes Program staff to estimate the area of the waterbody that is less than fifteen (15) feet in depth, not including islands or wetlands.

**Rationale:** A measure of the shallow, nearshore regions of the waterbody, commonly referred to as the littoral zone, is the area where aquatic plant growth is the most abundant and where nutrients entering from the surrounding lands are highest. In addition, a waterbody's littoral zone provides important habitat for fish, aquatic vertebrates, and wildlife. In general, lakes and ponds with large littoral zones tend to have excessive plant growth compared to waterbodies the drop off fast and consequently have small littoral zones.

**Process Followed:** Traced a map of the waterbody and found the scale to be 1 inch equal to 200 feet. Covered map with graphing paper and found scale to be 1 box is equal to 200 feet. This is because one inch is 1000 feet, and 5 boxes equaled an inch. Counted all boxes inside >15 depth, 452 in all. Found how many square feet are in an acre, 178,160,400 square feet. Multiplied the number of boxes in the >15 depth range, 452, by 200 (the number of square feet per box). This number came out to be 90,400, representing the number of feet under 15 feet in depth. Found the number of acres represented in 90,400 feet to be 2.1 acres. Subtracted this from 4,090, the total number of acres of the waterbody to reach number of acres under 15 feet in depth.

**Findings and Analysis:** Found the total number of acres under 15 feet in depth to be 2.1 or 5% of the total waterbody. This is important to know because of the active habitat the littoral zone offers. Many species reside in the littoral zone, making it one of the most populated within the waterbody. Knowing the total acreage of the zone, allows appropriate decisions making and consideration in the protection of the waterbody and its inhabitants.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) <10%	1
2) 10 – 25%	2
3) 26 – 50%	3
4) 51 – 75%	4
5) 76 – 100%	5

**Sources:** Improved Hydrographic Map of Lake Sunapee, New Hampshire. Boyer, Fred "GRANIT." Complex Systems Research Center. University of New Hampshire. 22 Oct. 2003 <<http://www.granit.sr.unh.edu/>>

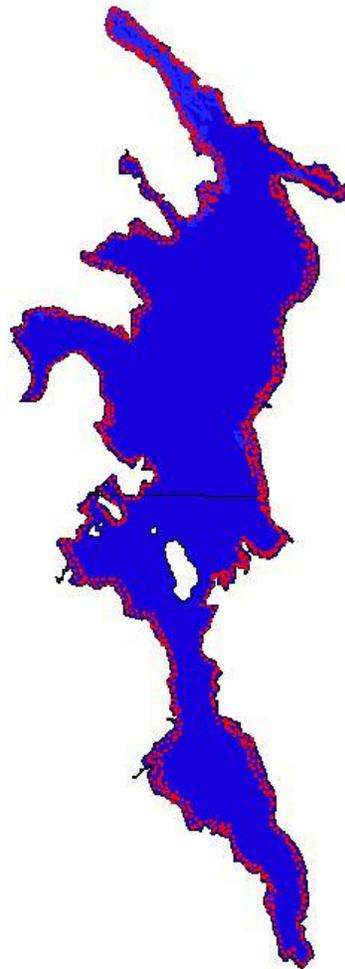
**Assessment of Question:** This is an important question because of the importance of the littoral zone and the condition of it. Boat traffic, mainly that powered by petroleum, can have detrimental effects on the littoral zone, mostly because of disturbance from the propeller. Non-petroleum powered boats cause a wake, but not nearly the disturbance. “No Rafting” and “No Wake” zones help in the reduction of the amounts of petroleum dispersed into the waterbody. Concern needs to be focused around the monitoring of the littoral zone and the amounts of petroleum and other pollutants dispersed into the waterbody.

**Date Completed:** November 2003.

**Investigator:** Joseph J. Jennings

# Water Depth <15 feet

Legend  
■ Lake Sunapee  
■ <15 feet



"Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied use of these data."

**Attribute 2:** Physical Water Body Characteristics

**Category:** Recreational Value

**Question E:** Shoreline configuration

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory* to determine shoreline configuration.

**Rationale:** A ratio of shoreline length compared to water body surface area. A value equal to one equates to a lake or pond that is near a perfect circle in shape. As the ratio increases and the water body's shape becomes more irregular, there is an increase in the contact between land and water and a greater opportunity for nutrient enrichment. In general, larger shoreline configuration ratios will have a more extensive littoral zone area and frequent embayments.

**Process Followed:** Located the *New Hampshire Lakes and Ponds Inventory*. It gave the ratio.

**Findings and Analysis:** The shoreline configuration ratio for Lake Sunapee is 3.30. This means that Lake Sunapee has a noncircular, highly irregular shape. Based on the shoreline configuration ratio, Lake Sunapee can be expected to have greater opportunity for nutrient enrichment and an extensive littoral zone; the zone in which the most aquatic life occurs.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 1.0 – 1.5 (Round or nearly so with few shoreline convolutions)	1
2) 1.51 – 2.0 (Variable in shape w/ frequent shoreline convolutions or embayments)	2
3) 2.01 – 2.5 (Irregular shape; numerous small embayments; some large embayments; frequent shoreline convolutions)	3
4) 2.51 – 3.0 (Variable in shape w/ highly convoluted shoreline)	4
5) >3.0 (Highly irregular shape; large and numerous embayments; almost continuous shoreline convolutions)	5

**Sources:**

New Hampshire Department of Environmental Services - Watershed Management Bureau. New Hampshire Lakes and Ponds Inventory. 1995 ed.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 2:** Visual/Aesthetic Characteristics

**Category:** Recreation

**Question F:** Island(s) presence / absence.

**Directions:** Consult a USGS topographic map (*note the scale of the map you use*), land use maps, National Wetlands Inventory maps, and any natural resource maps on file in the town(s), or the *New Hampshire Lakes and Ponds Inventory* to determine the number of islands present

**Rationale:** The presence of islands provides additional habitat for shoreline birds and mammals. However, large islands (> 1 acre) are likely to attract residential developments, in turn, increasing the potential for non-point source pollutants. Estimate the size of the islands and note if they are developed or undeveloped

**Process Followed:** We located the 2002 navigation chart for Lake Sunapee from the Lake Sunapee Protection Association (LSPA) and counted the number of islands. To determine if any of the islands were developed we asked LSPA staff.

**Findings and Analysis:** Ten islands are found on Lake Sunapee, only four are developed with residential homes. The larger of islands, Great Island, is approximately three acres; Star Island is half an acre. Isle of Pines is about one acre, and Emerald Island is about one quarter of an acre. The remaining islands are smaller and not developed at all.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) None	1
2) 1 – 3 islands	2
3) 4 – 8 islands	3
4) 9 – 15 islands	4
5) >15 islands	5

**Sources:**

Ayers, Aimee. Personal Conversation. October 17, 2003.

Lake Sunapee Protective Association: 2002 Navigation Chart of Lake Sunapee (scale 1:24,000 1 inch equals 2,000 feet (.38 statute mile))

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 2:** Physical Waterbody Characteristics

**Category:**

**Question G:** Shoreline wetlands.

**Directions:** Consult a USGS topographic map, a National Wetlands Inventory map, or conduct a trip around the lake to determine the extent of shoreline wetland areas. Examination of your local tax maps may also assist in defining wetland areas. It may also be useful to contact local conservation commissions to see if wetland inventories have been done in the area. Note the scale of the map used.

**Rationale:** The presence of wetlands provides additional wildlife habitat, flood storage capacity, and pollutant retention ability. In addition to the total number of wetland areas, you should also consider the size of the waterbody.

**Process Followed:** Counted the number of adjacent and/or relatively close wetlands to Lake Sunapee by using a USGS Topography map. After looking at this map, referred to GRANIT Hydrology layer downloads for the Lake Sunapee Watershed. This was conducted as a secondary reference in recognizing the adjacent wetlands. Here using a buffer that designated the 250 foot shoreline area it was possible to count the number of wetlands that can be considered shoreline wetlands.

**Findings and Analysis:** After buffering the lake with 250 feet, it was possible to count the number of wetlands within the shoreline area. There were two wetland areas that exist within this area. It needs to be noted that although they each lie within the shoreline area, they both also extend beyond this buffer zone. The two wetlands that are in the shoreline area are of significant size. Their role in the health of the lake is probably very important. Further examination of their drainage capacity would determine their value and how they should be managed.

The reason behind using the 250 foot shoreline buffer zone was to standardize the defined area of shoreline. Other inventory questions suggest 250 feet from the shoreline as the area than can be categorized as shoreline.

**Evaluation Criteria:**

2. Few (0-3) adjacent wetland areas
3. Moderate (4 – 6) adjacent wetland areas
- 3.) Numerous (>6) adjacent wetland areas

**Sources:**

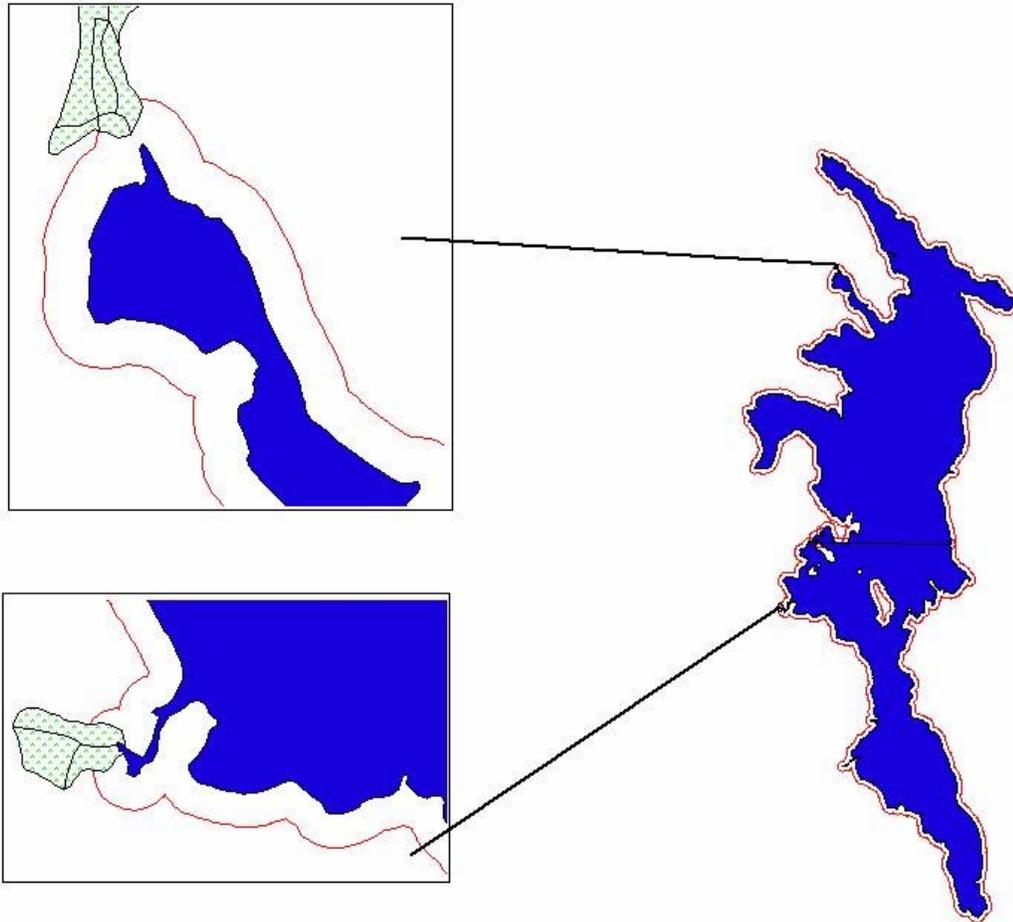
New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT). 30 May 2000. <<http://www.granit.sr.unh.edu/>>.  
“TopoZone Maps a la carte, Inc”. 1999-2003. USGS Topography Map. <[www.topozone.com](http://www.topozone.com)>.

**Assessment of Question:** The term adjacent can be interpreted differently among individuals. It can be implied as those wetlands directly bordering the waterbody or wetlands within the average 250 foot buffer of the waterbody that makes up shoreline area. Taking the later option would be more efficient in recognizing shoreline wetlands. Possibly recognizing wetlands within several radius zones from the shoreline could be a future addition in a watershed inventory.

**Date Completed:** November 2003

**Investigator:** Tamsen B Bolte

## Attribute 2 G Shoreland Wetlands



Produced by:  
Tamsen Bolte  
Colby-Sawyer College  
November 2003

"Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a coding program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data.

**Attribute 2:** Physical Waterbody Characteristics

**Category:** Susceptibility to Impairment

**Question H:** Watershed area: Lake volume ratio.

**Directions:** Obtain watershed area and lake volume estimates from the *New Hampshire Lakes and Ponds Inventory* or an alternative reliable source.

**Rationale:** This ratio provides an estimate of the extent of the surrounding land area contributing surface water runoff to the waterbody. A large watershed area to lake volume ratio indicates that surface water runoff entering the waterbody incorporates more surrounding land than a waterbody with a small ratio. This estimate provides an initial indicator of the importance of considering local land uses and their potential contributions of pollutants to the lake or pond. In addition, it provides another piece of information useful in characterizing the waterbody's hydrologic cycle.

**Process Followed:** Looked up information in the *Department of Environmental Services Water Supply & Pollution Control Division- Biology Bureau Lake Trophic Data*.

**Findings and Analysis:** In order to find the lake volume ratio, the watershed area must be divided by the lake area to. The watershed area is 11680.8 (ha) and the lake area is 1655.22 (ha). To get the lake volume ratio:

$$\frac{11680.8}{1655.22} \approx \frac{7.056}{1} \approx 7.056:1$$

Although this equation relates to the lake ratio, this inventory question, according to Jacquie Colburn was actually supposed to be about the lake surface area.

**Evaluation Criteria:**

- 1) Ratio  $\geq$  51:1
- 2) Ratio 36:1 – 50:1
- 3) Ratio 26:1 – 35:1
- 4) Ratio 11:1 – 25:1
- 5) Ratio  $\leq$  10:1

**Sources:**

Colburn, Jacquie. Telephone interview. 22 March 2004.  
Water Supply & Pollution Control Division- Biology Bureau of Department of Environmental Services. Lake Trophic Data. Department of Environmental Services, 1997.

**Assessment of Question:** The question is adequate as stated. This inventory question is adequately stated, but after talking with Jacquie Colburn, this inventory question is supposed to be about the lake surface area of the watershed of Lake Sunapee.

**Date Completed:** March 2004

**Investigator:** Sarah M. Young

**Attribute 2:** Physical Waterbody Characteristics

**Category:**

**Question H:** Watershed area: Lake volume ratio.

**Directions:** Obtain watershed area and lake volume estimates from the *New Hampshire Lakes and Ponds Inventory* or an alternative reliable source.

**Rationale:** This ratio provides an estimate of the extent of the surrounding land area contributing surface water runoff to the waterbody. A large watershed area to lake volume ratio indicates that surface water runoff entering the waterbody incorporates more surrounding land than a waterbody with a small ratio. This estimate provides an initial indicator of the importance of considering local land uses and their potential contributions of pollutants to the lake or pond. In addition, it provides another piece of information useful in characterizing the waterbody's hydrologic cycle.

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**Findings and Analysis:** In order to find the lake volume ratio, the watershed area must be divided by the lake area. The watershed area is 11680.8 (ha) and the lake area is 1655.22 (ha). To get the lake volume ratio:

$$\frac{11680.8}{1655.23} \approx \frac{7.056}{1} \approx 7.056:1$$

Although this equation relates to the lake ratio, this inventory question, according to Jacquie Colburn was actually supposed to be about the lake surface area.

**Evaluation Criteria:**

- 5) Ratio  $\geq$  51:1
- 6) Ratio 36:1 – 50:1
- 7) Ratio 26:1 – 35:1
- 8) Ratio 11:1 – 25:1
- 5) Ratio  $\leq$  10:1

**Sources:**

Colburn, Jacquie. Telephone interview. 22 March 2004.  
Water Supply & Pollution Control Division- Biology Bureau of Department of Environmental Services. Lake Trophic Data. Department of Environmental Services, 1997.

**Assessment of Question:** The question is adequate as stated. This inventory question is adequately stated, but after talking with Jacquie Colburn, this inventory question is supposed to be about the lake surface area of the watershed of Lake Sunapee.

**Date Completed:** March 2004

**Investigator:** Sarah M. Young

**Attribute 2:** Physical Waterbody Characteristics

**Category:** Susceptibility to Impairment

**Question I:** Hydraulic flushing rate.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory* to determine the hydraulic flushing rate.

**Rationale:** This question determines the rate at which a lake or pond flushes (i.e., a volume of water equal to the lake's volume which passes through the lake) per year. Waterbodies with large inflows and outflows relative to the lake volume have rapid flushing rates or flush quickly. Waterbodies with relatively small inflows and outflows relative to the lake volume have slow flushing rates or flush slowly. Flushing rates are important when considering the lag time necessary for protection or restoration efforts to be realized. In comparison, waterbodies with relatively slow flushing rates will generally exhibit a slower response to restoration or protection efforts than lakes or ponds with rapid flushing rates. Flushing rate is also important when considering nutrient sources, as waterbodies with slow flushing rates are generally influenced by nutrient cycles, while external nutrient sources are most influential to waterbodies with rapid flushing rates.

**Process Followed:** Consulted with the 1997 version of the *Department of Environmental Services Water Supply & Pollution Control Division- Biology Bureau: Lake Trophic Data*.

**Findings and Analysis:** According to the *Department of Environmental Services Water Supply & Pollution Control Division- Biology Bureau: Lake Trophic Data*, the hydraulic flushing rate is .30 times per year.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) $> 2 \text{ year}^{-1}$ (times per year)	1
2) $1 - 2 \text{ year}^{-1}$ (times per year)	2
3) $.5 - .99 \text{ year}^{-1}$ (times per year)	3
4) $.2 - .49 \text{ year}^{-1}$ (times per year)	4
5) $< .2 \text{ year}^{-1}$ (times per year)	5

**Sources:**

Water Supply & Pollution Control Division- Biology Bureau of Department of Environmental Services. Lake Trophic Data. Department of Environmental Services, 1997.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** February 2004

**Investigator:** Sarah M. Young

**Attribute 2:** Physical Waterbody Characteristics

**Category:** Unique Outstanding Values

**Question J:** Basin Morphometry.

**Directions:** Investigate the overall shape and design of your waterbody. Determine if it is generally one continuous open water area (i.e. single basin or “bathtub”) or if can be broken up into distinct sections (multiple basins). This question can best be answered by studying a detailed map of the waterbody. You should attempt to identify where the major inlets and outlets are, note any substantial shoreline constrictions, and utilize your general knowledge of suspected waterflow in the waterbody. If you have difficulty determining the basin morphometry, contact DES Lakes Program staff.

**Rationale:** This question is designed to help you recognize if there are one or many distinct basins in your waterbody. Lakes or ponds with multiple basins can behave like many different lakes in one. Ultimately, having a better understanding of this attribute will help focus your development of general and targeted management strategies.

**Process Followed:** Used an improved hydrographic map, which gives the overall shape and water depths of bodies of war.

**Findings and Analysis:** The shape of Lake Sunapee is fairly long and stretched out. It has approximately 5 basins and 3 major coves. These major coves/bays are Gardener Bay, Sunapee Harbor, and one inlet in Newbury Harbor and Herrick Cove. Sunapee Harbor is the one major outlet, which drains into Sugar River. (Lake Sunapee watershed Map 1). According to Aimee Ayres there are about 20 that contribute water to the lake. However, some of the larger tributaries are Herrick Cove, Jobs Creek, Burkehaven Islands, the northwest corner of Great Island, Star Island, and Hastings.

**Evaluation Criteria:**

- 1) 1 basin
- 2) – 5 basins
- 3) > 5 basins

**Score:**

- 1
- 3
- 5

**Sources:**

Improved Hydrographic Map of Lake Sunapee New Hampshire Drawn By Fred Q. Bower of Maine. Scale 1 inch equals 1000 feet.

Lake Sunapee Watershed Map. Durham NH. Created By Upper Valley Lake Sunapee Planning Commission. Features drawn by the Complex Systems Research Center, 2003

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Gordon Krantz

**Attribute 2:** Physical Waterbody Characteristics

**Category:** Unique and Outstanding Values

**Question K:** Water body origin.

**Directions:** Contact DES Lakes Program staff to determine the waterbody origin.

**Rationale:** Answering this question should help increase the awareness of how your waterbody was formed. Naturally occurring lakes and ponds are usually less productive, have a smaller watershed, and longer hydraulic residence times than human constructed impoundments. There may be other significant attributes linked directly to the waterbody's origin such as its recreational, economic, or aesthetic values.

**Process Followed:** Contacted Lee Wilder, *Public Outreach Coordinator* in the New Hampshire Department of Environmental services.

**Findings and Analysis:** According to Lee Wilder, "Lake Sunapee is a (naturally occurring) lake that formed as a glacial lake basin during the Pleistocene period."

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) Human Constructed impoundments would exist as either a stream of river otherwise.	1
2) Naturally occurring waterbody with water level raised or controlled by damming.	3
3) Naturally occurring lake or pond without human controlled waterleaves	5

**Sources:** Wilder, Lee. "The Waterbody Origin of Lake Sunapee." November 2003. .

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Gordon Krantz

**Attribute 2:** Physical Waterbody Characteristics

**Category:**

**Question L:** Stratification characteristics.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory* or the most recent data source with a temperature-by-depth profile. Waterbodies that demonstrate a  $>5^{\circ}$  F change in water temperature over a change of 6 feet or less in depth are considered to be “thermally stratified”. Thermal stratification is most distinct in mid-summer; therefore the data should be collected sometime from late June through late August.

**Rationale:** Summer thermal stratification is common to most New Hampshire lakes and ponds. However, since it creates distinct layers of water that do not mix, it is important to recognize if its phenomenon occurs and the possible consequences. Low dissolved oxygen levels in the hypolimnion (bottom layer) can limit the sections of waterbody available to fish and lead to the accumulation of nutrient. On the other hand, a well-oxygenated hypolimnion can provide a refuge for cold-water fish species such as trout and salmon, as well as limiting the accumulation of nutrients. However, a well-mixed lake (not stratified) will continuously cycle nutrients from the bottom sediments promoting a higher level of algal growth. Thermal stratification usually breaks down in the spring and fall as water temperatures in the upper (epilimnion) and lower layers overage allowing the water from all depths to mix completely.

**Process Followed:** Contacted lab manager of the Lake Sunapee Protective Association, Bonnie A. Lewis. Bonnie provided a *Deep Sites Lake Sunapee Protective Association Volunteer Lake Assessment Program 2003 Sampling Season* data sheet.

**Findings and Analysis:** During the months of June through August in 2004, Lake Sunapee experiences thermal stratification. In the summer the water layers do not mix and the lake stratifies. Sunapee is stratified in summer and mixes in October. By looking at the results from the *Dissolved Oxygen Temperature Profile* the dissolved oxygen shrinks in estimate as the depth drops. The temperature gradually decreases until it drastically decreases at the eleventh layer of depth. The *New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet* for late June through August on four Lake Sunapee deep site tests all show thermal stratification. In addition, in the attachment of “Dissolved Oxygen/ Template Profile,” the different color coding of the data represents the three layers of the lake where the data was recorded. See attachment for reference to the research data. This data sheet is an example of stratification for September 2003.

**Evaluation Criteria:**

- 1) Waterbody never or infrequently stratifies. If stratification occurs it is usually for  $<1$  week.
- 2) Waterbody experiences summer thermal stratification
- 3) Waterbody never completely mixes

**Sources:**

Lewis, Bonnie A. Personal Interview. 28 Oct. 2003.

Lake Sunapee Protective Association. "Deep Sites Lake Sunapee Protective Association Volunteer Lake Assessment Program 2003 Sampling Season." Lake Sunapee Protective Association, 2003.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** March 2004

**Investigator:** Sarah M. Young

Depth (m)	Dissolved Oxygen (mg/l)	Temp (°C)
1	8.6	19.5
2	8.48	19.5
3	8.63	19.4
4	8.63	19.3
5	8.53	19.3
6	8.58	19.3
7	8.50	19.3
8	8.50	19.3
9	8.52	19.3
10	8.32	19.2
11	7.97	18.1
12	7.21	16.1
13	7.32	13.9
14	7.41	12.0
15	7.33	10.5
16	7.5	9.4
17	7.07	8.5
18	6.50	7.8
19	6.30	7.3
20	6.8	7.0
21	4.74	6.7
22	3.73	6.4
23	3.59	6.3
24	1.51	6.1
25	1.38	6.3

Dissolved Oxygen/ Temperature Profile

Date Sampled: September 22, 2003

Time Sampled: 11:30am

**Attribute 2:** Physical Waterbody Characteristics

**Category:**

**Question M:** Flood storage ability

**Directions:** Contact the Dam Bureau at the DES, which maintains a comprehensive database of private, and state owned registered dams. The waterbody's flood storage capacity should be based on the information contained in this database. An additional source of information is the Office of Emergency Management.

**Rationale:** Flood frequency is important to landowners along the waterbody's perimeter and recreational users. Lakes or ponds prone to flooding can significantly damage homes, boathouses, docks, and boats. Frequent flooding can inundate nearby septic systems, limit public access, and impact overall recreational experiences. However, natural flooding may also benefit fish and wildlife. Understanding the lake or pond's flooding tendencies will help prioritize management goals and objectives.

**Process Followed:** Nancy McGrath at DES was contacted through e-mail and she sent over the information that was needed

**Findings and Analysis:** Lake Sunapee has a high flood storage ability. At recreation level the dam (#229.04) stores 19,800 acre-feet and is capable of storing 40,900 acre-feet when the water is at the top of the dam

**Evaluation Criteria:**

- 1) Flash floods
- 2) Prone to flooding
- 3) Low flood storage
- 4) Moderate flood storage
- 5) High flood storage

**Sources:**

Nancy McGrath, NH Department of Environmental Services, Water Division, Dam Bureau. PO Box 95, 6 Hazen Drive, Concord, NH 03302-0095. (603) 271-3406.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Beau Etter-Garrette

**Attribute 2:** Physical Waterbody Characteristics

**Category:**

**Question N:** Average water level alteration.

**Directions:** If a dam exists, identify the owner of the dam. If DES owns the dam, the Dam Bureau will have this information. If the dam is privately owned or owned by another state agency, contact them to inquire about the average seasonal drawdown. If the lake or pond does not have a water control structure on it, then consider the average natural level of water fluctuation.

**Rationale:** The amount a lake or pond's water level is artificially manipulated can affect the amount of habitat available for fish and other types aquatic organisms, lake accessibility, boating safety, and lakeside property desirability. However, artificial drawdown may also be necessary to reduce flooding frequency and property damage.

**Process Followed:** Nancy McGrath at DES was contacted through e-mail and she sent over the information that was needed

**Findings and Analysis:** From 1985 to 2002 Lake Sunapee's average water level alteration was 2-3 feet.

**Evaluation Criteria:**

- 1) > 8 feet
- 2) 6.1 – 8 feet
- 3) 4.1 – 6 feet
- 4) 2 – 4 feet
- 5) < 2 feet

**Sources:**

Nancy McGrath, NH Department of Environmental Services, Water Division, Dam Bureau. PO Box 95, 6 Hazen Drive, Concord, NH 03302-0095. (603) 271-3406.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Beau Etter-Garrette

**Attribute 2:** Physical Waterbody Characteristics

**Category:**

**Question O:** Water Control Structure

**Directions:** Contact the DES Dam Bureau to identify the size, type, construction date, classification, owner, and date of last inspection. Additionally, note if flowage rights exist and, if so, the ownership of those rights.

**Rationale:** A comprehensive management plan should include this as basic information regardless of whether regular flooding is an issue. The plan should be designed to serve both as a guidance document and a catalog of general information. Tracking the water control device inspection schedule for the lake or pond will ensure its safety and document any repairs.

**Process Followed:** Nancy McGrath at DES was contacted through e-mail and she sent over the information that was needed

**Findings and Analysis:** Size: 14 feet high, 80 feet long  
Type: unknown  
Construction Date: 1932  
Classification: unknown  
Owner: NH Water Resources Council  
Date of Last Inspection: June 3, 2002

**Sources:**

Nancy McGrath, NH Department of Environmental Services, Water Division, Dam Bureau. PO Box 95, 6 Hazen Drive, Concord, NH 03302-0095. (603) 271-3406.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Beau Etter-Garrette

**Attribute 2:** Physical Waterbody Characteristics

**Category:**

**Question P.** Inlets (tributaries).

**Directions:** Consult a USGS topographic map(s) containing the waterbody. Identify and record the names and general locations, (i.e. mark them on a topographic map or record their latitude and longitude), of all the perennial and intermittent streams and rivers draining into the lake or pond being considered. It may be necessary to visit each stream and river to verify its width.

**Rationale:** The inlets draining into the lake or pond serve as the primary transport mechanisms of nutrients and pollutants associated with the land uses within the watershed under consideration. Inlets also serve as important corridors for fish and wildlife, and offer additional recreational opportunities.

**Process Followed:** Used the National Wetlands Inventory to identify perennial and intermittent streams in Lake Sunapee. The streams were identified, and after they were identified noted Robert Wood the associate director of Lake Sunapee Protection Association. To verify results and ask if there are any streams that are wider than 10feet.

A GIS map was made showing where each inlet (tributary) was located. Using a topographic map the inlets names were also identified and along with there longitude and latitude.

**Findings and Analysis:**

The Perennial and Intermittent streams are:

- Bartlet Brook
- Blodget Brook
- Chandler Brook
- Otter Pond Brook
- King Hill Brook
- Muzzy brook
- Pike Brook
- Red Water Creek

These six streams are wider than 10 feet (wood).

Their names, Longitude and Latitude are as follows:

- Bartlet Brook 43.20 N 72.02 W
- Blodget Brook 43.22 N, 72.02 W
- Chandler Brook Inlet 43.20 N 72.03 W
- Muzzy Brook 43.25 N, 72.04 W
- Otter Brook 43.25 N 72.04 W
- Pike Brook 43.23 N 72.02 W

**Evaluation Criteria:**

- 1) Intermittent inlets only
- 2) A single perennial inlet <10 feet wide
- 3) A single perennial inlet > 10 feet wide
- 4) Multiple (>1) perennial inlet > 10 feet wide

**Sources:**

Robert Wood, *The Associate Director of LSPA.*

Inventory The National Wetlands Inventory retrieved from the World Wide Web Nov 2003. <<http://wetlands2.nwi.fws.gov/sites/nwi/viewer.htm?Title,>>

Map Terrain Navigator Pro 2003, Version 5.04

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Gordon Krantz

**Attribute 2** Physical/waterbody Characteristics

**Category:**

**Question:** Q. Outlets and Tributaries

**Directions:** Consult a USGS topographic map(s) containing the waterbody. Identify and record the names and general locations, (i.e. mark them on a topographic map or record their latitude and longitude), of all the streams and rivers draining out of the lake or pond being considered.

**Rationale:** The outlets draining the lake or pond serve as important transport mechanisms of available nutrients and pollutants. You should be aware of their general size and location. Outlets also serve as important corridors for fish and wildlife, and offer additional recreational opportunities.

**Process Followed:** A GPS reading was taken on a bridge at the base of Lake Sunapee's only outlet, Sunapee Harbor.

**Findings and Analysis:** The Longitude and Latitude reading for Sugar River was 43.23 Latitude north by 72.04 degrees Longitude west. The outlet at Lake Sunapee may serve as a critical gateway to transport nutrients from the lake to the sugar river. The outlet is that is also located at near a marina. This may have an adverse affect on the Sugar River because pollutants may be transferred through the outlet.

**Evaluation Criteria:** There is no evaluation criterion for this question.

**Sources:** A Garmin GPS system was used to obtain information.

**Assessment of Question:** This question adequate as stated.

**Date Completed:** November 2003

**Investigator:** Gordon Krantz

**Attribute 3:** Water Quality Characteristics

**Category:**

**Question A:** Water body trophic status

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory*. This document uses a technique that incorporates multiple water quality parameters developed by DES and provides an overall classification system. Alternative methods are acceptable, but you should note the parameters used in determining the lake or pond's trophic status.

**Rationale:** A water body's trophic status is essentially a measure of its productivity or the amount of organic matter that it produces. The three basic categories in order of decreasing productivity are eutrophic, mesotrophic, and oligotrophic. The addition of unnaturally high amounts of nutrients, primarily phosphorus or nitrogen, can artificially increase lake or pond productivity. Recognizing and maintaining or restoring your water body's natural trophic state is important when developing specific actions for a management plan.

**Process Followed:** Located the *New Hampshire Lakes and Ponds Inventory*.

**Findings and Analysis:** Lake Sunapee is classified as oligotrophic due to its clean, clear and practically drinkable water. Although the lake is very clean, an oligotrophic lake is not always a good classification. Oligotrophic which means a clean and clear lake also means very little aquatic life. An abundance of plants and fish is generally not found in this type lake.

**Evaluation Criteria:**

- 1) Eutrophic
- 2) Mesotrophic
- 3) Oligotrophic

**Sources:**

New Hampshire Department of Environmental Services - Watershed Management Bureau. *New Hampshire Lakes and Ponds Inventory*. 1995 ed.

**Assessment of Question:** The question was adequate as stated.

**Date Completed:** October 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 3:** Water Quality Characteristics

**Category:**

**Question B:** Alkalinity or Acid Neutralizing Capacity (ANC)

**Directions:** Consult the *New Hampshire Lakes and Pond Inventory*, DES Volunteer Lake Assessment Program (VLAP) reports, UNH Lay Lakes Monitoring Program (LLMP) reports, or an alternative reliable source to determine the alkalinity.

**Rationale:** Alkalinity (or ANC) is a measure of the ability for water to neutralize acidic inputs. New Hampshire lakes and ponds have historically had low alkaline waters due to the granite bedrock. This makes them particularly susceptible to acid precipitation.

**Process Followed:** Located the most current *New Hampshire Lakes and Pond Inventory*. Called Andrea LaMoreaux of DES in order to further understand the information present in the *New Hampshire Lakes and Pond Inventory*.

**Findings and Analysis:**

Station Number	September 7, 1995	February 28, 1996
Station 1 (mg/L)	5.4, 5.1, 5.5	4.9, 5.0
Station 2 (mg/L)	4.7, 4.9, 5.4	5.6, 4.7
Station 3 (mg/L)	4.8, 4.9, 5.8	4.7, 5.0

The dates of the most recent analysis were 1995 through 1996. The state does testing every ten to fifteen years on the lake. They do testing in the summer and the winter at the same three deep sites on the lake. The deep sites do not directly correspond to the deep sites used by the LSPA in their testing of the lake. The reason three readings are present in the data from September 7 is because a reading is taken at all three layers of the lake and during the winter they take readings of two layers.

**Evaluation Criteria:**

- 1) <0 (acidified)
- 2) 0 – 2 mg/L (extremely vulnerable)
- 3) 2.1 - 10 mg/L (moderately vulnerable)
- 4) 10.1 – 25.0 mg/L (low vulnerability)
- 5) >25.0 mg/L (not vulnerable)

**Source:**

New Hampshire Department of Environmental Services - Watershed Management Bureau. *New Hampshire Lakes and Ponds Inventory*. 1995 ed. LaMoreaux, Andrea. DES. Personal interview. Dec. 10, 2003.

**Assessment of Question:** The data (numbers) are some what unclear as to where and what the readings are from so a little more clarity as to what each number is a

measurement of may be helpful. Also the fact that the deep sites used by the state to gather the data used to answer this question may or may not be the same sites that the LSPA uses to collect its data is confusing as to what information should be more trusted, the annual data taken by the LSPA or the every ten years or so data take by the state.

**Date Completed:** December 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 3:** Water Quality Characteristics

**Category:**

**Question C:** Calcium concentration

**Directions:** Consult the *New Hampshire Lakes and Pond Inventory*, DES VLAP reports, UNH LLMP reports, or an alternative reliable source to determine the calcium concentration.

**Rationale:** Calcium carbonate, in rock forms such as limestone, readily dissolves in water and is an important compound contributing to a waterbody's alkalinity. Calcium concentration may also be used to gauge a lake's susceptibility to invasion by zebra mussels. Zebra mussels require calcium for shell growth and need levels of at least 9 mg/L for colonization.

**Process Followed:** Located and consulted the *New Hampshire Lakes and Pond Inventory* to find the calcium concentration.

**Findings and Analysis:** The most recent analysis study took place in 1995 and 1996. The data was as follows: On September 7, 1995 at deep site number one the calcium readings were 3.4mg/L. Deep site number two had a reading of 3.4mg/L. And at deep site three the calcium reading was 3.3mg/L. Findings show that this is a very good level for calcium concentrations. This is important because Zebra mussels will not be able to colonize in Lake Sunapee because the lake has to have a concentration at least 9mg/L.

**Evaluation Criteria:**

- 1) < 1.0 mg/L
- 2) 1.1 – 4.0 mg/L
- 2) 4.1 – 8.0 mg/L
- 3) 8.1 – 12.0 mg/L
- 5) >12.0 mg/L

**Sources:**

State of New Hampshire Department of Environmental Services: Water Supply and Pollution Control Division- Biology Bureau. *New Hampshire Lakes and Ponds Inventory*, Vol 4.

**Assessment of Question:** The calcium concentrations were only tested at one depth at the different sites. The data did not state what depth this was and does not state whether or not it is uniform throughout the lake. This finding is good news for Lake Sunapee since if the lake had high calcium concentrations the lake would be susceptible to Zebra mussels.

**Date Completed:** October 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 3:** Physical Waterbody Characteristics

**Category:** Susceptibility to Impairment

**Question D:** pH.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory*, DES VLAP reports, UNH LLMP reports, or an alternative reliable source to determine the pH. If the waterbody regularly stratifies be sure the data was collected from epilimnion (i.e. the layer of water extending from the surface to the thermocline).

**Rationale:** A lake or pond’s pH is an important factor affecting the type and amount of aquatic life it can support. Highly acidified (pH<5.0) waterbodies are not suitable for the survival of most fish species, but are not harmful to humans. Documentation of the lake or pond’s pH may help in assessing its sensitivity to atmospheric deposition of acidic compounds. However, some waterbodies may have naturally low pH (~6.0) levels due to organic (humic and fulvic) acids that result from the breakdown of plant matter.

**Process Followed:** Consulted with Bonnie A. Lewis, of the Lake Sunapee Protective Association (LSPA), who provided the New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet.

**Findings and Analysis:**

Station or Depth	pH
Epilimnion	6.65
Hypolimnion	6.17
Metalimnion	6.43

The date of the most recent analysis was in October 22, 2003. The higher pH results can be indicated from organic acids that result from decomposition of plant matter. Based on the data, Lake Sunapee’s pH is satisfactory. The lake’s pH also has minimal to no impairment to aquatic organisms making Lake Sunapee very clean.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) > 6.0 (satisfactory; minimal to no impairment to aquatic organisms)	1
2) 5.0 – 6.0 (endangered; toxic to some aquatic organisms)	3
3) < 5.0 (critical; toxic to most fish species)	5

**Sources:**

Lewis, Bonnie A. Personal Interview. 28 Oct. 2003.  
New Hampshire Volunteer Lake Assessment Program. “Laboratory Analysis Data Sheet.” Lake Sunapee Protective Association, 2003.

**Assessment of Question:** The question is adequate as stated. The results of this question are important to know, in order for the citizens of the Lake Sunapee Watershed and other people who use the lake for recreational use.

**Date Completed:** February 2004

**Investigator:** Sarah M. Young

**Attribute 3:** Physical Waterbody Characteristics

**Category:** Susceptibility to Impairment

**Question E:** Total Phosphorus concentration.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory*, DES VLAP reports, UNH LLMP reports, or an alternative reliable source to determine the pH. If the waterbody regularly stratifies be sure the data was collected from epilimnion (i.e. the layer of water extending from the surface to the thermocline).

**Rationale:** Phosphorus limits the growth of algae and rooted aquatic plants in the majority of New Hampshire lakes and ponds. Inputs of unnatural phosphorus loads can significantly impact water quality by stimulating excessive algal growth. Identifying unnatural phosphorus inputs and potential remedies is important in the development of a comprehensive management plan.

**Process Followed:** Contacted Bonnie A. Lewis of the Lake Sunapee Protective Association (LSPA), who gave me the New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet.

**Findings and Analysis:**

Station or Depth	Total Phosphorus (mg/L)
Epilimnion	.007
Hypolimnion	.006
Metolimnion	.006

These readings were collected in September 22, 2003. Since Lake Sunapee's water regularly stratifies, the phosphorous reading should be collected from epilimnion (the water layer from the surface to the thermocline). According to the New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet, the measurements were originally given in ug/L and then were converted into mg/L. For instance, 7 ug/L is equivalent to .007 mg/L.

**Evaluation Criteria:**

6) < 0.005 mg/L (ideal)	1
7) 0.005 – 0.010 mg/L (low)	2
8) 0.011 – 0.020 mg/L (average)	3
9) 0.021 – 0.040 mg/L (high)	4
10) > 0.040 mg/L (excessive)	5

**Sources:**

Lewis, Bonnie A. Personal Interview. 28 Oct. 2003.

New Hampshire Volunteer Lake Assessment Program. "Laboratory Analysis Data Sheet." Lake Sunapee Protective Association, 2003.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** February 2004

**Investigator:** Sarah M. Young

**Attribute 3:** Water Quality Characteristics

**Category:** Recreation

**Question F:** Secchi disk transparency.

**Directions:** Consult the *New Hampshire Lakes and Pond Inventory*, DES VLAP reports, UNH LLMP reports, or an alternative reliable source to determine the transparency.

**Rationale:** A secchi disc measurement provides an indication of overall water clarity. Lakes or ponds with heavily stained or muddy waters will generally have low secchi disc measurements. Likewise, waterbodies with high concentrations of suspended algae will also have low secchi disc readings.

**Process Followed:** Contacted Bonnie A. Lewis of the Lake Sunapee Protective Association (LSPA), and referred to the New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet.

**Findings and Analysis:** The data of the secchi disc was collected in September 22, 2003. The measurement of the secchi disk was 8.575 meters. They are proof that the lake is indeed a clear, oligotrophic lake, with good water clarity. This is very good because it results in a high aesthetic value among vacation goers.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) < 1 meter	1
2) 1.0 - 4.0 meters	2
3) 4.1 - 8.0 meters	3
4) 8.1 - 12.0 meters	4
5) > 12.0 meters	5

**Sources:**

New Hampshire Volunteer Lake Assessment Program. "Laboratory Analysis Data Sheet." Lake Sunapee Protective Association, 2003.

**Assessment of Question:** Question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 3:** Physical Waterbody Characteristics

**Category:** Susceptibility to Impairment

**Question F:** Secchi disc transparency.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory*, DES VLAP reports, UNH LLMP reports, or an alternative reliable source to determine the transparency.

**Rationale:** A secchi disc measurement provides an indication of overall water clarity. Lakes or ponds with heavily stained or muddy waters will generally have low secchi disc measurements. Likewise, waterbodies with high concentrations of suspended algae will also have low secchi disc readings.

**Process Followed:** Contacted Bonnie A. Lewis of the Lake Sunapee Protective Association (LSPA), and referred to the New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet.

**Findings and Analysis:** The data of the secchi disc was collected in September 22, 2003. The measurement of the secchi disk was 8.575 meters.

<b>Evaluation Criteria:</b>	<b>Score:</b>
6) < 1 meter	5
7) 1.0 - 4.0 meters	4
8) 4.1 - 8.0 meters	3
9) 8.1 - 12.0 meters	2
10) > 12.0 meters	1

**Sources:**

Lewis, Bonnie A. Personal Interview. 28 Oct. 2003.  
New Hampshire Volunteer Lake Assessment Program. "Laboratory Analysis Data Sheet." Lake Sunapee Protective Association, 2003.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** February 2004

**Investigator:** Sarah M. Young

**Attribute 3:** Water Quality Characteristics

**Category:** Unique and Outstanding

**Question F:** Secchi disc transparency

**Directions:** Consult the *New Hampshire Lakes and Pond Inventory*, DES VLAP reports, UNH LLMP reports, or an alternative reliable source to determine the transparency.

**Rationale:** A secchi disc measurement provides an indication of overall water clarity. Lakes or ponds with heavily stained or muddy waters will generally have low secchi disc measurements. Likewise, waterbodies with high concentrations of suspended algae will also have low secchi disc readings.

**Process Followed:** received information from Bonnie A Lewis of the Lake Sunapee Protective Association (LSPA), who directed me to the New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet.

**Findings and Analysis:** The Data Collected on September 22<sup>nd</sup> 2003. The measurement for the Secchi disk was 8.575 meters.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) < 1 meter	1
2) 1.0 – 4.0 meters	2
3) 4.1-8.0 meters	3
4) 8.1-12.0 meters	4
5) >12.0 meters	5

**Sources:**

Lewis, Bonnie A. Personal Interview. 28 Oct. 2003.  
New Hampshire Volunteer Lake Assessment Program. "Laboratory Analysis Data Sheet." Lake Sunapee Protective Association, 2003.

**Assessment of Question:** This question is clearly stated.

**Date Completed:** Dec. 2003

**Investigator:** Gordon Krantz

**Attribute 3: Water Quality Characteristics**

**Category:**

**Question G: Hazardous material spill events(s)**

**Directions:** Visit the NH DES One Stop Database to examine the Remediation and Initial Response Spill Sites list for past records of hazardous material spills into or nearby the waterbody.

**Rationale:** Many of New Hampshire's roadways that pass near or over portions of lakes, ponds, or streams increase the possibility of accidental spills of hazardous materials from transport vehicles. In addition, for lakes or ponds which have marine service facilities on them or businesses nearby, accidental spillage of hazardous materials into the waterbody is of great concern. In completing this inventory, you should identify any past spills that have occurred and document if the problem persists.

**Process Followed:** GIS data was received by email compiled and analyzed with Granit GIS data. The GIS data was then compared with data compiled on the One Stop Data retrieval online website. A Hydrographic map of Lake Sunapee was also used in the process of locating hazardous spill sites. Map labels called Spatial Data Notes were used to identify remediation and initial spill sites on the GIS map.

**Findings and Analysis:** The culmination of GIS data and one stop Retrieval data have yielded two hazardous waste remediation sites, and one initial spill site. One hazardous spill site is located in the town of New London NH on Old Dump Road. The site was discovered on July 18 of 1997. According to the Data Spatial Notes the type of spill at this site was non-petroleum based, or chlorinated solvents. Information as of June 20<sup>th</sup> 2003, shows that there is a clean up underway to remove this hazardous material from soils at the site. However, recent status of the site cleanup project is unavailable. The second hazardous remediation site is located near Lake Sunapee Harbor. This is another site of a non petroleum chemical spill or chlorinated solvent. The site was discovered in 1984, but no recent action has been taken. There is one initial spill site located near Jobs Creak near Lake Sunapee. However, recent information at the One Stop data retrieval site shows that there is no recent action being done at this site.

**Evaluation Criteria:**

- 1) Spill with current detectable water quality impacts
- 2) Spill with water quality impacts that were detectable < 3 months ago
- 3) Spill with water quality impacts that were detectable 3 – 12 months ago
- 4) Spill with water quality impacts that were detectable >12 months ago
- 5) No known spill events or spill without any detectable water quality impacts

**Sources:**

Improved Hydrographic Map of Lake Sunapee New Hampshire Drawn By Fred Q. Bower of Maine. Scale 1 inch equals 1000 feet.  
"NH Granit." 1999-2000. 05 Mar 2004. <<http://www.granit.sr.unh.edu/>>.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Gordon Krantz

**Attribute 3** Water Quality Characteristics

**Category:**

**Question H:** Water Quality Concerns

**Directions:** Contact the DES Lakes Program staff to determine if the waterbody has any unique pollutants that could be problematic.

**Rationale:** It is possible that pollutants such as pesticides, herbicides, petroleum byproducts (MTBE), mercury, dioxin, or even excessive siltation could compromise the water quality of the lake or pond. Document these occurrences and monitor their status.

**Process Followed:** Contacted Jody Conner, the Limnology Center Director at the New Hampshire Department of Environmental Services.

**Findings and Analysis:** There is no point source pollution but non point source pollution is a concern because there are roads around Lake Sunapee and every time it rains the water in the culverts drain into Lake. One of the most common forms of pollution in Lake Sunapee is phosphorus. Phosphorus pollution in the lake is caused by runoff from impervious surfaces such as roads and developments. Roads and developments and surface runoff pollution go hand and hand. Land use like agriculture can also effect how much phosphorus pollution drains into the lake. Around Lake Sunapee there are areas horse barns which could also affect the level of phosphorus pollution along with golf courses and lawns around the lake.

**Sources:** Jody Connor Limnology Center Director.

**Assessment of Question:** The question is fine as stated.

**Date Completed:** Dec. 2003

**Investigator:** Gordon Krantz

**Attribute 3:** Water Quality Characteristics

**Category:** Susceptibility to Impairment

**Question I:** Historic point source discharges.

**Directions:** Contact the NH DES Watershed Management Bureau for any listings for the waterbody in the *Classification and Priority Listing of New Hampshire Lakes, Volume 1*.

**Rationale:** Although a point source polluter may not presently exist on the lake, a historic source point source discharge (i.e. sewage outfall) may have contributed an additional phosphorus load or other notable pollutants to the waterbody in the past. If so, it is possible the pollutants may continue to be bound to the bottom sediment and could continue to play an important role in the internal nutrient cycle of the waterbody. Identification and awareness of these historic anthropogenic inputs can be important when devising a non-point source nutrient reduction strategy.

**Process Followed:** Contacted NH DES Water Management Bureau. Channeled through several departments until appropriate department was contacted:

- Drinking Water Source Protection Program (DSWAP):  
Program Staff: Johanna McKenna- 603-271-7017, [jmckenna@des.state.nh.us](mailto:jmckenna@des.state.nh.us)  
Paul Susca- 603-271-7061, [psusca@des.state.nh.us](mailto:psusca@des.state.nh.us)
- Groundwater Discharge Permitting and Regulation:  
Mitch Locker- 603-271-2858, [mlocker@des.state.nh.us](mailto:mlocker@des.state.nh.us)
- Water Supply Engineering:  
Roy Gilbreth- 603-271-1494
- Wetlands Bureau:  
Sharon Dusharine- 203-271-3503

Once the right person was contacted, they referred to the *Classification and Priority Listing of New Hampshire Lakes, Vol. 1*.

**Finding and Analysis:** A review of the *Classification and Priority Listing of New Hampshire Lakes*, 1981 study, found there are no historic point source discharges to Lake Sunapee.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1.) None	1
2.) 1 or more; discharge discontinued at least 20 years ago	2
3.) 1 or more; discharge discontinued at least 10 years ago	3
4.) 1 or more; discharge discontinued at least 5 years ago	4
5.) Discharge presently exists	5

**Sources:**

Conner, Jody. Limnology Section, Department of Environmental Services. (603) 271-3414.

Gilbreth, Roy. Environmental Inspector, Wastewater Engineering Bureau, Water Division, Department of Environmental Services, P.O. Box 95, Concord, NH 03302-0095 (603) 271-1494 Email [rgilbreth@des.state.nh.us](mailto:rgilbreth@des.state.nh.us)

Towne, R.E. and R.H. Estabrook. 1981. Classification and Priority Listing of New Hampshire Lakes. Vol. I and II, Parts 1-6. Staff Rept. No. 121. NHWSPCC.

**Assessment of Question:** The results of this question can be significant in determining a watershed's level of susceptibility to impairment. Sources of pollution are often recognized during their "contamination period" and forgotten about after they are out of use or the concern has a potential source of pollution has not been recognized. Historical point source discharges are important to establish in order to implement a plan of action to contain and prevent present and future contamination. By knowing point source polluters, their location, and what types of contaminants have been added to the environment, the process of understanding their consequences and how to limit exposure can prevent associated health problems, both human and environmental.

**Date Completed:** November 2003

**Investigator:** Tamsen B Bolte

**Attribute 3:** Water Quality Characteristics

**Category:**

**Question J:** Presence in the 305(b), 303(a), or Unified Watershed Management (UWA) report.

**Directions:** Consult the most recent 305(b) and 303(d) reports and the 1998 Unified Watershed Management report for the State of New Hampshire submitted by DES to the EPA. Note whether the waterbody is listed on any of these reports and the reason(s) why it was listed. Please note: Since all surface waters in New Hampshire are impaired for fish and shellfish consumption due to elevated levels of mercury in fish/shellfish tissue, this impairment should not be included for this question.

**Rationale:** Each of these reports are designed to give a broad overview of water quality in New Hampshire. The criterion for listing in each of these reports varies among reports and from year to year. Therefore, while the listing of specific waterbodies on these lists provides some indication of potential water quality impairment, it does not indicate any particular level of severity. In any case take note if the waterbody is listed and why it is listed. In some cases, a listed waterbody is eligible for special funding opportunities to further protect or restore water quality.

**Process Followed:** Located the most recent 305(b) and 303(d) reports and the 1998 Unified Watershed Management report for the State of New Hampshire submitted by DES to the EPA.

**Findings and Analysis:** Lake Sunapee was listed in the 2000 edition of the 305(b) report as a site of exotic species removal; the removal was done by hand according to the report. Lake Sunapee was listed as having in-stream biomonitoring assessment prior to 1995, which was conducted by DES, of Sunapee's tributaries for the purpose of assessing species richness, species composition, population size, and trophic composition of resident aquatic organisms. This type of monitoring is seen as one of the best ways to maintain the integrity of the surface water and helps to show if aquatic organisms are being impacted adversely by pollutants over long periods of time. Lake Sunapee was not mentioned in the 1998 303(d) report but the Sugar River, which is the only outlet of the lake, was mentioned for insufficient dissolved oxygen (DO) and bacteria but that was south of the Coy Paper Mill Dam in Claremont.

**Evaluation Criteria:**

- 1) Listed on 305(b), 303(d), or UWA report
- 2) Not listed on 305(b), 303(d), or UWA report

**Sources:**

2000 New Hampshire Department of Environmental Services 305(b) Water Quality Report  
1998 New Hampshire Department of Environmental Services 303(d) Water

Quality Report

**Assessment of Question:** The question was adequate as stated.

**Date Completed:** October 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 4:** Biological / Ecological Characteristics

**Category:** Recreation

**Question A:** Algal abundance (chlorophyll *a* level).

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory* or an alternative reliable source to determine the algal abundance.

**Rationale:** The algal abundance in a waterbody is function of water temperature, the amount of sunlight it receives, and nutrients it contains. In particular, nutrients (primarily nitrogen and phosphorus) are often critical in controlling algal growth. Lakes or ponds with naturally high quantities of nitrogen and phosphorus will have a much higher quantity of algae than waterbodies with low levels of these nutrients. In many cases, lakes or ponds subjected to unnaturally high quantities of nitrogen or phosphorus through runoff of excess fertilizer or leakage of faulty septic systems will experience nuisance algal growths. Therefore, it is desirable to determine what level of algal growth occurs in the lake or pond, and whether the observed levels are within the expected natural range for similar waterbodies.

Chlorophyll *a* is a photosynthetic pigment found in most algae. The measure of its abundance in a water sample provides an easy surrogate measure of the amount (but *not* the type) of algae present in a waterbody at the time of collection.

**Process Followed:** Located and consulted the *New Hampshire Lakes and Pond Inventory* to find chlorophyll *a* readings.

**Findings and Analysis:** The data of the chlorophyll *a* level (ug/l) was collected on September 22, 2003. The chlorophyll *a* measured to be 1.11 mg/m<sup>3</sup>. Again these readings are of the abundance of algae not the types present. This lack of algae growth results in Lake Sunapee having the water clarity that is so good.

**Evaluation Criteria:**

- 1) >15.0 µg/L (nuisance amounts)
- 2) 10.1 – 15.0 µg/L (more than desirable)
- 3) 5.1 – 10.0 µg/L (more than desirable)
- 4) 3.0 – 5.0 µg/L (good)
- 5) < 3.0 µg/L (good)

**Source:**

- 1
- 2
- 3
- 4
- 5

**Sources:**

New Hampshire Volunteer Lake Assessment Program. "Laboratory Analysis Data Sheet." Lake Sunapee Protective Association, 2003.

**Assessment of Question:** Question is adequate as stated.

**Date Completed:** October 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 4:** Biological/ Ecological Characteristics

**Category:** Susceptibility to Impairment

**Question A:** Algal abundance; chlorophyll a level.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory* or an alternative reliable source to determine the algal abundance.

**Rationale:** The algal abundance in a waterbody is function of water temperature, the amount of sunlight it receives, and nutrients it contains. In particular, nutrients (primarily nitrogen and phosphorus) are often critical in controlling algal growth. Lakes or ponds with naturally high quantities of nitrogen and phosphorus will have a much higher quantity of algae than waterbodies with low levels of these nutrients. In many cases, lakes or ponds subjected to unnaturally high quantities of nitrogen and phosphorus through runoff of excess fertilizer or leakage of faulty septic systems will experience nuisance algal growths. Therefore, it is desirable to determine what level of algal growth occurs in the lake or pond, and whether the observed levels are within the expected natural range for similar waterbodies.

Chlorophyll *a* is a photosynthetic pigment found in most algae. The measure of its abundance in a water sample provides an easy surrogate measure of the amount (but not the type) of algae present in a waterbody at the time of collection.

**Process Followed:** Contacted Bonnie A. Lewis of the Lake Sunapee Protective Association (LSPA), who referred to the *New Hampshire Volunteer Lake Assessment Program Laboratory Analysis Data Sheet*

**Findings and Analysis:** The data of the chlorophyll *a* level (ug/l) was collected on September 22, 2003. The chlorophyll *a* measured to be 1.11 mg/m<sup>3</sup>.

<b>Evaluation Criteria:</b>	<b>Source:</b>
1) >15.0 µg/L (nuisance amounts)	5
2) 10.1 – 15.0 µg/L (more than desirable)	4
3) 5.1 – 10.0 µg/L (more than desirable)	3
4) 3.0 – 5.0 µg/L (good)	2
5) < 3.0 µg/L (good)	1

**Sources:**

Lewis, Bonnie A. Personal Interview. 28 Oct. 2003.  
New Hampshire Volunteer Lake Assessment Program. "Laboratory Analysis Data Sheet." Lake Sunapee Protective Association, 2003.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** February 2004

**Investigator:** Sarah M. Young

**Attribute 4:** Biological/ Ecological Characteristics

**Category:** Susceptibility of Impairment

**Question B:** Algal community composition.

**Directions:** Consult the *New Hampshire Lakes and Ponds Inventory* or an alternative reliable source to determine the algal community composition.

**Rationale:** While it is the algal abundance, (see Question A above), that causes the nuisance, the types of algae present and their relative percent abundance of the total algal community are also important when assessing the condition of the lake or pond. While many different species and cases of algae can form blooms (visible accumulations of algae), it is the blue-green algae, or Cyanobacteria, that are of particular importance. This class of algae is important for two reasons. First, blue-greens are the only algae that float to the surface and form paint-like scums, often accumulating along down-wind shores. Secondly, some types of blue-green algae contain toxins. These toxins can kill dogs and other animals and if consumed in quantity, can cause gastro-intestinal upsets for minor ingestions and can cause skin and eye, ear and nose irritations from bodily contact.

It is not unusual or unhealthy for blue-greens to be present in minor amounts, but when they become the dominant species present, the likelihood of nuisance blooms developing increases if sufficient nutrients are present. The most commonly observed blue-green algae in NH lakes include: Anabaena, Aphanizomenon, Microcycets, Coelosphaerium, Oscillatoria, Lyngbybya and Gloeotrichia. All but Coelosphaerium and Gloeotrichia are known to have toxin-producing forms.

If you observe a paint-like or pea soup-like scum of algae along your shore, keep children and pets out of the water and notify NH DES so that the scum can be tested for the presence of toxins.

**Process Followed:** Contacted Bonnie A. Lewis, who gave the contact information of Andrea Lamoreaux, who works for NH DES. Andrea Lamoreaux provided *Lake Sunapee Deep Spot Stations Cyanobacteria (NH DES Volunteer Lake Assessment Program 2002* spreadsheet. See attachment for details.

**Findings and Analysis:** Cyanobacteria, which were once known as blue-green algae, have recently been reclassified as bacteria. Cyanobacteria species were previously classified as blue green algae because of their superficial resemblance to green algae. Cyanobacteria are also photosynthetic bacteria that have a different cell structure than the true algae. However, research indicates that their abundance increases as the nutrients in a lake increase. They are part of the aquatic food web and can be eaten by various grazers in the lake ecosystem, such as zooplankton and mussels.

In New Hampshire, four of the most common cyanobacteria include: Anabaena, Aphanizomenon, Oscillatoria, and Microcystis. Anabaena produce neurotoxins that

interfere with the nerve function and have almost immediate effects when ingested. Microcystis are best known for producing hepatotoxins known as microcystins.

The attachment contains information regarding the presence of Cyanobacteria in Lake Sunapee. Lake Sunapee is sampled at four deep spots (Stations 200, 210, 220, and 230) through the New Hampshire Department of Environmental Services Volunteer Lake Assessment Program. This data is from the 2002 sampling season. Percentages indicate the relative abundance of a particular cyanobacteria species within an entire plankton sample.

By looking at the known data as seen in the attachment, coming up with specific number estimate can be difficult to do for the following reasons:

- Algae populations vary from season to season based on weather conditions, succession, and reproductive cycles;
- Algae populations vary from year to year based on weather conditions;
- Algae populations vary from place to place within the lake.

According to Andrea Lamoreaux, 10% - 30% of the algae in Lake Sunapee may be cyanobacteria (formerly known as blue-green algae).

**Evaluation Criteria:**

- 1) <10% blue-greens
- 2) 10.0 – 30.0% blue-greens
- 3) 30.1 – 50.0% blue-greens
- 4) 50.1 – 70% blue-greens
- 5) >70% blue-greens

**Source:**

- 1
- 2
- 3
- 4
- 5

**Sources:**

Lamoreaux, Andrea. Phone Interview and Email Correspondence. 17 Nov. 2003.

Lewis, Bonnie A. Personal Interview. 28 Oct. 2003.

*Lake Sunapee Deep Spot Stations Cyanobacteria (NH DES Volunteer Lake Assessment Program 2002.*

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** February 2004

**Investigator:** Sarah M. Young

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

**Lake Sunapee  
Deep Spot Stations  
Cyanobacteria  
(NH DES  
Volunteer Lake  
Assessment  
Program 2002)**

<b>17-Jun-02</b>	<b>Microcystis</b>	<b>Anabaena</b>
<b>Stn 200</b>	5.50%	24.80%
<b>Stn 210</b>	0.85%	19.60%
<b>Stn 220</b>	1.60%	5.64%
<b>Stn 230</b>	0.87%	6.10%

<b>29-Jul-02</b>	<b>Microcystis</b>	<b>Anabaena</b>
<b>Stn 200</b>		
<b>Stn 210</b>		24.20%
<b>Stn 220</b>		12.00%
<b>Stn 230</b>		11.20%

<b>19-Aug-03</b>	<b>Microcystis</b>	<b>Anabaena</b>
<b>Stn 200</b>	25.00%	20.00%
<b>Stn 210</b>		
<b>Stn 220</b>	12.80%	
<b>Stn 230</b>		

<b>30-Sep-03</b>	<b>Microcystis</b>	<b>Anabaena</b>
<b>Stn 200</b>		
<b>Stn 210</b>		10.10%
<b>Stn 220</b>	23.10%	
<b>Stn 230</b>	40.30%	

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Unique or Outstanding Values

**Question C:** Fish species diversity.

**Directions:** Consult the New Hampshire Fish and Game Department to obtain a complete listing of the fish known to occur in the waterbody.

**Rationale:** The number of species of fish that inhabit a waterbody is strongly influenced by the variety of habitats that are present. In general, large lakes will have a greater diversity of fish species than small ponds. However, in certain instances a lake or pond may contain an isolated fish species or a wide range of habitat types capable of supporting an uncommonly high number of fish species making the community unique. An assessment of the fish community should include both game (naturally occurring or stocked) and non-game fish species.

**Process Followed:** Contacted the New Hampshire Fish and Game Department and asked for information on exotic animal species in Lake Sunapee. Don Miller, the Large Lake Fisheries Biologist, responded with the following information.

**Findings and Analysis:**

- Common White Sucker
- Bullhead
- Pickerel
- Common Shiner
- Yellow Perch
- Cusk
- Landlock Salmon
- Brook Trout
- Smallmouth Bass
- Largemouth Bass
- Fallfish
- Golden Shiner
- Pumpkinseed
- Red-breast Sunfishes
- Lake Trout
- Rock Bass (This species was illegally introduced to the lake and now has a negative impact on the other species. Unfortunately it is invasive and Lake Sunapee has a high level of Rock Bass.)

**Evaluation Criteria:**

- 1) 0-2 species
- 2) 3-5 species
- 3) 6-8 species
- 4) 9-12 species
- 5) >12 species

**Score:**

- 1
- 2
- 3
- 4
- 5

**Sources:**

Miller, Don. (donmiller@starband.net). "Exotic Species." E-mail to  
Tamsen Bolte (tbolte@colby-sawyer.edu). 19 November 2003.

**Assessment of Question:** The date of assessment of the species was not available.

**Date Completed:** November 2003

**Investigator:** Emily Goodrich

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Unique or Outstanding Values

**Question D:** Avian species diversity.

**Directions:** Consult the Bird Checklist in Appendix B for a listing of birds in NH which use lake and/or pond habitat. (Note: This checklist was developed using *New England Wildlife: Habitat, Natural History, and Distribution*, 1983.) Using the checklist, identify the avian species sited in and around the waterbody. Work with DES Lakes Program staff, NH Fish and Game, local conservation organizations or local birding groups/individuals to determine the best source of information to complete this question.

**Rationale:** Birds that rely on water in some fashion, as a medium containing food or habitat, provide a link to the terrestrial environment. Lakes or ponds with many bird species indicate that there are some potentially unique qualities to the ecosystem of interest. Further, waterbodies with a diverse avian community may be popular bird watching sites for the public.

**Process Followed:** Referred to *New England Wildlife* and *Atlas of Breeding Birds in New Hampshire*. Also consulted the Bird Checklist in Appendix B for the list of species that use the lake habitat.

**Findings and Analysis:**

- Wood Duck
- Mallard
- Common Loon
- Common Merganser
- Hooded Merganser
- Pied-billed Grebe
- Great Blue Heron
- Spotted Sandpiper
- Herring Gull
- Red-winged Blackbird
- Bobolink
- Barn Swallow
- Cliff Swallow
- Northern Roughwinged Swallow
- Tree Swallow
- Bank Swallow
- Common Grackle
- Swamp Sparrow
- Eastern Bluebird
- Olive-sided Flycatcher
- Common Raven

- Common Yellowthroat
- Belted Kingfisher

**Evaluation Criteria:**

**Score:**

1) 0-5 species	1
2) 6-10 species	2
3) 11-15 species	3
4) 16-20 species	4
5) >20 species	5

**Sources:**

DeGraaf, Richard M., and Mariko Yamasaki. New England Wildlife: Habitat, Natural History, and Distribution. Hanover: University Press of New England, 2001.

Foss, Carol R., ed. *Atlas of Breeding Birds in New Hampshire*. Dover, NH: Arcadia, 1994

**Assessment of Question:** The date of assessment of the species was not available.

**Date Completed:** November 2003

**Investigator:** Emily Goodrich

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Unique or Outstanding Values

**Question E:** Mammal species diversity.

**Directions:** Consult the Mammal Checklist in Appendix B for a listing of all mammals in NH which use lake and/or pond habitat. (Note: This checklist was developed using *New England Wildlife: Habitat, Natural History, and Distribution*, 1983.) Using the checklist, identify the mammal species sited in and around your waterbody. Work with DES Lakes Program staff, NH Fish and Game, or local conservation organizations to determine the best source of information to complete this question.

**Rationale:** Mammals that rely on water in some fashion, either for food or habitat, provide a link to the terrestrial environment. Lakes or ponds with many mammal species indicate that there are some potentially unique qualities to the ecosystem of interest. Further, waterbodies with a diverse mammal community may be popular wildlife viewing sites for the public.

**Process Followed:** Referred to *New England Wildlife* and Mike Marchand who is a Wetland Systems Biologist of Nongame & Endangered Wildlife Program of New Hampshire Fish & Game. Also consulted the Mammal Checklist in Appendix B for the list of species that use the lake habitat.

**Findings and Analysis:**

- Black Bear
- Beaver
- Mink
- Moose
- Star-nosed mole
- River Otter
- Water Shrew

**Evaluation Criteria:**

- 1) 0-2 species
- 2) 3-5 species
- 3) 6-8 species

**Score:**

- 1
- 3
- 5

**Sources:**

DeGraaf, Richard M., and Mariko Yamasaki. New England Wildlife: Habitat, Natural History, and Distribution. Hanover: University Press of New England, 2001.

Marchand, Mike. (michael.marchand@WILDLIFE.STATE.NH.US). "Lake Inventory." E-mail to Emily Goodrich (egoodrich@colby-sawyer.edu). 26 November 2003.

**Assessment of Question:** The date of assessment of species was not available.

**Date Completed:** November 2003

**Investigator:** Emily Goodrich

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Unique or Outstanding Values

**Question F:** Reptile and amphibian species diversity.

**Directions:** Consult the Reptile and Amphibian Checklist in Appendix B for a listing of all reptiles and amphibians in NH which use lake and/or pond habitat. (Note: This checklist was developed using *New England Wildlife: Habitat, Natural History, and Distribution*, 1983.) Using the checklist, identify those species sited in and around your waterbody. Work with DES Lakes Program staff, NH Fish and Game, or local conservation organizations to obtain the information necessary for this question. Note: Reptile and amphibian community identification can be a time consuming process. For the purposes of this inventory, complete the checklist using local knowledge and the sources noted above. For a more intensive, accurate survey, consult Appendix C which provides further information on surveying salamander and frog communities.

**Rationale:** Reptiles and amphibians are common to all lakes and ponds of New Hampshire. The various types of animals in this group, with few exceptions, are fairly inconspicuous, being heard but not commonly seen. However, this does not diminish their importance to the ecological community. With some assistance and coordination among interested parties, a general assessment of the reptile and amphibian community is possible if there is not any current information available. Completion of this question is helpful in compiling a comprehensive catalog of the biological diversity residing in and around the lake or pond.

**Process Followed:** Referred to *New England Wildlife* and Mike Marchand who is a Wetland Systems Biologist of Nongame & Endangered Wildlife Program of New Hampshire Fish & Game. Also consulted the Reptile and Amphibian Checklist in Appendix B for the list of species that use the lake habitat.

**Findings and Analysis:**

- Common Musk Turtle (Stinkpot)
- Eastern Painted Turtle
- Midland Painted Turtle
- Snapping Turtle
- Wood Turtle
- Bullfrog
- Green Frog
- Tree Frog
- Northern Leopard Frog
- Pickerel Frog
- Wood Frog
- Spring Peeper
- Blue Spotted Salamander
- Four-toed Salamander

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

- Spotted Salamander
- Red-spotted Newt
- Eastern Ribbon Snake
- Northern Water Snake

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 0-2 species	1
2) 3-5 species	2
3) 6-8 species	3
4) 9-12 species	4
5) >12 species	5

**Sources:**

DeGraaf, Richard M., and Mariko Yamasaki. New England Wildlife: Habitat, Natural History, and Distribution. Hanover: University Press of New England, 2001.

Marchand, Mike. (michael.marchand@WILDLIFE.STATE.NH.US). "Lake Inventory."  
E-mail to Emily Goodrich (egoodrich@colby-sawyer.edu). 26 November 2003.

**Assessment of Question:** The date of assessment of species was not available.

**Date Completed:** November 2003

**Investigator:** Emily Goodrich

**Attribute 4:** Biological/Ecological Characteristics

**Category:**

**Question G:** Aquatic macroinvertebrate community composition

**Directions:** Contact the DES Lakes Program staff to obtain the information necessary for this question.

**Rationale:** Aquatic invertebrates are those organisms that primarily inhabit lakes, ponds, and rivers, and do not have a backbone. Similar to reptiles and amphibians, this group of animals is often overlooked when assessing lakes and ponds. Take time to capitalize on this opportunity to become familiar with the different types of aquatic invertebrates that inhabit the lake or pond.

**Process Followed:** Contacted Robert “Woody” Wood of the LSPA and asked him about the macroinvertebrates in Lake Sunapee

**Findings and Analysis:** Mussels, clams, freshwater jellyfish, crayfish, and freshwater sponges/bryozoans all exist in Lake Sunapee. Although they do exist, finding these macroinvertebrates can be difficult, and it could take a good amount of time searching before any are found. Part of the reason that they are not more abundant could be because of pollution do to recreation on the lake such as unburned gas and oil from boats.

**Evaluation Criteria:**

- 1) 0 groups present
- 2) 1 group present
- 3) 2 groups present
- 4) 3 groups present
- 5) 4 or more groups present

**Sources:**

Personal Interview with Robert Wood of the Lake Sunapee Protective Association.  
(November 19, 2003 4:00p.m.)

**Assessment of Question:** This question was adequate as stated.

**Date Completed:** November 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Recreational Value

**Question H:** Scenic Specialized habitats, breeding or rearing areas.

**Directions:** Contact the DES Lakes Program staff to identify the most effective and efficient method to obtain the information necessary to complete this question.

**Rationale:** Some types of wildlife require specialized structures (i.e. beaver lodges) or breeding and rearing areas in order to be considered permanent residents (rather than transient) of a waterbody. Identification of these types of structures or areas (i.e. heron rookeries) in and around the lake or pond adds to its ecological significance. Also, an awareness of the general locations of these structures or areas is important when considering development or land use options.

**Process Followed:** Referred to *New England Wildlife* and Mike Marchand who is a Wetland Systems Biologist of Nongame & Endangered Wildlife Program of New Hampshire Fish & Game. Also consulted Avian, Mammal, and Reptile and Amphibian Checklists in Appendix B.

**Findings and Analysis:**

- Wood Duck- natural or artificial nest cavities, persistent shallow water, and some brushy cover for retreat
- Mallard- shallow water
- Common Loon- bodies of water with stable water level and islets for nesting, shallow coves for rearing of young
- Common Merganser- clear forested streams, rivers, and remote ponds, large trees with cavities for nesting
- Hooded Merganser- clear forested streams, rivers, ponds, lakes and swamps with nearby cavity trees
- Great Blue Heron- open water or wet land habitats, forested wetlands or tall trees near water in areas free from human disturbances
- Red-winged Blackbird- emergent vegetation adjacent to open areas with scattered tall shrubs and trees
- Bobolink- large expanses of grassland or older hay fields with little or no alfalfa, high litter cover and scattered broad-leaf forbs for nesting sites
- Barn Swallow- nest sited, especially buildings, near open habitats
- Cliff Swallow- vertical substrate with an overhang for nesting, a mud supply for nest construction, fresh water with a smooth surface for drinking, and open foraging areas near the nest site
- Northern Roughwinged Swallow- suitable nest sites within half a mile of water
- Tree Swallow- tree cavities in the open for nesting
- Bank Swallow- open habitat near flowing water and steep but stabilized banks of erodable soils: soil, gravel, or clay

- Common Grackle- open areas with open water for foraging adjacent to graves or woodlots for nesting and roosting
- Swamp Sparrow- marshes with open shallow water, low rank vegetation, and elevated signposts, but sometimes nests in rank grasses in wet northern clear-cut
- Eastern Bluebird- low cavities for nesting and perches for foraging
- Olive-sided Flycatcher- tall, exposed perches, typically near bogs, swamps, clear cuts, or beaver ponds
- Common Yellowthroat- moist areas with dense, herbaceous vegetation mixed with shrubs and small trees
- Belted Kingfisher- nesting sites preferably within a mile of clear water with abundant aquatic prey, and perches above the water to sight prey
- Black Bear- secure den sites located under fallen trees, in hollow standing trees and logs on the ground, etc
- Beaver- supply of young hardwoods within 100 ft of water for dam-building materials
- Mink- den sites inside hollow logs, natural cavities under tree roots, beaver lodges, or in muskrat bank burrows along stream, marsh, or lake edges
- Moose- wetlands proffered in summer for relief from mosquitoes and flies and for aquatic plant food items
- Star-nosed mole- wet, mucky humus
- River Otter- waterbodies, rivers, or streams containing fish, suitable den sites
- Water Shrew- herbaceous cover, cold waterbodies: bog, stream, lake
- Common Musk Turtle (Stinkpot)- riparian systems; slow moving, muddy-bottom streams and river
- Eastern Painted Turtle- aquatic habitat with basking structures and areas of open water
- Midland Painted Turtle- aquatic habitat with basking structures and areas of open water
- Snapping Turtle- aquatic habitat; muddy bottomed wetlands preferred
- Wood Turtle- wooded banks of sandy-bottom streams with adjacent meadows; open sandy nesting areas
- Bullfrog- deep permanent water and emergent vegetation, lakes, river oxbows
- Green Frog- riparian sites
- Tree Frog- aquatic sites for breeding
- Northern Leopard Frog- wet meadows
- Pickerel Frog- shallow, clear water of bogs and woodland ponds for breeding
- Wood Frog- temporary woodland pools, backwaters of slow-moving streams
- Spring Peeper- wetlands dominated by emergent vegetation for breeding
- Blue Spotted Salamander- wooded swamps, ponds, marshes, ditches, or semi permanent water for breeding; relatively open or forested aquatic sites
- Four-toed Salamander- acidic wet woodlands with sphagnum mats
- Spotted Salamander- mesic woods with fish-free permanent, semi permanent, or ephemeral water for breeding
- Red-spotted Newt- water with aquatic vegetation for the adult newt
- Eastern Ribbon Snake- aquatic habitats

- Northern Water Snake- branches or logs overhanging the water, or boulders of dams and causeways on reservoirs

**Evaluation Criteria:**

**Score:**

1) 0/1 unique habitat type, area, or structure	1
2) 2 unique habitat type, area, or structures	2
3) 3 unique habitat type, area, or structures	3
4) 4 unique habitat type, area, or structures	4
5) 5 unique habitat type, area, or structures	5

**Sources:**

DeGraaf, Richard M., and Mariko Yamasaki. New England Wildlife: Habitat, Natural History, and Distribution. Hanover: University Press of New England, 2001.

Marchand, Mike. (michael.marchand@WILDLIFE.STATE.NH.US). "Lake Inventory." E-mail to Emily Goodrich (egoodrich@colby-sawyer.edu). 26 November 2003.

**Assessment of Question:** The date of assessment and general locations of the species was not available. It was hard to understand what exactly the question was asking, because according to *New England Wildlife* all species present within this area have specialized habitats, breeding or rearing areas. None of them stressed that the areas were unique. The question should be expanded with additional criteria.

**Date Completed:** November 2003

**Investigator:** Paul Barrile & Emily Goodrich

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Unique or Outstanding Values

**Question H:** Specialized habitats, breeding or rearing areas.

**Directions:** Contact the DES Lakes Program staff to identify the most effective and efficient method to obtain the information necessary to complete this question.

**Rationale:** Some types of wildlife require specialized structures (i.e. beaver lodges) or breeding and rearing areas in order to be considered permanent residents (rather than transient) of a waterbody. Identification of these types of structures or areas (i.e. heron rookeries) in and around the lake or pond adds to its ecological significance. Also, an awareness of the general locations of these structures or areas is important when considering development or land use options.

**Process Followed:** Referred to *New England Wildlife* and Mike Marchand who is a Wetland Systems Biologist of Nongame & Endangered Wildlife Program of New Hampshire Fish & Game. Also consulted Avian, Mammal, and Reptile and Amphibian Checklists in Appendix B.

**Findings and Analysis:**

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- Black Bear- secure den sites located under fallen trees, in hollow standing trees and logs on the ground, etc
- Beaver- supply of young hardwoods within 100 ft of water for dam-building materials
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- Midland Painted Turtle- aquatic habitat with basking structures and areas of open water
- Snapping Turtle- aquatic habitat; muddy bottomed wetlands preferred
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- Bullfrog- deep permanent water and emergent vegetation, lakes, river oxbows
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- Northern Leopard Frog- wet meadows
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- Wood Frog- temporary woodland pools, backwaters of slow-moving streams
- Spring Peeper- wetlands dominated by emergent vegetation for breeding
- Blue Spotted Salamander- wooded swamps, ponds, marshes, ditches, or semi permanent water for breeding; relatively open or forested aquatic sites
- Four-toed Salamander- acidic wet woodlands with sphagnum mats
- Spotted Salamander- mesic woods with fish-free permanent, semi permanent, or ephemeral water for breeding
- Red-spotted Newt- water with aquatic vegetation for the adult newt
- Eastern Ribbon Snake- aquatic habitats

- Northern Water Snake- branches or logs overhanging the water, or boulders of dams and causeways on reservoirs

**Evaluation Criteria:**

**Score:**

1) 0/1 unique habitat type, area, or structure	1
2) 2 unique habitat type, area, or structures	2
3) 3 unique habitat type, area, or structures	3
4) 4 unique habitat type, area, or structures	4
5) 5 unique habitat type, area, or structures	5

**Sources:**

DeGraaf, Richard M., and Mariko Yamasaki. New England Wildlife: Habitat, Natural History, and Distribution. Hanover: University Press of New England, 2001.

Marchand, Mike. (michael.marchand@WILDLIFE.STATE.NH.US). "Lake Inventory." E-mail to Emily Goodrich (egoodrich@colby-sawyer.edu). 26 November 2003.

**Assessment of Question:** The date of assessment and general locations of the species was not available. It was hard to understand what exactly the question was asking, because according to *New England Wildlife* all species present within this area have specialized habitats, breeding or rearing areas. None of them stressed that the areas were unique. The question should be expanded with additional criteria.

**Date Completed:** November 2003

**Investigator:** Emily Goodrich

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Susceptibility to Impairment

**Question I:** Exotic aquatic plant species.

**Directions:** Consult the Exotic Species Map/List from NH DES or contact the New Hampshire Fish and Game Department, or the UNH Center of Freshwater Biology to determine the exotic plants and animals that occur in the lake or pond as well as its proximity to the nearest waterbody with an exotic species.

**Rationale:** Exotic aquatic species refers to those plant or animal species that are not native to New Hampshire waterbodies. Currently there are 6 invasive aquatic plants known to occur in New Hampshire (see Worksheet for list). When introduced into a waterbody these plants tend to out-compete native plant species and form dense, unattractive growths. In addition, heavy growths of aquatic plants can contribute an excessive amount of decaying matter to the bottom of the lake, ultimately causing a reduction in the amount of dissolved oxygen.

**Process Followed:** Referred to the “Exotic Aquatic Plant Sites in New Hampshire” map online at the NH DES, Water Management Bureau, Exotic Species Program website to find locations of exotic aquatic plants. Also referred to two brochures published by the LSPA and by the NH DES, Water Division.

**Findings and Analysis:**

Exotic Plants in New Hampshire:

- Hydrilla (*Hydrilla verticillata*)
- Variable Milfoil (*Myriophyllum heterophyllum*)
- Eurasian Milfoil (*Myriophyllum spicatum*)
- Common Reed (*Phragmites australis*)
- Purple Loosestrife (*Lythrum salicaria*)
- Yellow Floating Heart (*Nymphiodes peltata*)
- Frogbit (*Hydrocharis morsus-ranae*)
- Water Chestnut (*Trapa natans*)
- Parrot Feather (*Myriophyllum aquaticum*)
- Curly Leaf Pondweed (*Potamogeton crispus*)
- Brazillian Elodea (*Egeria densa*)
- Fanwort (*Cambomba caroliniana*)
- Europwan Naiad (*Najas minor*)

Exotic Aquatic Plants in Lake Sunapee

- Variable Milfoil (*Myriophyllum heterophyllum*)
- Purple Loosestrife (*Lythrum salicaria*)
- Common Reed (*Phragmites australis*)

The presence of these exotic aquatic species has been well recognized. Management programs to limit the spread of these invasives into other parts of the lake and other waterbodies have helped to prevent their spread. Boat washes have been one of the most effective programs in decreasing the risk of having particles of these species entering the Lake Sunapee water system.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) Waterbody does not currently have an exotic plant, is beyond 10 miles of a waterbody with an exotic plant, and has low recreational use	1
2) Waterbody does not currently have an exotic plant, is beyond 10 miles of a waterbody with an exotic plant, and has moderate to high recreational use	2
3) Waterbody does not currently have an exotic plant, is within 10 miles of a waterbody with an exotic plant, and has low recreational use	3
4) Waterbody does not currently have an exotic plant, is within 10 miles of a waterbody with an exotic plant, and has moderate to high recreational use	4
5) Waterbody has an established exotic plant, regardless of the size of the infestation	5

**Sources:**

“Exotic Aquatic Plant Sites in New Hampshire Map”. New Hampshire Department of Environmental Services, Watershed Management Bureau, Exotic Species Program. [http://www.des.state.nh.us/wmb/exoticspecies/milfoil\\_list.htm](http://www.des.state.nh.us/wmb/exoticspecies/milfoil_list.htm)

“The Frightful Fourteen”. <http://www.des.state.nh.us/wmb/exoticspecies/fourteen.pdf>

“Invasive Aquatic Plants: What Can We Do?”. Lake Sunapee Protective Association.

**Assessment of Question:** This question is extremely important to the future status of the waterbody. Knowing that exotics exist within a waterbody is just as important as knowing how to manage the problem. In conjunction with this question, checking to see if there is a management/prevention program in the watershed, both to prevent more exotics from being introduced and to limit the export of existing exotics, should be assessed. While knowing what exotic aquatic species presently exist, another question to add to the inventory would be to identify where other exotic species exist and their location compared to this particular waterbody. The

Attribute asks to list the nearest waterbodies with other exotic aquatic plant species, however these locations are not involved in the evaluation criteria. The evaluation criteria is very general and may not pertain to all exotic aquatic species that could potentially make their way into this water system. A second part to the evaluation criteria might include assessing the locations of species not yet existing in this waterbody, and listing their locations. Looking at the susceptibility to impairment, it is important to be aware of the level of risk there is for an exotic to be introduced to the system.

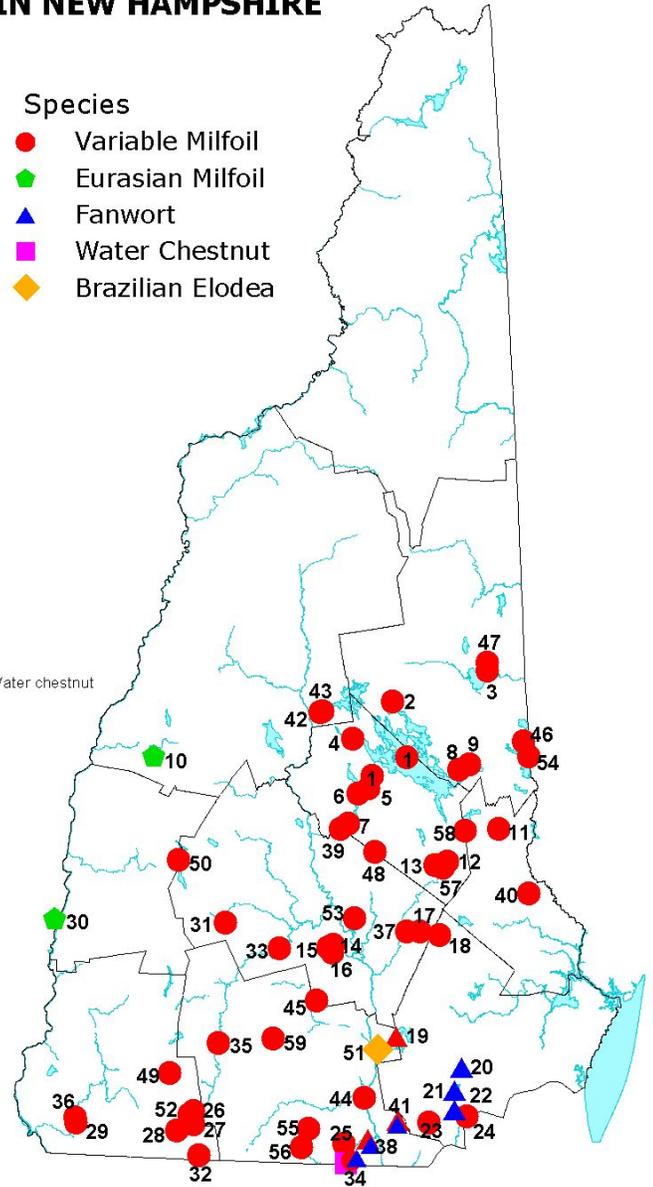
**Date Completed:** November 2003

**Investigator:** Tamsen B Bolte

### EXOTIC AQUATIC PLANT SITES IN NEW HAMPSHIRE

Site#	Year	Waterbody (town)	Species
1	1970	Winnepesaukee Lake (Gilford)	Variable milfoil
1	1990	Paugus Bay (Laconia)	Variable milfoil
2	1975	Lees Pond (Moultonborough)	Variable milfoil
3	1995	Ossipee Lake-Broad Bay (Freedom)	Variable milfoil
4	1980	Waukegan Lake (Meredith)	Variable milfoil
5	1990	Opechee Lake (Laconia)	Variable milfoil
6	1995	Winnisquam Lake (Meredith/Belmont)	Variable milfoil
7	1995	Silver Lake (Tilton)	Variable milfoil
8	1980	Crescent Lake (Wolfeboro)	Variable milfoil
9	1995	Wentworth Lake (Wolfeboro)	Variable milfoil
10	2000	Mascoma Lake (Enfield)	Eurasian milfoil
11	1998	Sunnise Lake (Middleton)	Variable milfoil
12	1990	Locke Lake (Barnstead)	Variable milfoil
13	1995	Suncook Lakes (Barnstead)	Variable milfoil
14	1990	St Paul's School Pond (Concord)	Variable milfoil
15	1990	Little Turkey Pond (Concord)	Variable milfoil
16	1990	Big Turkey Pond (Concord)	Variable milfoil
17	1998	Bixby Pond (Epsom)	Variable milfoil
18	1990	Northwood Lake (Northwood)	Variable milfoil
19	1995	Massabesic Lake (Auburn)	Variable milfoil; Fanwort
20	1980	Phillips Pond (Sandown)	Fanwort
21	1965	Big Island Pond (Derry)	Fanwort
22	1965	Arlington Mill Reservoir (Salem)	Fanwort
23	1995	Cobbetts Pond (Windham)	Variable milfoil
24	1996	Captain Pond (Salem)	Variable milfoil
25	1990	Flints Pond (Hollis)	Variable milfoil
26	1995	Cheshire Pond (Jaffrey)	Variable milfoil
27	1990	Contocook Lake (Jaffrey)	Variable milfoil
28	1975	Pearly Pond (Rindge)	Variable milfoil
29	1998	Forest Lake (Winchester)	Variable milfoil
30	1995	Connecticut River (Charlestown)	Eurasian milfoil
31	1995	Massasecum Lake (Bradford)	Variable milfoil
32	2000	Monomonac Lake (Rindge)	Variable milfoil
33	2000	Hopkinton Lake/Dam (Hopkinton)	Variable milfoil
34	2000	Nashua River (Nashua)	Variable milfoil; Fanwort; Water chestnut
35	2000	Powder Mill Pond (Hancock)	Variable milfoil
36	2000	Ashuelot River (Winchester)	Variable milfoil
37	2000	Little Suncook River (Epsom/Northwood)	Variable milfoil
38	2000	Mine Falls Pond (Nashua)	Variable milfoil; Fanwort
39	2000	Winnepesaukee River (Tilton)	Variable milfoil
40	2000	Cocheco River (Rochester)	Variable milfoil
41	2000	Robinson Pond (Hudson)	Variable milfoil; Fanwort
42	2000	Squam River (Ashland)	Variable milfoil
43	2000	Squam Lakes (Holderness/Ashland)	Variable milfoil
44	2000	Horseshoe Pond (Merrimack)	Variable milfoil
45	2000	Gorham Pond (Dunbarton)	Variable milfoil
46	2000	Belleau Lake (Wakefield)	Variable milfoil
47	2000	Danforth Pond (Freedom)	Variable milfoil
48	2000	Rocky Pond (Gilmanton)	Variable milfoil
49	2001	Dublin Lake (Dublin)	Variable milfoil
50	2001	Sunapee Lake (Sunapee)	Variable milfoil
51	2001	Nutts Pond (Manchester)	Brazilian elodea
52	2001	Contocook River (Jaffrey)	Variable milfoil
53	2002	Turtle Pond (Concord)	Variable milfoil
54	2002	Balch Lake (Wakefield)	Variable milfoil
55	2002	Melendy Pond (Brookline)	Variable milfoil
56	2002	Potanipo Lake (Brookline)	Variable milfoil
57	2002	Brindle Pond (Barnstead)	Variable milfoil
58	2003	Jones Pond (New Durham)	Variable milfoil
59	2003	Scobie Pond/Haunted Lake (Francestown)	Variable milfoil

- Species**
- Variable Milfoil
  - ◆ Eurasian Milfoil
  - ▲ Fanwort
  - Water Chestnut
  - ◆ Brazilian Elodea



**Attribute 4:** Biological/Ecological Characteristics

**Category:** Susceptibility to Impairment

**Question J:** Exotic aquatic animal species.

**Directions:** Consult the Exotic Species Map/List from NH DES or contact the New Hampshire Fish and Game Department, or the UNH Center of Freshwater Biology to determine the exotic plants and animals that occur in the lake or pond as well as its proximity to the nearest waterbody with an exotic species.

**Rationale:** Exotic aquatic species refers to those plant or animal species that are not native to New Hampshire waterbodies. In regards to exotic aquatic animals, there are numerous fishes, such as the smallmouth bass, that long ago became established in most of New Hampshire's waterways. However, more recent exotic animals known to upset the balance of the ecosystem should be your primary concern. Such species include the Japanese live-bearing snail and the zebra mussel. At the present time zebra mussels are not known to occur in any New Hampshire waterbodies. However, their planktonic larval stage coupled with heavy boater usage of our lakes and ponds from people throughout the northeast region make their introduction possible. If introduced and allowed to become established, zebra mussels could seriously affect the aquatic food chain, clog industrial and drinking water intakes, and cover submerged structures such as docks.

**Process Followed:** Referred to species distribution maps of exotic aquatic animals, both at distribution ranges and within the state of New Hampshire. If species were not present in this lake system, then looked at nearest known location to determine the viability of an exotic aquatic animal being introduced. Also contacted New Hampshire Fish and Game Inland Fisheries Division.

**Findings and Analysis:**

Exotic Aquatic Animals of Concern:

- Zebra Mussels (*Dreissena polymorpha*)
  - Nearest location- Lake Bomoseen, Bomoseen, VT
  - 1 ½ to 2 hours driving distance
- Chinese Mystery Snail (*Viviparus malleatus*)
  - Nearest location- North America West Coast
- Alewife (*Alosa pseudoharengus*)
  - Nearest location- Lake St. Catherine, Rutland County, VT
- Rusty Crayfish (*Orconectes rusticus*)
  - Nearest location- present in drainages along NH and VT border- refer to website for distribution map  
[http://nas.er.usgs.gov/crustaceans/maps/or\\_rusticus.gif](http://nas.er.usgs.gov/crustaceans/maps/or_rusticus.gif)

Exotic Aquatic Animals in Lake Sunapee:

- **There are no exotic aquatic animal species currently present in Lake Sunapee.**

Native Fish Species found in Lake Sunapee:

- Sunapee (Golden) Trout (*Salvelinus aureolus*) -locally extinct
- Common White Sucker (*Catostomus Commerson*)
- Brown Bullhead (*Ameiurus nebulosus*)
- Chain Pickerel (*Esox niger*)
- Common Shiner (*Luxilus cornutus*)
- Yellow Perch (*Perca flavescens*)
- Cusk (*Brosme brosme*)

Introduced Aquatic Fish in Lake Sunapee:

- Rock Bass (*Ambloplites rupestris*)\*
- Landlocked Salmon (*Salmo salar*)
- Brook Trout (*Salvelinus fontinalis*)
- Smallmouth Bass (*Micropterus dolomieu*)
- Largemouth Bass (*Micropterus salmoides*)
- Fallfish (*Semotilus corporalis*)
- Golden Shiner (*Notemigonus crysoleucas*)
- Pumpkinseed Sunfish (*Lepomis gibbosus*)
- Red-breast Sunfish (*Lepomis auritus*)
- Lake Trout (*Salvelinus namaycush*)
- Chinook Salmon (*Oncorhynchus tshawytscha*)- locally extinct
- Rainbow Trout (*Oncorhynchus mykiss*)-locally extinct

\* Lake Sunapee currently has a high level of rock bass that have negatively impacted many of the remaining species in the lake system.

**Evaluation Criteria:**

**Score:**

- |   |   |
|---|---|
| 1) Waterbody does not currently have an exotic animal, is beyond 10 miles of a waterbody with an exotic animal, and has low recreational use              | 1 |
| 2) Waterbody does not currently have an exotic animal, is beyond 10 miles of a waterbody with an exotic animal, and has moderate to high recreational use | 2 |
| 3) Waterbody does not currently have an exotic animal, is within 10 miles of a waterbody with an exotic animal, and has low recreational use              | 3 |
| 4) Waterbody does not currently have an exotic animal, is within 10 miles of a waterbody with an exotic animal, and has moderate to high recreational use | 4 |
| 5) Waterbody has an established exotic animal, regardless of the size of the infestation  | 5 |

**Sources:**

“Aquatic Nuisance Species in Vermont”. Vermont Department of Environmental Conservation, Lakes and Ponds Management Protection. 20 November 2003. <<http://www.anr.state.vt.us/dec/waterq/ans/zmdist.htm>>.

“Don’t Leave Them Stranded”.

<[http://www.wildlife.state.nh.us/Outdoor Recreation/exotic\\_aquatics\\_brochure.pdf](http://www.wildlife.state.nh.us/Outdoor_Recreation/exotic_aquatics_brochure.pdf)>.

“Invasivespecies.gov” 20 November 2003. <<http://www.invasivespecies.gov/>>.

Miller, Don. Fisheries Biologist, Region 2. “Re: Exotic Species”.

[donmiller@starband.net](mailto:donmiller@starband.net); [fish@WILDLIFE.STATE.NH.US](mailto:fish@WILDLIFE.STATE.NH.US) (20 Nov 2003).

**Assessment of Question:** This question focuses on the primary exotic aquatic animals that are brought to mind in reference to this topic, such as the Zebra Mussel and Chinese Mystery Snail. These are important issues for a lake system to be aware of, especially if they are a problem or have a high capacity to experience such detrimental introductions. This question, or an extension to this attribute, should be to identify introduced fish species. Many people forget that some fish species are not native since such fish have been established for a long period of time. Understanding the effects that non-native species have on the ecosystem, through education, can help reduce the potential for more exotic species to become present.

**Date Completed:** November 2003

**Investigator:** Tamsen B Bolte

**Attribute 4:** Biological/Ecological Characteristics

**Category:** Unique or Outstanding Values

**Question K:** Threatened and endangered plant and animal species and exemplary natural communities.

**Directions:** Consult New Hampshire Natural Heritage Inventory Program (NH NHI) of the NH Department of Resources and Economic Development (DRED) and the NH Fish and Game Department to identify the status of any plants or animals listed either by the state or federal government as threatened or endangered. Endangered species are defined as those in danger of being extirpated from their natural range. Threatened species are defined as those plants or animals facing the possibility of becoming endangered. Include only those species or communities that occur within the immediate watershed (i.e. land or water that drains directly into the waterbody).

**Rationale:** Plants or animals listed as endangered or threatened, either by the state or nationally, will require additional efforts to ensure their continued existence. The lake or pond and the land within its watershed may contain one or more of these species. Their occurrence within your watershed\* indicates that there are special characteristics about that area that permit its survival. In addition, there may be a specific area that promotes the existence of a unique or highly diverse natural community of plants and animals. Known as “exemplary natural communities”, these areas should be recognized with the same significance as threatened or endangered species. A management plan should identify these species or areas and recognize that their protection is critical.

\* Only take note of those species within the immediate lake watershed.

**Process Followed:** Contacted NH Natural Heritage Bureau (NHB).

**Findings and Analysis:**

Threatened species that are state listed: Fragrant Fern (*Dryopteris Fragens*) and Loesel’s Twayblade (*Liparis Loeselii*).

Exemplary natural communities as identified by the NH Natural Heritage Inventory: NNE Circumneutral Cliff Community and SNE Circumneutral Talus Forest/Woodland.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) None	1
2) 1 or more species listed by the state as threatened	2
3) 1 or more federally listed threatened species	3
4) 1 or more species listed by the state as endangered OR 1-2 exemplary natural communities	4
5) 1 or more federally listed endangered OR >2 exemplary natural communities	5

**Sources:**

Cairns, Sara. "Re: New Hampshire Comprehensive Lake Inventory." NH Natural Heritage Bureau Division of Forests & Lands. scairns@dred.state.nh.us (6 Oct. 2003)

**Assessment of Question:** The New Hampshire Natural Heritage Inventory Program (NH NHI) has changed their name to NH Natural Heritage Bureau (NHB). There are no species that are federally listed as threatened. And there were no endangered species for both state and federally listed.

**Date Completed:** October 2003

**Investigator:** Emily Goodrich

**Attribute 4:** Biological/Ecological Characteristics

**Category:**

**Question L:** New Hampshire Natural Heritage Inventory Program (NHI) rank.

**Directions:** Consult NH NHI Program of the NH Department of Resources and Economic Development to identify the plant or animal of greatest concern that resides within the watershed of interest. Then determine its “flag” ranking by the NH NHI. The species chosen can be any plant or animal of local or global interest. Depending on the species selected, its “flag” ranking will determine the appropriate point value.

**Rationale:** The “flag” rank by the NH NHI of the species selected indicates its population status and the uniqueness of the watershed. If the chosen species is endangered worldwide and occurs in or around your watershed ensuring its survival, through protective measures, is critically important. Even if the chosen species is not rare statewide or globally, but is important locally to the public, similar effort should be put forth to ensure its continued existence, but with the realization that its presence does not make that watershed particularly unique biologically.

**Process Followed:** Contacted NH Natural Heritage Bureau (NHB).

**Findings and Analysis:**

Species selected for assessment: Fragrant Fern (*Dryopteris Fragrans*)

Reason for selection: Critically imperiled because of extreme rarity (generally one to five occurrences) or some factor of its biology makes it particularly vulnerable to extinction. And it’s demonstrably widespread and secure, although the species may be quite rare in parts of its range, particularly at the periphery.

Species selected for assessment: Loesel’s Twayblade (*Liparis Loeselii*)

Reason for selection: Imperiled because rarity (generally six to 20 occurrences) or other factors demonstrably make it very vulnerable to extinction. And it’s demonstrably widespread and secure, although the species may be quite rare in parts of its range, particularly at the periphery.

**Evaluation Criteria:**

- 1) Species not considered to be rare, endemic, disjunctive, threatened, or endangered; No flag ranking by NH NHI
- 2) Species secure globally, but may be rare in parts of its statewide range; single “flag” ranking by NH NHI.
- 3) Species moderately rare globally; good evidence of statewide rarity; double “flag” ranking by NH NHI.
- 4) Species globally rare (<20 occurrences worldwide); extremely rare statewide vulnerable statewide; triple “flag” ranking by NH NHI.
- 5) Species imperiled because of global rarity globally and extremely rare statewide; quadruple “flag ranking by NH NHI.

**Sources:**

Cairns, Sara. "Re: New Hampshire Comprehensive Lake Inventory." NH Natural Heritage Bureau Division of Forests & Lands. scairns@dred.state.nh.us (6 Oct. 2003)

**Assessment of Question:** The New Hampshire Natural Heritage Inventory Program (NH NHI) has changed their name to NH Natural Heritage Bureau (NHB).

**Date Completed:** October 2003

**Investigator:** Emily Goodrich

**Attribute 5:** Recreational Characteristics

**Category:** Recreation

**Question A:** Average watercraft density on lake or pond.

**Directions:** Refer to the NH DES Watercraft Survey in Appendix B for instructions on determining the average watercraft density on a lake or pond.

**Rationale:** An estimate of watercraft use provides one component for estimating the waterbody's popularity. Ultimately, estimating watercraft use will be helpful in establishing a carrying capacity or maximum number of watercraft that is desirable on the individual waterbody and/or the need to provide specialized facilities such as boat launches and public restrooms.

**Process Followed:** Used information that was collected over the summer at various locations from Aimee Ayers, member of the Lake Sunapee Protection Association. Then used calculations listed in Appendix B to establish the average watercraft activity per day.

\*Note: The numbers that represent the averages were recorded at the middle of the lake.

**Findings and Analysis:** Referred to following page for quantitative data and results. The middle of Lake Sunapee experienced approximately five watercraft (both non-motor and motor combined) on a daily basis. The surface area of the lake is 4,090 acres, which gives the estimate of less than one watercraft per acre. The problem with looking at this specific result, is that it only represents one area on the lake. However in opposition to this variable, the middle of the lake would seem to best represent the most popular section. All of these factors need to be kept in mind while compiling the impact that the lake receives from watercraft use. Boat activity can be greatly influenced by several factors; such as weather, scenic opportunities, lake popularity (can be positive or negative), other recreational opportunities, water quality, accessibility, and many other specific variables. The amount of watercraft activity on Lake Sunapee should be particularly important in the near future, with the addition of another boat launch ramp by NH Fish and Game.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 1 watercraft/<5 acres	1
2) 1 watercraft/5-15 acres	2
3) 1 watercraft/16-30 acres	3
4) 1 watercraft/31-50 acres	4
5) 1 watercraft/50+ acres	5

**Sources:**

Ayers, Aimee. Lake Sunapee Protection Association. Summer 2003 Watercraft Survey of Lake Sunapee data. July 2003-August 2003.

Watercraft Survey Instructions. New Hampshire Comprehensive Lake Inventory- NH  
DES Lakes Management and Protection Program. Appendix B. Pages 73 - 74.

**Assessment of Question:** This is a very useful inventory question to have considering that the amount of use that a lake receives, directly affects the quality of the water and the quality of enjoyment by people that recreate on the lake.

**Date Completed:** November 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 5:** Recreational Activities

**Category:** Susceptibility to Impairment

**Question A:** Average watercraft density on lake or pond.

**Directions:** Refer to the NH DES Watercraft Survey in Appendix B for instructions on determining the average watercraft density on a lake or pond.

**Rationale:** An estimate of watercraft use provides one component for estimating the waterbody's popularity. Ultimately, estimating watercraft use will be helpful in establishing a carrying capacity or maximum number of watercraft that is desirable on the individual waterbody and/or the need to provide specialized facilities such as boat launches and public restrooms.

**Process Followed:** Used information that was collected over the summer at various locations from Aimee Ayers, member of the Lake Sunapee Protection Association. Then used calculations listed in Appendix B to establish the average watercraft activity per day.

\*Note: The numbers that represent the averages were recorded at the middle of the lake.

**Finding and Analysis:** Refer to the following page for quantitative data, results and map of estimated viewing area. The lake is approximately 4090 acres, however, even from the middle of the lake; the entire waterbody cannot be viewed from one location. Having completed the survey from the middle of the lake, the surveyor was able to view as much as possible of it, as well as assuming the middle of the lake will see the most boats. An estimate was calculated using ArcView, to try to get a number close to the approximate viewable area from one point in the middle of the lake. This estimate came to be 1425 acres. Found the average watercraft density to be .008 watercraft/acre. The problem with looking at this specific result is that it represents one area on the lake. All of these factors need to be kept in mind while compiling the impact that the lake receives from watercraft use. Boat activity can be greatly influenced by several factors; such as weather, scenic opportunities, lake popularity (can be positive or negative), other recreational opportunities, water quality, accessibility, and many other specific variables. The amount of watercraft activity on Lake Sunapee should be particularly important in the near future, with the possible addition of another boat launch ramp by New Hampshire Fish and Game.

<b>Evaluation Criteria:</b>	<b>Score:</b>
6) 1 watercraft/<5 acres	5
7) 1 watercraft/5-15 acres	4
8) 1 watercraft/16-30 acres	3
9) 1 watercraft/31-50 acres	2
10) 1 watercraft/>50 acres	1

**Sources:**

Ayers, Aimee. Personal Interview. November 2003.

Watercraft Survey Instructions. New Hampshire Comprehensive Lake Inventory-  
NH DES Lakes Management and Protection Program. Appendix B.

Pages 73 - 74.

**Assessment of Question:** This is an extremely important survey question to have when doing a watershed analysis. The amount of use that a lake receives directly affects the quality of the water and the quality of enjoyment by people that recreate on the lake. It might be interesting to add another section to the watercraft use equation, such as how many boats are moored or docked compared to the number of launched boats. This may be hard to define, yet with help from the dock inventory and harbor activity list, this may be possible to add to the comprehensive lake inventory.

**Date Completed:** November 2003

**Investigator:** Tamsen B. Bolte  
Joseph J. Jennings

**Watercraft Survey of Lake Sunapee  
Summer 2003-Lake Sunapee Protective Association**

Date	Non-Motor	Motor	Total	Day of Week
<b>Location- Middle</b>				
19-Jul	15	11	26	Saturday
26-Jul	13	9	22	Saturday
15-Aug	5	5	10	Friday
17-Aug	0	12	12	Sunday
17-Aug	2	20	22	Sunday
22-Aug	0	2	2	Friday
27-Aug	0	0	0	Wednesday
31-Aug	2	6	8	Sunday

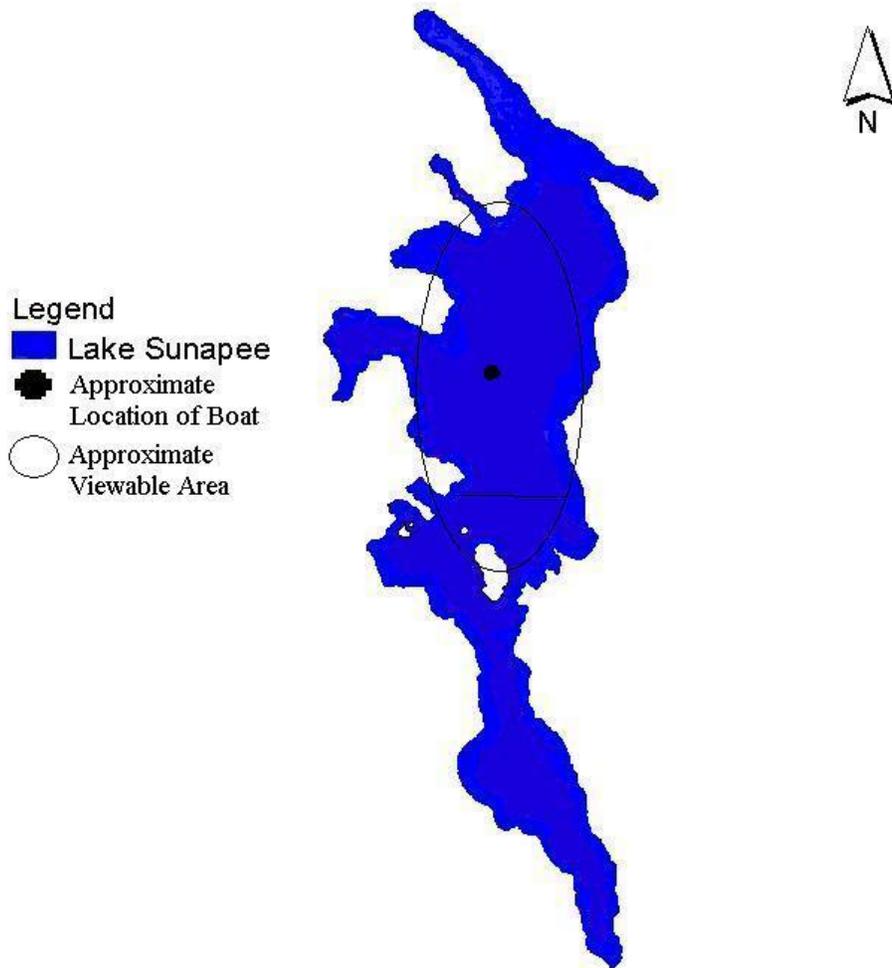
Dates used are highlighted- Red for weekdays used  
Light Blue for weekends used

- To estimate the number of watercraft per day:
  - A. Average the two weekday counts ((week day one + week day two)/2).
  - B. Multiply number from A by 5.
  - C. Add the two weekend counts (weekend day one + weekend day two).
  - D. Add totals from B and C.
  - E. Divide number from D by 7.
- To determine the average watercraft density of the waterbody: divide the total number of watercraft per day (E) by the water surface area of the waterbody.

- A. Aug. 15-10  
Aug. 22- 2  
 $10+2=12/2=6$
- B.  $6*5=30$
- C. July 19- 26  
Aug. 17-22  
 $26+22=48$
- D.  $48+30=78$
- E.  $78/7=11.1$

Watercraft Density:  $11.1/1425 = .008$  watercraft/acre.

# Estimated Viewing Area From Center of Lake



"Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied use of these data."

**Attribute 5:** Type of watercraft use

**Category:** Recreational value

**Question B:** Type of watercraft in use.

**Directions:** Estimate the average percentage of both petroleum and non-petroleum powered watercraft in use on the waterbody during 4 mid-summer days. Watercraft survey instructions are included in Appendix B to assist in the estimate

**Rationale:** Lakes and ponds that support or allow watercraft use can become crowded in the summer months. In addition, if the percentages of power and non-power boats are known, the needs and desires of these different types of watercraft users can be considered in future waterbody access plans.

**Process Followed:** Used information gathered from various points of the waterbody gathered by Aimee Ayers of the Lake Sunapee Protection Agency. Then used the formulas and calculations listed in Appendix B to establish the average percentage of petroleum versus non-petroleum powered boats and watercrafts. Different locations were used from various points on the waterbody.

\*Note: formula and math shown below.

**Findings and Analysis:** Refer to the following pages for complete data, results, and map of estimated viewable area from the middle of the lake. Used the middle of the lake data collected only, because it offers the greatest viewing area of the lake as a whole. Used the same map used in Attribute 5 A, so the same estimate of 1425 acres was used. Totaled both the number of petroleum and non-petroleum powered boats viewed during the survey. Found the number of non-petroleum powered boats to be 37 and the number of petroleum powered to be 65. Divided each total by 102 (the total number of boats viewed) and found the percentage of each type of boat. This gives an idea of the types of boats most commonly found on Lake Sunapee. It also shows the importance of non-petroleum boat usage on the waterbody.

Date	Non-Petroleum	Petroleum
19-Jul	15	11
26-Jul	13	9
15-Aug	5	5
17-Aug	0	12
17-Aug	2	20
22-Aug	0	2
27-Aug	0	0
31-Aug	2	6
<b>Total</b>	37	65
<b>Formula</b>	$x/102=\text{percent of total}$	$x/102=\text{percent of total}$
<b>% of Total</b>	<b>36%</b>	<b>64%</b>

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 76 – 100% power : 0 – 24% non-power	1
2) 51 – 75% power : 25 – 49% non-power	2
3) 26 – 50% power : 50 – 74% non-power	3
4) 1 – 25% power : 75 – 99% non-power	4
5) 0% power : 100% non-power	5

**Sources:**

Ayers, Aimee. Personal Interview. November 2003. Summer 2003 Watercraft Survey data collected July-August.

Watercraft Survey Instructions. New Hampshire Comprehensive Lake Inventory NH-DES Lakes Management and Protection Program. Appendix B. pages 73-75.

**Assessment of Question:** This is an important question because it is one way to monitor the pollutants dispersed into the waterbody, caused by petroleum powered boats. A ratio can be developed to compare the number of petroleum powered boats and non-petroleum powered boats. A point should be made regarding the roughness of the water, caused by heavy petroleum powered boat traffic, weather, etc. This has a direct influence on the number of non-petroleum powered boats. Added an option to evaluation criteria, because it was not offered and best fit the findings.

**Date Completed:** November 2003

**Investigator:** Paul Barrile (Joe Jennings)

**Attribute 5:** Type of watercraft use

**Category:** Susceptibility to Impairment

**Question B:** Type of watercraft in use. Estimate the average percentage of petroleum and non-petroleum powered watercraft in use on the waterbody during the mid-summer.

**Directions:** Estimate the average percentage of both petroleum and non-petroleum powered watercraft in use on the waterbody during 4 mid-summer days. Watercraft survey instructions are included in Appendix B to assist in the estimate

**Rationale:** Lakes and ponds that support or allow watercraft use can become crowded in the summer months. In addition, if the percentages of power and non-power boats are known, the needs and desires of these different types of watercraft users can be considered in future waterbody access plans.

**Process Followed:** Used information gathered from various points of the waterbody gathered by Aimee Ayers of the Lake Sunapee Protection Agency. Then used the formulas and calculations listed in Appendix B to establish the average percentage of petroleum versus non-petroleum powered boats and watercrafts. Different locations were used from various points on the waterbody.

\*Note: formula and math shown below.

**Findings and Analysis:** Refer to the following page for map of approximate viewable area from the middle of the lake. Used the middle of the lake data collected only, because it offers the greatest viewing area of the lake as a whole. Used the same map used in Attribute 5 A, so the same estimate of 1425 acres was used. Totaled both the number of petroleum and non-petroleum powered boats viewed during the survey. Found the number of non-petroleum powered boats to be 37 and the number of petroleum powered to be 65. Divided each total by 102 (the total number of boats viewed) and found the percentage of each type of boat. This gives an idea of the types of boats most commonly found on Lake Sunapee. It also shows the importance of non-petroleum boat usage on the waterbody.

Formula:

**A:** Add number of boats viewed each day from the center of the lake (37 non-petroleum, 65 petroleum)

**B:** Added both totals together (totaled 102)

**C:** Divided each total, petroleum and non-petroleum, by the number of the total number of boats

Date	Non-Petroleum	Petroleum
19-Jul	15	11
26-Jul	13	9
15-Aug	5	5
17-Aug	0	12
17-Aug	2	20
22-Aug	0	2
27-Aug	0	0
31-Aug	2	6
<b>Total</b>	<b>37</b>	<b>65</b>
<b>Formula</b>	x/102=percent of total	x/102=percent of total
<b>% of Total</b>	<b>36%</b>	<b>64%</b>

\*Note: All data is recorded from the middle of the lake

**Evaluation Criteria:**

**Score:**

- |  |   |
|--|---|
| 6) 76 – 100% power : 0 – 24% non-power | 1 |
| 7) 51 – 75% power : 25 – 49% non-power | 2 |
| 8) 26 – 50% power : 50 – 74% non-power | 3 |
| 9) 1 – 25% power : 75 – 99% non-power  | 4 |
| 10) 0% power : 100% non-power          | 5 |

**Sources:**

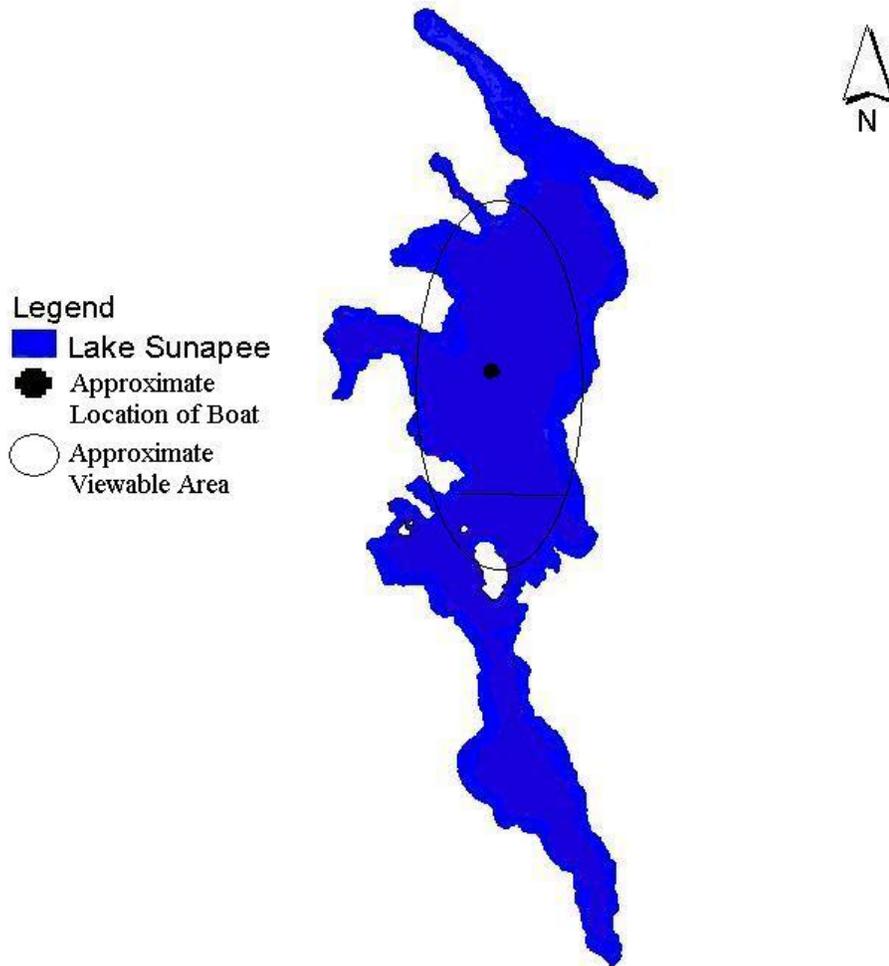
Ayers, Aimee. Personal Interview. November 2003. Summer 2003 Watercraft Survey data collected July-August.  
 Watercraft Survey Instructions. New Hampshire Comprehensive Lake Inventory NH-DES Lakes Management and Protection Program. Appendix B. pages 73-75.

**Assessment of Question:** This is an important question because it is one way to monitor the pollutants dispersed into the waterbody, caused by petroleum powered boats. A ratio can be developed to compare the number of petroleum powered boats and non-petroleum powered boats. A point should be made regarding the roughness of the water, caused by heavy petroleum powered boat traffic, weather, etc. This has a direct influence on the number of non-petroleum powered boats. Added an option to evaluation criteria, because it was not offered and best fit the findings.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings

# Estimated Viewing Area From Center of Lake



"Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied use of these data."

**Attribute 5:** Recreational Characteristics

**Category:** Recreation

**Question C:** Private marine service / docking facilities.

**Directions:** local tax maps to determine the name(s) and location(s) of all the privately owned marine service or docking facilities that surround the waterbody's perimeter.

**Rationale:** Knowing the locations of all the service and docking facilities will assist in estimating the number of boats that use the waterbody of interest. Cataloging the names and locations of these facilities will be useful in creating a shoreline use map. Finally, when obtaining this information, identify those areas that provide refueling areas or waste disposal centers.

**Process Followed:** Located a navigation chart for Lake Sunapee that has the docking and refueling stations marked. Consulted Aimee Ayers of the Lake Sunapee Protection Association who provided information regarding marine services on Lake Sunapee.

**Findings and Analysis:** A total of four private marine and docking facilities exist on Lake Sunapee. The Sunapee harbor station, Georges Mill's station, the Newbury harbor station, and the Lake Sunapee Yacht Club. There may not be that many facilities on the lake itself but there are plenty of boaters on it. The majority of the summer crowding comes from tourists that have their own boat that they bring. Thus these marinas and docking facilities are mainly for the local residents and the summer residents that have a house located on the lake.

**Evaluation Criteria:**

	<b>Score:</b>
1) None	1
2) 1 – 3 marines	2
3) 4 – 6 marines	3
4) 7 – 10 marines	4
5) >10 marines	

**Sources:**

Ayers, Aimee. Personal Conversation. November 19, 2003.

Lake Sunapee Protective Association: 2002 Navigation Chart of Lake Sunapee (scale 1:24,000 1 inch equals 2,000 feet (.38 statute mile))

**Assessment of Question:** Question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 5:** Recreational Characteristics

**Category:**

**Question D:** Other water dependent activities.

**Directions:** Identify all other types of recreational activities that require open water and that occur on the lake or pond.

**Rationale:** In addition to power boating, there are a great variety of other recreational activities that might occur on a waterbody. Some of these activities could potentially provide unique opportunities and attract a large number of people. Whether or not the activities are unique to a waterbody, they should be considered in the development of a management plan.

**Process Followed:** Referred to local literature and recreation departments.

**Findings and Analysis:** In addition to power boating, other recreational activities that occur on Lake Sunapee, include:

- Swimming
- Fishing
- Boat tours
- SCUBA diving
- Sea plane landing
- Rafting
- Snorkeling
- Waterskiing
- Non-motorized boating
  - Kayaking
  - Canoeing
  - Windsurfing
  - Rowing
  - Paddle boating
- Knee-boarding

Most of these activities occur everyday on the lake during the spring and summer seasons. SCUBA diving and Sea plane landing occurs the least; for the most part SCUBA divers are in the lake performing studies and sea planes are only used by the select few who own a plane. During peak season the lake is highly populated by people partaking in these recreational activities, and though there is no set equation to calculate the lake's capacity, it seems Lake Sunapee is capable of handling the amount of recreational activity that continually occurs. The amount of bacteria and algae have not reached lethal levels, and the worst threat to the lake from recreational activities is the spread of milfoil, but with boat washings enforced, the invasion of milfoil has been secluded to Georges Mills.

**Evaluation Criteria:**

- 1) 1 – 3 different activities
- 2) 4 – 6 different activities
- 3) >6 different activities

**Sources:**

Andrews, Bob. (2003). New London Recreation Department. *Local Links*.

<http://www.nlrec.com>. (25 Oct. 2003).

Lake Sunapee Protection Association. (1999). *Navigation Chart of Lake Sunapee*.

Spotted Dog Web Group Design. (2003). SunapeeHarbor.com. *Harbor Activities*.

<http://www.sunapeeharbor.com/harbor.htm>. (25 Oct. 2003).

**Assessment of Question:** This question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu

**Attribute 5:** Recreational Characteristics

**Category:** Recreational Value

**Question E:** Recreational Fishing

**Directions:** Find the waterbody in the *Fishing Waters of New Hampshire* booklet published by the NH Fish and Game Department. Record the number and type of game fish species that occur in the lake or pond. You may wish to denote whether the species is regularly stocked by the NH Fish and Game Department.

**Rationale:** Fishing is an important recreational use of many lakes and ponds. In New Hampshire, waterbodies with warmwater game fish species are most common. Lakes or ponds with coldwater game fish species also occur, but are not as common. Identifying the game fish species present is the first step in evaluating the value of the waterbody’s recreational fishery.

**Process Followed:** Contacted the New Hampshire Fish and Game Department and asked for information on exotic animal species in Lake Sunapee, which included fish species. Don Miller (Position, Title) responded with the proper information. The New Hampshire Fish and Game website was also checked to find what types of fish, both warmwater and coldwater species, were listed for Lake Sunapee. The information gathered from all the sources was compiled together and all species listed were included whether on one list or all the lists.

**Findings and Analysis:**

<i>Warmwater Species</i>	<i>Coldwater Species</i>
<b>Smallmouth Bass</b> <b>Largemouth Bass</b> <b>Eastern Pickerel</b> <b>Horned Pout</b> <b>Rock Bass</b> <b>Yellow Perch</b>	<b>Landlocked Salmon</b> <b>Lake Trout</b> <b>Brook Trout</b> <b>Cusk (Burbot)</b> <b>Bullhead</b> <b>Sunapee (Golden) Trout</b>

Although Lake Sunapee is not viewed as a lake of interest to anglers, the lake does host a number of species that would entice any angler. The problem is that the populations of these species are not high enough to attract serious attention from anglers.

**Evaluation Criteria:**

**Score:**

- |                                    |   |
|------------------------------------|---|
| 1) Single warm water species       | 1 |
| 2) Multiple warm water species     | 2 |
| 3) Single coldwater species        | 3 |
| 4) Multiple coldwater species      | 4 |
| 5) Warmwater and coldwater species | 5 |

**Sources:**

Miller, Don. Personal Interview. New Hampshire

Department of Fish and Game.  
Freshwater Fishing Guide link on New Hampshire Fish and Game website  
[http://www.wildlife.state.nh.us/Fishing/Fishing\\_PDFs/FW\\_Fishing\\_Guide\\_02.pdf](http://www.wildlife.state.nh.us/Fishing/Fishing_PDFs/FW_Fishing_Guide_02.pdf)

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 5:** Recreational Characteristics

**Category:** Recreational value

**Question F:** Occurrence of fishing tournaments / derbies

**Directions:** Consult the NH Department of Fish and Game website to identify any fishing tournaments / derbies that have occurred on the lake or pond within the last few years. Also research tournament/derby lists from the past five years to note the year with the maximum number of events.

**Rationale:** Exceptional populations of game fish (along with lake accessibility, accommodations, and desire for local promotion) attract additional recreational fishing pressure through organized tournaments or derbies. These events usually last 1 – 2 days and can significantly increase boat traffic and angling efforts. An awareness of the frequencies and timing of these events will assist with the development of organized plans that accommodate the anglers and their boats in a wise and practical manner.

**Process Followed:** Reviewed the website of New Hampshire Department of Fish and Game to gain as much information about tournaments on the lake. Spoke with to Aimee Ayers of the LSPA to gain information and spoke with to Dickie Wright, owner of Dickie’s Bait and Tackle.

**Findings and Analysis:** The website for Fish and Game did not have any fishing tournaments listed for Lake Sunapee but did provide information about a six year compilation of information about bass tournaments for the entire state. That information has been provided as a supplement to this question. When talking to Dickie Wright, I was told that no tournaments have been held for a few years because the sport fish populations are not at a high enough level to conduct a worthwhile tournament. When talking to Aimee Ayers of the LSPA, I was told the same information, but that the annual rock bass derby, which has been held for the last few years, is still being held every August.

**Evaluation Criteria:**

	<b>Score:</b>
1) None	1
2) 1 / year	2
3) 2 – 3 / year	3
4) 3 – 5 / year	4
5)>5 / year	5

**Sources:**

2003 Fishing Tournaments in New Hampshire Updated October 16, 2003

[http://www.wildlife.state.nh.us/Fishing/fish\\_tournament\\_table.htm](http://www.wildlife.state.nh.us/Fishing/fish_tournament_table.htm)

A Summary of New Hampshire Bass Tournament Data (1996-2001) \*info included.[http://www.wildlife.state.nh.us/Fishing/Fishing\\_PDFs/bass\\_tournament\\_data01.doc](http://www.wildlife.state.nh.us/Fishing/Fishing_PDFs/bass_tournament_data01.doc)

Personal Interview with Dickie Wright, selectman for Newbury, owner of

Dickie's Outdoor Sports. (December 1, 2003)  
 Personal Interview with Aimee Ayers of the LSPA. (December 1, 2003).

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** December 2003

**Investigator:** Paul Barrile and Micah Mitchell

*Sunapee Lake*

Bass tournament effort ranked seventeenth over the six-year period (4,432 angler hours) and effort was very variable, ranging from a low of 140 angler hours in 2001 to a high of 1,474 angler hours in 1996 (Table 2). Bass tournament pressure ranked lowest over the six-year period (0.18 angler hours/acre/year) and was far below the statewide value (Table 3). The six-year catch rate of smallmouth bass ranked sixth (0.19 fish/hour), was slightly greater than the statewide value and annual catch rates were variable (Table 4). The six-year average weight of smallmouth bass ranked twenty-third (1.48 lbs), was 0.40 pounds less than the statewide value and annual average weights were variable (Table 6).

Table 2. Bass tournament effort (angler hours) over a six-year period (1996-2001) on lakes that had three or more permitted bass tournaments per year.

Lake	Surface Acres	1996	1997	1998	1999	2000	2001	6-Year Total	Rank
Balch Pond	704	64	302	548	370	632	789	2,705	25
Big Island Pond	510	1,385	520	768	640	751	928	4,992	14
Bow	1,160	685	1,198	1,394	2,215	1,987	1,281	8,760	6
Conway	1,299	200	462	128	160	232	912	2,094	27
Crystal (Gilmanton)	441	168	44	499	161	487	371	1,730	30
Deering Reservoir	315	418	152	220	180	481	491	1,942	28
Great East	885	393	384	758	558	783	635	3,511	20
Highland (Stoddard)	712	1,192	1,595	1,032	1,233	1,178	1,306	7,536	8
Hopkinton	120	480	841	340	1,116	1,102	1,082	4,961	15
Lovell	538	712	571	344	684	502	353	3,166	21
Mascoma	1,115	361	368	392	739	272	364	2,496	26
Massabesic	2,900	960	254	1,078	1,809	1,074	576	5,751	12
Merrymeeting	1,111	434	456	241	112	366	195	1,804	29
Milton Three Ponds	383	1,548	1,563	2,915	2,162	2,058	2,506	12,752	5
Monomonac	1,048	396	652	1,074	2,241	1,846	1,588	7,797	7
Newfound	4,106	496	1,131	2,134	579	2,029	648	7,017	11
Northwood	687	594	1,196	846	1,617	1,168	1,626	7,047	10
Ossipee	3,092	321	1,517	1,501	2,070	586	1,256	7,251	9
Pawtuckaway	900	3,272	3,261	3,592	736	3,368	2,087	16,316	4
Spofford Lake	707	894	0	300	240	662	968	3,064	22
Squam (Big & Little)	7,173	2,096	2,281	3,256	3,538	1,911	4,004	17,086	3

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

<b>Sunapee</b>	<b>4,085</b>	<b>1,474</b>	<b>1,184</b>	<b>228</b>	<b>264</b>	<b>1,142</b>	<b>140</b>	<b>4,432</b>	<b>17</b>
Suncook	672	422	530	781	567	957	1,227	4,484	16
Swain's (Barrington)	405	575	748	728	772	540	867	4,230	18
Turkey Pond	339	168	347	250	331	505	126	1,727	31
Waukewan	913	830	1,016	432	1,167	899	894	5,238	13
Webster	612	197	493	563	446	480	646	2,825	24
Wentworth	3,017	505	1,121	532	790	736	304	3,988	19
Wicwas	328	160	691	456	499	440	683	2,929	23
Winnepesaukee	44,586	8,304	15,978	14,387	18,833	23,084	19,542	100,128	1
Winnisquam	4,264	2,846	3,125	4,002	5,262	5,445	3,231	23,911	2
<b>Totals</b>	<b>89,127</b>	<b>32,550</b>	<b>43,981</b>	<b>45,719</b>	<b>52,091</b>	<b>57,703</b>	<b>51,626</b>	<b>283,670</b>	

Table 3. Bass tournament pressure (angler hours/acre/year) over a six-year period (1996-2001) on lakes that had three or more permitted bass tournaments per year.

Lake	1996	1997	1998	1999	2000	2001	6-Year Summary	Rank
Balch Pond	0.09	0.43	0.78	0.53	0.90	1.12	0.64	21
Big Island Pond	2.72	1.02	1.51	1.25	1.47	1.82	1.63	7
Bow	0.59	1.03	1.20	1.91	1.71	1.10	1.26	9
Conway	0.15	0.36	0.10	0.12	0.18	0.70	0.27	27
Crystal (Gilmanton)	0.38	0.10	1.13	0.37	1.10	0.84	0.65	20
Deering Reservoir	1.33	0.48	0.70	0.57	1.53	1.56	1.03	12
Great East	0.44	0.43	0.86	0.63	0.88	0.72	0.66	19
Highland (Stoddard)	1.67	2.24	1.45	1.73	1.65	1.83	1.76	4
Hopkinton	4.00	7.01	2.83	9.30	9.18	9.02	6.89	1
Lovell	1.32	1.06	0.64	1.27	0.93	0.66	0.98	13
Mascoma	0.32	0.33	0.35	0.66	0.24	0.33	0.37	24
Massabesic	0.33	0.09	0.37	0.62	0.37	0.20	0.33	25
Merrymeeting	0.39	0.41	0.22	0.10	0.33	0.18	0.27	27
Milton Three Ponds	4.04	4.08	7.61	5.64	5.37	6.54	5.55	2
Monomonac	0.38	0.62	1.02	2.14	1.76	1.52	1.24	10
Newfound	0.12	0.28	0.52	0.14	0.49	0.16	0.28	26
Northwood	0.86	1.74	1.23	2.35	1.70	2.37	1.71	6
Ossipee	0.10	0.49	0.49	0.67	0.19	0.41	0.39	23
Pawtuckaway	3.64	3.62	3.99	0.82	3.74	2.32	3.02	3
Spofford Lake	1.26	0.00	0.42	0.34	0.94	1.37	0.72	18
Squam (Big & Little)	0.29	0.32	0.45	0.49	0.27	0.56	0.40	22
<b>Sunapee</b>	<b>0.36</b>	<b>0.29</b>	<b>0.06</b>	<b>0.06</b>	<b>0.28</b>	<b>0.03</b>	<b>0.18</b>	<b>29</b>
Suncook	0.63	0.79	1.16	0.84	1.42	1.83	1.11	11
Swain's (Barrington)	1.42	1.85	1.80	1.91	1.33	2.14	1.74	5
Turkey Pond	0.50	1.02	0.74	0.98	1.49	0.37	0.85	16
Waukewan	0.91	1.11	0.47	1.28	0.98	0.98	0.96	14
Webster	0.32	0.81	0.92	0.73	0.78	1.06	0.77	17
Wentworth	0.17	0.37	0.18	0.26	0.24	0.10	0.22	28
Wicwas	0.49	2.11	1.39	1.52	1.34	2.08	1.49	8
Winnepesaukee	0.19	0.36	0.32	0.42	0.52	0.44	0.37	24
Winnisquam	0.67	0.73	0.94	1.23	1.28	0.76	0.93	15

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<b>Statewide Summary</b>	<b>0.37</b>	<b>0.49</b>	<b>0.51</b>	<b>0.58</b>	<b>0.65</b>	<b>0.58</b>	<b>0.53</b>	
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Table 4. Catch rates (fish/hour) of smallmouth bass entered for weigh-in during bass tournaments over a six-year period (1996-2001) on lakes that had three or more permitted bass tournaments per year. Data do not include bass culled before weigh-in.

Lake	1996	1997	1998	1999	2000	2001	6-Year Summary	Rank
Balch Pond	0.05	0.03	0.01	0.02	0.03	0.04	0.03	16
Big Island Pond	0.01	0.03	0.01	0.005	0.03	0.03	0.02	17
Bow	0.19	0.19	0.20	0.16	0.20	0.19	0.18	7
Conway	0.11	0.19	0.09	0.14	0.02	0.17	0.15	9
Crystal (Gilmanton)	0.19	0.05	0.10	0.10	0.14	0.21	0.14	10
Deering Reservoir	0.05	0.02	0.16	0.09	0.16	0.09	0.10	12
Great East	0.21	0.11	0.17	0.13	0.07	0.28	0.16	8
Highland (Stoddard)	0.05	0.03	0.05	0.01	0.02	0.02	0.03	16
Lovell	0.11	0.10	0.16	0.21	0.13	0.18	0.15	9
Mascoma	0.21	0.26	0.25	0.22	0.12	0.18	0.21	4
Massabesic	0.11	0.11	0.05	0.06	0.05	0.09	0.07	14
Merrymeeting	0.18	0.25	0.15	0.14	0.29	0.30	0.23	3
Milton Three Ponds	0.08	0.10	0.07	0.06	0.07	0.10	0.08	13
Monomonac	0.02	0.01	0.01	0.02	0.01	0.02	0.01	18
Newfound	0.28	0.18	0.12	0.17	0.16	0.10	0.15	9
Northwood	0.16	0.08	0.14	0.13	0.10	0.13	0.12	11
Ossipee	0.11	0.12	0.18	0.26	0.13	0.16	0.18	7
Pawtuckaway	0.02	0.01	0.05	0.07	0.04	0.09	0.04	15
Spofford Lake	0.10		0.03	0.11	0.13	0.12	0.10	12
Squam (Big & Little)	0.23	0.17	0.24	0.23	0.20	0.26	0.23	3
<b>Sunapee</b>	<b>0.26</b>	<b>0.13</b>	<b>0.31</b>	<b>0.27</b>	<b>0.12</b>	<b>0.16</b>	<b>0.19</b>	<b>6</b>
Suncook	0.11	0.15	0.17	0.11	0.28	0.26	0.20	5
Swain's (Barrington)	0.03	0.06	0.02	0.05	0.06	0.06	0.04	15
Waukewan	0.16	0.14	0.10	0.21	0.34	0.23	0.21	4
Webster	0.13	0.08	0.13	0.15	0.09	0.06	0.10	12
Wentworth	0.27	0.29	0.30	0.35	0.42	0.50	0.34	1
Wicwas	0.00	0.01	0.002	0.01	0.02	0.04	0.02	17
Winnepesaukee	0.26	0.31	0.25	0.26	0.26	0.24	0.26	2
Winnisquam	0.19	0.22	0.22	0.20	0.16	0.22	0.20	5
<b>Statewide Summary</b>	<b>0.16</b>	<b>0.19</b>	<b>0.17</b>	<b>0.19</b>	<b>0.18</b>	<b>0.18</b>	<b>0.18</b>	

**Attribute 5:** Recreational Characteristics

**Category:** Recreational Value

**Question G:** Angler Usage

**Directions:** Using the method outlined in the angler survey instructions included in Appendix C, estimate the approximate number of anglers per acre for an average day during the summer.

**Rationale:** Completing this question will provide an estimate of the popularity of the waterbody in regards to its recreational fishing opportunities. An estimate of angler use should be considered in conjunction with lake or pond surface area, as this will ultimately determine the density of recreational anglers. The amount of angler usage that a waterbody receives will help in assessing the need to provide specialized facilities such as boat launching or public shoreline fishing areas.

**Process Followed:** Spoke with to Dickie Wright, selectman for Newbury and owner of Dickie's Outdoor Sports, and Aimee Ayers, of the LSPA, about the popularity of Lake Sunapee as a recreational fishing opportunity and the approximate angler usage. Used information from the Fish and Game website about angler usage during bass tournaments on Lake Sunapee.

**Findings and Analysis:** The angler survey that goes with this question was not done over the summer because when attempting to do it, Aimee Ayers reported that she just did not see anyone fishing on the lake. When talking to Dickie Wright, he said that no one really fishes there anymore and if you see two people out there fishing for trout or salmon, than that's more than usual. With the information found on the Fish and Game website, the numbers for Lake Sunapee, calculated in angler hours/acre/year, for bass tournament pressure from 1996-2001 were the lowest of any body of water in the state. The highest number recorded was 0.36 angler hours/acre/year in 1996, the lowest was in 2001 with a number of 0.03 angler hours/acre/year and the mean of the six years studied (1996-2001) was 0.18 angler hours/acre/year, ranking the lake twenty-ninth which was the lowest. With this lack of angler usage during tournaments, it is safe to say that on a normal day the numbers will be much lower. An exact number is unable to be determined but surely the angler usage for Lake Sunapee is not what it was in years past and will stay that way until the fish come back.

Table 3. Bass tournament pressure (angler hours/acre/year) over a six-year period (1996-2001) on lakes that had three or more permitted bass tournaments per year.

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

<b>Lake</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>6-Year Summary</b>	<b>Rank</b>
Balch Pond	0.09	0.43	0.78	0.53	0.90	1.12	0.64	21
Big Island Pond	2.72	1.02	1.51	1.25	1.47	1.82	1.63	7
Bow	0.59	1.03	1.20	1.91	1.71	1.10	1.26	9
Conway	0.15	0.36	0.10	0.12	0.18	0.70	0.27	27
Crystal (Gilmanton)	0.38	0.10	1.13	0.37	1.10	0.84	0.65	20
Deering Reservoir	1.33	0.48	0.70	0.57	1.53	1.56	1.03	12
Great East	0.44	0.43	0.86	0.63	0.88	0.72	0.66	19
Highland (Stoddard)	1.67	2.24	1.45	1.73	1.65	1.83	1.76	4
Hopkinton	4.00	7.01	2.83	9.30	9.18	9.02	6.89	1
Lovell	1.32	1.06	0.64	1.27	0.93	0.66	0.98	13
Mascoma	0.32	0.33	0.35	0.66	0.24	0.33	0.37	24
Massabesic	0.33	0.09	0.37	0.62	0.37	0.20	0.33	25
Merrymeeting	0.39	0.41	0.22	0.10	0.33	0.18	0.27	27
Milton Three Ponds	4.04	4.08	7.61	5.64	5.37	6.54	5.55	2
Monomonac	0.38	0.62	1.02	2.14	1.76	1.52	1.24	10
Newfound	0.12	0.28	0.52	0.14	0.49	0.16	0.28	26
Northwood	0.86	1.74	1.23	2.35	1.70	2.37	1.71	6
Ossipee	0.10	0.49	0.49	0.67	0.19	0.41	0.39	23
Pawtuckaway	3.64	3.62	3.99	0.82	3.74	2.32	3.02	3
Spofford Lake	1.26	0.00	0.42	0.34	0.94	1.37	0.72	18
Squam (Big & Little)	0.29	0.32	0.45	0.49	0.27	0.56	0.40	22
<b>Sunapee</b>	<b>0.36</b>	<b>0.29</b>	<b>0.06</b>	<b>0.06</b>	<b>0.28</b>	<b>0.03</b>	<b>0.18</b>	<b>29</b>
Suncook	0.63	0.79	1.16	0.84	1.42	1.83	1.11	11
Swain's (Barrington)	1.42	1.85	1.80	1.91	1.33	2.14	1.74	5
Turkey Pond	0.50	1.02	0.74	0.98	1.49	0.37	0.85	16
Waukewan	0.91	1.11	0.47	1.28	0.98	0.98	0.96	14
Webster	0.32	0.81	0.92	0.73	0.78	1.06	0.77	17
Wentworth	0.17	0.37	0.18	0.26	0.24	0.10	0.22	28
Wicwas	0.49	2.11	1.39	1.52	1.34	2.08	1.49	8
Winnepesaukee	0.19	0.36	0.32	0.42	0.52	0.44	0.37	24
Winnisquam	0.67	0.73	0.94	1.23	1.28	0.76	0.93	15
<b>Statewide Summary</b>	<b>0.37</b>	<b>0.49</b>	<b>0.51</b>	<b>0.58</b>	<b>0.65</b>	<b>0.58</b>	<b>0.53</b>	

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 1 angler / > 10 acres	1
2) 1 angler / 8.1 - 10 acres	2
3) 1 angler / 6.1 – 8 acres	3
4) 1 angler / 4 – 6 acres	4
5) 1 angler / < 4 acres	5

**Sources:**

Personal Interview with Dickie Wright, selectman for Newbury, owner of Dickie's Outdoor Sports. (December 1, 2003)

Personal Interview with Aimee Ayers of the LSPA. (December 1, 2003)

A Summary of New Hampshire Bass Tournament Data (1996-2001) \*info pertinent to question is included.

[http://www.wildlife.state.nh.us/Fishing/Fishing\\_PDFs/bass\\_tourn\\_data01.doc](http://www.wildlife.state.nh.us/Fishing/Fishing_PDFs/bass_tourn_data01.doc)

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** December 2003

**Investigator:** Paul Barrile and Micah Mitchell

**Attribute 5:** Recreational Characteristics

**Category:**

**Question H:** Ice dependent activities.

**Directions:** Identify all types of recreational activities that occur on the lake or pond while it is ice covered.

**Rationale:** Many of New Hampshire's lakes and ponds host a number of winter activities that occur while they are frozen. Identifying these activities will assist in evaluating the overall recreational value of a waterbody.

**Process Followed:** Referred to local literature and recreation departments.

**Findings and Analysis:** Recreational activities that occur on Lake Sunapee when it is frozen include:

- Ice skating
- Snowmobiling
- Driving
- Cross country skiing
- Ice fishing
- SCUBA diving

Though there are fewer activities during the winter season, there are still a number of people attracted to the area, especially to Mount Sunapee ski area. All of these activities increase the amount of traffic in the area, which in turn increases the amount of pollution from motor vehicles; however, skiing and snowmobiling have the greatest effect on the lake's watershed. The ski area is the biggest attraction, which means more artificial snow is made; this means more water is taken from the town's water supply. After the ski season ends, the snow melts and an excess of runoff flows into Lake Sunapee, bringing the salts and other chemicals on the roads with it. Snowmobiling is harmful because the vehicles have two-stroke engines, which pollute by emitting thick, oily smoke from the exhaust and they also leak fuel from the exhaust port every time the engine is started. Some snowmobiles are made with four-stroke engines, but those are only the newer more expensive models.

**Evaluation Criteria:**

- 1) 1 – 3 activities
- 2) 4 – 6 activities
- 3) > 6 activities

**Sources:**

Andrews, Bob. (2003). New London Recreation Department. *Local Links*.  
<http://www.nlrec.com>. (25 Oct. 2003).

Lake Sunapee Protection Association. (1999). *Navigation Chart of Lake Sunapee*.

Spotted Dog Web Group Design. (2003). SunapeeHarbor.com. *Harbor Activities*.  
<http://www.sunapeeharbor.com/harbor.htm>. (25 Oct. 2003).

**Assessment of Question:** This question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu

**Attribute 5:** Recreational Characteristics

**Category:**

**Question I:** Non-water dependent activities.

**Directions:** Identify all types of recreational activities that occur around the shoreline of the lake or pond that do not require water.

**Rationale:** Non-water dependent activities, such as hiking or camping, are also an important component in determining the lake or pond's recreational value. Identifying these activities and their relative popularity should be considered when planning public shoreline recreational facilities.

**Process Followed:** Referred to local literature and recreation departments.

**Findings and Analysis:** Recreational activities that occur around the shoreline of Lake Sunapee that do not require water include:

- Bicycling
- Hiking
- Cross Country Skiing
- Snowmobiling
- Four wheeling
- Scenic driving
- Snowshoeing
- Picnicking
- Camping
- Hunting

A lot of these activities occur throughout every season, but some are more harmful than others. Snowmobiling and four wheeling are harmful because the vehicles have two-stroke engines, which pollute by emitting thick, oily smoke from the exhaust and they also leak fuel from the exhaust port every time the engine is started. Some snowmobiles and four wheelers are made with four-stroke engines, but those are only the newer more expensive models. Hikers, campers and picnickers may create more litter in the area, but this can be avoided by posting no littering signs and placing trash cans at popular recreation areas.

**Evaluation Criteria:**

- 1) 1 – 3 activities
- 2) 4 – 6 activities
- 3) > 6 activities

**Sources:**

Andrews, Bob. (2003). New London Recreation Department. *Local Links*.  
<http://www.nlrec.com>. (25 Oct. 2003).

Lake Sunapee Protection Association. (1999). *Navigation Chart of Lake Sunapee*.  
Spotted Dog Web Group Design. (2003). SunapeeHarbor.com. *Harbor Activities*.  
<http://www.sunapeeharbor.com/harbor.htm>. (25 Oct. 2003).

**Assessment of Question:** This question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu

**Attribute 5:** Recreational Characteristics

**Category:**

**Question J:** Commercial seasonal camps.

**Directions:** Identify the name(s) and location(s) of any extended-stay (>1 week) summer camps (i.e. youth camps).

**Rationale:** These facilities are important recreational centers that make the lake or pond unique. Their attendees often gain a deep appreciation of the waterbody and the inherent values that it provides. Depending on its size and location, the camp(s) may require special consideration when developing a management plan.

**Process Followed:** Obtained local phone books for all six towns and recorded camps listed. The camps that were listed within any of the towns had to be located on a map, to see if they were located in the Lake Sunapee Watershed.

**Finding and Analysis:** There are no extended-stay camps located in the Lake Sunapee Watershed. There are several camps located within some of the towns; however they do not fall within the watershed parameters.

**Evaluation Criteria:**

- 1) None
- 2) 1 camp
- 3) 2 – 4 camps
- 4) 4 – 6 camps
- 5) > 6 camps

**Sources:**

New Hampshire Yellow Page Phone Book. “Camps”, “Campgrounds”. Merrimack County. 2003.

**Assessment of Question:** This question pertains to the amount of recreational activity the watershed experiences. If there were camps present in the watershed, it would be very beneficial to know their attendance rates and location in relation to waterbodies.

**Date Completed:** October 2003

**Investigator:** Tamsen B Bolte

**Attribute 5:** Recreational Characteristics

**Category:** Recreation

**Question K:** Boat launches and access sites.

**Directions:** Identify the name(s), location(s), and owner(s) of all public and private boat launching site(s) for the waterbody. Consult the maps from the NH Department of Fish and Game to obtain the most complete information

**Rationale:** The ability to gain access to any lake or pond is likely to be directly related to its water-dependent recreational popularity. These sites can also serve as information stations to educate the public about the condition and concerns that pertain to the waterbody of interest. Since they can also concentrate on- and off-water recreational activities they must also be designed and maintained in a manner that protects and matches the natural characteristics of the waterbody.

**Process Followed:** Consulted the Navigation Chart for Lake Sunapee that had the listing of the boat launches and access sites on it.

**Findings and Analysis:** Lake Sunapee has seven access sites:

- Georges Mills Harbor Launch
- Sunapee Harbor Launch
- Newbury Harbor Launch
- Blodgett's Landing Boat Launch
- Burkehaven Hill Boat Launch (private)
- Sunapee State Beach Boat Launch
- Lake Sunapee Yacht Club Launch (private)

**Evaluation Criteria:**

**Score:**

1) None	1
2) 1 – 3 launches/access sites	2
3) 4 – 6 launches/access sites	3
4) 7 – 10 launches/access sites	4
5) >10 launches/access sites	5

**Sources:**

Lake Sunapee Protective Association: 2002 Navigational Chart of Lake Sunapee (scale 1:24,000 1 inch equals 2,000 feet (.38 statute mile))

**Date Completed:** November 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 5:** Recreational Characteristics

**Category:** Recreation

**Question L:** Other recreation and support facilities.

**Directions:** Note the name(s), location(s), and owner(s) of any parks, camping, or bathing facilities that occur on a waterbody's shoreline and the activities that are allowed.

**Rationale:** For the non-boating public, the number of alternative shoreline recreational facilities that are provided will, in part, determine its popularity. Similar to public boat launching sites, these areas can also serve as information stations to educate the public about the condition and concerns that pertain to the waterbody of interest. Since they can also concentrate shoreline and nearshore recreational activities they must also be designed and maintained in a manner that protects and matches the natural characteristics of the waterbody.

**Process Followed:** Consulted map of the watershed that included the beaches and other recreational facilities around the lakes edge.

**Findings and Analysis:** Lake Sunapee offers many opportunities for swimming and bathing. The beaches found on the lakes edge include the following:

- Georges Mills Beach
- Dewey Beach
- Sunapee Harbor Beach
- Mount Sunapee State Park Beach
- Newbury Harbor Beach
- Blodgett's Landing Beach

Other recreational facilities that are offered within the watershed include Mount Sunapee State Park and The Fells. Mount Sunapee State Park offers skiing and other snow activities in the winter and in the summer hiking, chairlift rides, and the use of their facilities for wedding and other large gatherings. The Fells offers educational programs in history, horticulture and the environment, as well as a place for hiking and solitude.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) None	1
2) 1 facility	2
3) 2 – 3 facilities	3
4) 4 – 5 facilities	4
5) >5 facilities	5

**Sources:**

Lake Sunapee Protection Association: 2002 Navigation Chart of lake Sunapee (scale 1:24,000 1 inch equals 2,000 feet (.38 statute mile))

**Date Completed:** November 2003

**Investigator:** Micah Mitchell and Paul Barrile

**Attribute 5:** Recreational Characteristics

**Category:**

**Question M:** Time of recreational use / activities

**Directions:** Record the time of year (season), time of week, and time of day that each of the three most popular recreational activities take place on or around the waterbody.

**Rationale:** Documenting the times that a variety of recreational activities occur on the lake or pond will assist in identifying any potential conflicts that may arise among user groups. Also, if completed over a number of years, this information will track the recreational trends on the lake or pond and assist in developing plans to provide adequate facilities.

**Process Followed:** Contacted Aimee Ayers of the Lake Sunapee Protection Agency regarding the three most popular events/dates on the waterbody. Contacted Robert Carrick at the Lake Sunapee Yacht Club, regarding information on the Star Sailboat Open. Contacted The Sunapee Snowmobile Club regarding the Snowmobile Club Testing that occurs on the waterbody.

**Findings and Analysis:** Found the three most populated events on the waterbody to be the Fourth of July, the Snowmobile Club Testing, and the Star Sailboat Open (Yacht racing). Found as follows:

- **July 4<sup>th</sup>**- nothing during the day time, but heavy activity at night. Fireworks are let off, a barge around the Loon Island Lighthouse, and sometimes around the White Shutters. Over 200 boats usually attend, leading to a very populated waterbody, with very dense boat activity. Dangerous when the fireworks are over because the rushes to get home, all the boats move at once.
- **Snowmobile Testing**- Occurs in February. Races/testing all day at the State Beach, many people around to view testing. Bonfire at night at the State Beach with a huge number of people around to view. Fireworks are normally let off at the State Beach during the bonfire.
- **Star Sailboat Open**-Lake Sunapee Yacht Club. Crowded because of the races, and the viewers of the races. Crowded surrounding the race-course with both petroleum and non-petroleum powered boats. The racecourse is populated because of the racing boats. But the danger area is usually the boats and people watching the race from the side of the course. Takes place in early August.
- **Also Note:** The League of New Hampshire Crafts Fair holds the annual craft fair in August, at Mount Sunapee. The fair attracts thousands. Large number of people at the mountain normally leads to an increase in the number of people on and around the lake. This leads to an increase in boat density and number of cars on the roads surrounding the lake.

**Sources:** Ayers, Aimee. Personal Interview. November 2003.

**Assessment of Question:** This is an important question because it deals with the most populated times of year on the waterbody. These events occur over the entire year, not just the summer, which shows the importance of year round recreational activity on the waterbody. Each of the three most populated events increases the population on the waterbody, and pollution concerns are raised. Fireworks fall back into the waterbody after being viewed, the snowmobile testing causes gasoline traces to be found on the snow where they occur. The density of the activity, both boat, and human increase greatly, leading to a higher number of boats and people on the waterbody.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings

**Attribute 6:** Restrictions for Prohibited Uses

**Category:**

**Question A:** Public swimming facility postings\* imposed because of threats to human health.

*\*A posting occurs when high numbers of toxic cyanobacteria occur or when E. coli or Enterococci bacteria exceed NH state standards (See NH DES Environmental Fact Sheet WD-BB-41). In the case of E. coli or Enterococci, high bacteria levels persist only for a short time period (i.e. <2 days) and swimmers are advised to swim at their own risk during this time. While the posting is in effect additional water samples are collected to determine if the problem is acute or chronic.*

**Directions:** Consult the New Hampshire *Surface Water Quality Assessment 305(b)* report, or the Environmental Protection Agency's *National Health Protection Survey of Beaches*.

**Rationale:** Postings of public swimming facilities are a nuisance and concern to visiting recreational users and lakeside as well as community property owners. Awareness of the frequencies and locations of such closures is useful in prioritizing water quality protection efforts.

**Process Followed:** Consulted the US EPA's *National Health Protection Survey of Beaches* on-line. Information can be extracted from the four previous swim seasons for each public beach. Information concerning each public beach on Lake Sunapee was recorded. Attained the 2002 NH *Surface Water Quality Assessment 305(b)* report from the NH DES website. Contacted Jody Conner, who is the monitoring agent for the EPA at the NH DES, who has been in charge of the Lake Sunapee public beaches.

**Finding and Analysis:** The US EPA's *National Health Protection Survey of Beaches* provided information on the five public beaches located on Lake Sunapee and Little Lake Sunapee for the following years: 2002, 2001, 2000, and 1999. Over the course of these four years, the water was monitored for bacteria and pathogens by the New Hampshire Department of Environmental Services' monitoring agent Jody Connor during the three month swimming season on a monthly basis. Blodgett's Landing, Bucklin Town Beach, Depot Beach, Dewey Beach, and Georges Mill Town Beach experienced no elevated levels of bacteria during the 2002 swim season. A posted advisory due to elevated bacteria levels of E. coli was at Dewey Beach in June 2000 for a total of three days. The most recent beach closing occurred in July 2003 at Dewey Beach in Sunapee.

**Evaluation Criteria:**

- 1) > 6 within past 3 years
- 2) 4 – 6 within past 3 years
- 3) 2 – 4 within past 3 years
- 4) 1 within past 3 years
- 5) None within past 3 years

**Sources:**

Connor, Jody. NH DES; US EPA Monitoring Agent. (603) 271-3414.

[J.Connor@DES.state.nh.us](mailto:J.Connor@DES.state.nh.us)

New Hampshire Department of Environmental Services, Watershed Management Bureau. New Hampshire Final 2002 305(b) and 303(d) Surface Water Quality Assessment Report. 2002.

United States Environmental Protection Agency, Office of Water, Office of Science and Technology. National Health Protection Survey of Beaches. 7 May 2003. 23 September 2003 <<http://www.epa.gov/waterscience/beaches/data.html>>.

**Assessment of Question:** The results of this inquiry are important to know, in order to provide for a safe and healthy recreational spot. Positive tests may show patterns at particular beaches, signaling a need for evaluation of the problems and solution. Facility postings due to increased bacterial levels that are repetitive every season may deter the public from continual use of the area. The EPA's *National Protection Survey of Beaches* provided the most useful information, even though the most recent swimming season's results have yet to be posted. The other recommended source, New Hampshire's *Surface Water Quality Assessment 305(b)* report, while containing valuable information, did not include information pertinent to this question.

**Date Completed:** September 2003

**Investigator:** Tamsen B Bolte

**Attribute 6:** Restrictions for Prohibited Uses

**Category:**

**Question B:** Fish Consumption limits due to threats to human health.

**Directions:** Consult the NH Department of Health and Human Services website for any fish consumption limits due to threats to human health.

**Rationale:** If any such restrictions apply to the lake (other than the statewide recommendations in regards to mercury in fish tissue) public awareness is important to ensure compliance with the restrictions.

**Process Followed:** Referred to the NH Fish and Game Department website. A June 2003 edition of “*Is It Safe to Eat the Fish? Reminder About Fish Consumption Guidelines*” was viewed with a list of statewide recommendations. Review the NH F&G’s booklet entitled Fish Consumption, Advisory for Freshwater Fish, Ocean Fish and Shellfish for more specific information and guidelines.

**Finding and Analysis:** The Department of Health and Human Services has developed advisory guidelines for fish consumption. These recommendations have been established due to the presence of mercury in freshwater fish. Mercury adversely affects the central nervous system in young children and fetuses. In 2001 the DHHS posted a statewide advisory after reviewing significant studies throughout the state. The following constitute the recommended consumption of NH freshwater fish.

- Everyone should limit their freshwater fish intake. With special advisory to the following groups:
  - Pregnant and nursing women, women who may get pregnant: One eight-ounce meal per month.
  - Children under age seven: One three-ounce meal per month.
  - All other adults and children age seven and older: Four eight-ounce meals per month.
- People should eat smaller fish. For largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*) and chain pickerel (*Esox niger*), fish longer than twelve inches should be avoided.

**Evaluation Criteria:**

- 1.) Advisory to limit or avoid fish consumption because of suspected pollutant other than mercury
- 2.) Avoid consumption of fish recommendation issued for specific waterbody because of suspected mercury contamination
- 3.) General statewide advisory on fish consumption because of potential exposure to mercury

**Sources:**

- New Hampshire Department of Health and Human Services. 23 September 2003  
<[http://www.dhhs.state.nh.us/DHHS/DHHS\\_SITE/default.htm](http://www.dhhs.state.nh.us/DHHS/DHHS_SITE/default.htm)>
- New Hampshire Department of Health and Human Services, Office of Community and Public Health. Fish Consumption Advisory Booklet.  
<<http://www.dhhs.state.nh.us/NR/rdonlyres/e35nhw4f2cwpfssrrq35owciz5r3scki pkllolgg7xpjdhbqgo2ppe7hgcohafj6xk2xrls6ex3u3udmrz3vsdo6dhf/fish-consume-advisory.pdf>>
- Pinski, Dennis (DHHS) and Jane Vachon (NH F&G). Is It Safe to Eat the Fish? Reminder About Fish Consumption Guidelines. Concord: New Hampshire Fish and Game Department. 18 June 2003.

**Assessment of Question:** The conclusion of this question is not necessarily specific to the watershed being investigated. However the information is important for all viewers of this document. The average person, most likely, is probably not aware of the potential danger with excessive fish consumption and the recommended healthy intake. As a potential threat to human health, this problem might be more overlooked than should be. More measures to aid in limiting these effects can be developed to decrease related health problems. The listed website to preview the Fish Consumption Advisory Booklet, printed by the NH F&G, is out of date in the contact section. A new website is listed in the sources.

**Date Completed:** September 2003

**Investigator:** Tamsen B Bolte

**Attribute 6:** Restrictions for Prohibited Uses

**Category:**

**Question C:** Recreational Fishing Restrictions.

**Directions:** Consult the most current edition of the *New Hampshire Freshwater Fishing Digest*, published by the New Hampshire Fish and Game Department for a list of statewide and waterbody-specific fishing regulations and restrictions.

**Rationale:** Special fishing restrictions apply to many waterbodies in New Hampshire and can provide unique opportunities for anglers. Often these restrictions are designed specifically to manage populations of naturally producing species or are an attempt to equally satisfy anglers fishing for stocked species.

**Process Followed:** Reviewed a copy of the *NH 2003 Freshwater Fishing Digest*.

**Finding and Analysis:**

Important Laws and Rules in New Hampshire:

- Hooks used for bait from ice-in to March 31 must have only a single hook point. From April 1 to ice-in, 2 hooks for bait may be used. One must be a single hook point and the other must not exceed three hook points.
- No more than 6 ice fishing devices per person shall be used to take fish while ice fishing.

Unlawful Actions:

- The use of lead sinkers (1 ounce or less) and jigs (less than 1 inch along its longest axis) in freshwater lakes and ponds is prohibited.

General Fishing Rules:

<b>Species</b>	<b>Seasons and Daily Limits</b>
<b>Black Bass (Smallmouth bass and Largemouth bass)</b>	Ice-in to May 14 and June 16 to June 30-2 fish; May 15- June 16- all fish must be immediately released unharmed at site of catch; July 1 to ice-in- 5 fish.
<b>Brook Trout, Brown Trout, Rainbow Trout, Tiger Trout, Splake</b>	Combined daily limit; Open water- 5 fish or 5 pounds, whichever is reached first. Through the ice- 2 fish. No length limit.
<b>Lake Trout</b>	Open water season- April 1 to September 30; Ice-fishing season- January 1 to March 21. 2 fish daily limit. Minimum length 18 inches. Daily bag limit for lake trout and salmon is 2 fish- (2 lake trout, 2 salmon, or 1 of each).
<b>Landlocked Salmon</b>	Season: April 1 to September 30. 2 fish daily limit. Minimum length 15 inches. Daily bag limit for lake trout and Salmon is 2 fish- (2 lake trout, 2 salmon, or 1 of each).
<b>Pickereel</b>	No closed season. 10 fish daily limit; no length or weight limits.
<b>Northern Pike</b>	No closed season. 10 fish daily limit; minimum length 28

	inches.
<b>Walley</b>	No closed season. 2 fish daily limit; minimum length 18 inches; no limit on weight.
<b>White/ Yellow Perch, Crappie, Horned Pout, Sunfish and Rockbass</b>	No closed season. No daily limits; no length or weight limits.
<b>Carp</b>	No closed season; no daily limits; no length or weight limits.
<b>Cusk</b>	No closed season; no daily limits; no length or weight limits.
<b>American Shad</b>	No closed season; 2 fish limit.
<b>Shad (Whitefish)</b>	No length or weight limit; 2 fish daily limit.
<b>Smelt</b>	2 quart liquid measure of whole (head and tail intact) freshwater smelt in 24 hour period between 12 noon one day and 12 noon the following day. A person cannot take smelt while using a boat propelled by mechanical power. Angling: June 16-March 14. Dip Net: March 15-April 30, dip net not over 18 inches in diameter.
<b>Suckers</b>	No closed season; no daily limits; no length or weight limits.

Lake and Pond Special Rules:

- Rules for Lake Trout and/or Salmon Lakes (Lake Sunapee): This water body is managed for lake trout and or/ landlocked salmon, and is open year-round subject to restrictions. The taking of brook trout, rainbow trout, lake trout, trout hybrids, and salmon between two hours after sunset and one hour before sunrise is prohibited.
- Rules for Trout Pond (Pleasant Lake): This water body is managed for trout, and is open to fishing for all species the 4<sup>th</sup> Saturday in April through October 15. Fishing for any species is prohibited from October 16 until the 4<sup>th</sup> Saturday in April the following year.
- Additional Rules: Use or possession of live fish for bait shall be permitted.

**Evaluation Criteria:**

- 3.) All fishing prohibited
- 4.) Combination of restrictions
- 5.) Gear restrictions (e.g. fly-fishing only)
- 6.) Fishing prohibited in selected areas or certain usage of bait prohibited or restricted
- 7.) No special restrictions; regulations follow general rules outlined by NH Fish and Game Department

**Sources:**

Vetter, Wayne E. (Executive Director). New Hampshire Fish and Game Department. 2003 New Hampshire Freshwater Fishing Digest.

**Assessment of Question:** While this question is relevant if there are any outstanding rules and regulations on fishing, for the most part will conclude with a general answer. Possibly a more relevant question to add to the inventory would be to ask if the water

body is stocked and with what species. Obtaining the fishing rule booklet was very easy, as they are available wherever fishing licenses are sold.

**Date Completed:** October 2003

**Investigator:** Tamsen B Bolte

**Attribute 6:** Restrictions or Prohibited Uses

**Category:**

**Question D:** Waterbody is designated as a drinking water supply.

**Directions:** Consult *Administrative Rules Env – Ws 386, Protection of the Purity of Surface Water Supplies*, or with the assistance of NH DES staff, consult the NH DES One Stop web site Public Water Systems List.

**Rationale:** Lakes or ponds that serve as a current, emergency, or future drinking water supply have specific watershed restrictions. Enforcement and awareness of these restrictions can vary depending on the size of the waterbody and its proximity to population centers. As part of a management plan, identify the specific restrictions and the perceived level of compliance by the public. Once this is completed, it is important to prioritize protection methods and efforts.

**Process Followed:** Consulted the DES website, which includes a link to the Env-Ws 386 Protection of the Purity of Surface Water Supplies rule and a link to a guidance document entitled Model Rule for the Protection of Water Supply Watersheds (refer to attached documents).

**Findings and Analysis:** Specific watershed restrictions include:

1. A person shall not build, continue, or maintain any privy, pig-pen, stable, or other building or structures in which horses, cattle, swine or other animals or fowls are kept, within 75 feet of Lake Sunapee's, high water mark, or within 75 feet of any bay, cove, or inlet thereto, or within 75 feet of any stream tributary to said pond, bays, coves or inlets;
2. A person shall not allow any sink water, urine, or water that has been used for washing or cleansing either materials, persons, or food, to run into said pond, or into any bay, cove, or inlet thereof, or into any stream tributary thereto, or into any excavation or cesspool in the ground or on the surface of any ground within 75 feet of said pond's high water mark, or of any bay, cove, or inlet, or within 75 feet of any stream tributary thereto;
3. A person shall not throw or deposit any dead animal or fish, or parts thereof, or food or any article perishable or decayable, or any dung either human or animal, kitchen waste, swill, or garbage, into said pond, or leave or permit any such wastes to remain within 75 feet of the high water mark, or into any bay, cove, or inlet of said pond, or into any stream tributary thereto, or within 75 feet of such bay, cove, or inlet, stream or tributary thereto;
4. A person shall not throw any sawdust, or allow any sawdust to fall, into said lake or into any stream tributary thereto;
5. No person shall bathe in said lake within one fourth mile of where water is taken for a public supply, or within like distance to any private intake pipe, provided notice to that effect is conspicuously posted in the vicinity;
6. No person shall keep or maintain a boat, either for public or private use, nor house-boat or other construction for use to float, steam, or sail upon said lake, or shall have, keep, or maintain a ship closet, urinal, or other construction of easement which shall permit excrement or other offal to fall or empty into said lake. All boats carrying passengers shall be provided with water-tight tanks or receptacles which shall be kept in a good sanitary condition, and the contents thereof shall be disposed of at least one hundred feet from the shore of said lake's high water mark, and 100 feet from any bay, cove, or inlet of said lake, or any stream

tributary thereto, and in such manner as shall be satisfactory to the health authorities before mentioned;

7. A person shall not throw, deposit or allow to remain upon the ice of the waters of said lake, or upon that of any bay, cove, or inlet thereof, or of any stream tributary thereto, any matter waste or materials such as are described in (2), (3) and (4) above; and

8. A person shall not use a sea plane on said lake.

Compliance by the public is necessary for this rule to exist because it is unique in that the protection process is typically initiated by the water supplier, who asks DES to adopt specific provisions for a specific source. Then, once DES adopts the provisions, the water supplier becomes an agent of the state in monitoring for compliance with the rule.

Restriction eight should be noted because it conflicts with the recreational activities that occur on the open water of Lake Sunapee. There is a sea plane landing strip located on the southern end of the lake in Newbury, directly across from the State Park Beach. This should be addressed because this gives insight into how strictly the restrictions are enforced. If something as large as a seaplane is restricted, but is still used on the lake, then it seems almost nothing is strictly enforced.

**Evaluation Criteria:**

1) Waterbody does not serve as current, emergency, or future drinking water supply.

2) Waterbody currently serves as a drinking water supply or is designated as an emergency or future drinking water supply and has watershed rules in place.

**Sources:**

Susca, Paul & Pillsbury, Sarah. (2001). New Hampshire Department of Environmental Services. *Env-Ws 386 Protection of the Purity of Surface Water Supplies rule*. <http://des.state.nh.us/dwspp/shedrule.htm>. (22 Oct. 2003).

Susca, Paul & Pillsbury, Sarah. (2001). New Hampshire Department of Environmental Services. *Model Rule for the Protection of Water Supply Watersheds*. <http://des.state.nh.us/dwspp/shedrule.htm>.

**Assessment of Question:** The directions to the question advise referencing the NH DES One Stop web site Public Water Systems List, but this is a confusing website because it gives no direct answers and it is difficult to navigate. Using a browser such as Google to search directly for the Env-Ws 386 Protection of the Purity of Surface Water Supplies rule is less complicated and more efficient. The information provided is easy to understand and utilize.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu

**Attribute 6:** Restrictions or Prohibited Uses

**Category:** Recreation

**Question E:** Power boat restrictions.

**Directions:** Consult the list of waterbodies with watercraft-specific restrictions in the *State of NH Restricted Bodies of Water* published by the NH Department of Safety – Division of Safety Services.

**Rationale:** The enactment of power boat restrictions or prohibitions can be effective in protecting surface water quality or sensitive aquatic and nearshore ecological communities. Power boats may also be prohibited or horsepower limited on specific waterbodies to retain its remote or wilderness characteristics and maintain public safety. However, it must be recognized that all types of watercrafts must be considered equally when developing recreational use policies.

**Process Followed:** Referenced a copy of the *State of NH Restricted Bodies of Water*.

**Findings and Analysis:** Lake Sunapee has several restrictions pertaining to speed and minimum distances from shore as listed below. These restrictions help to ensure the health of the lake through erosion protection. Also, slower speeds in shallow areas decrease the amount of disturbance on the lake bottom which can potentially add phosphorus and increase algae growth. Regulations increase the safety of boaters and reduce the chance of boating accidents which could negatively affect the lake.

Sunapee Lake

SAF-C 402.69 -

- a) Sunapee Harbor, westerly from a line running northerly from the dock at Indian Cave Lodge, so called, shall be a "no wake" area.
- b) No person shall operate a vessel at a speed exceeding 6 MPH in Burkehaven northwesterly of a line running northeasterly from the boathouse on Emerald Island through the barrel light to the shore of Liberty Island.
- c) No person shall operate a vessel at a speed exceeding 10 MPH on that section of Sunapee Lake at Georges Mills Bay northwesterly from a line running southerly from the camp of John F. Seekamp on the northeasterly shore to the camp of Ernest Huber on the southwesterly shore.
- d) No person shall operate a vessel at a speed exceeding 6 MPH in Gardiner Bay west of a line between Weather's dock on the south and Chamberlin's boat house on the north.
- e) That portion of Sunapee Lake, beginning at light 12 and running northwesterly into and including George's Mills Harbor shall be a "no wake" area.
- f) Rafting shall be prohibited in the vicinity of 2000 feet north northeast of Twin Islands, adjacent to the red top spar buoy in Georges Mills.
- g) That portion of Lake Sunapee in the town of Newbury, from the eastern end at tax map #20, lot #122-475 to the western end at tax map #20, lot #323-437 measuring approximately 500 feet from shoreline to shoreline and 700 feet from the beginning of the proposed line to the southern most shoreline at the town of Newbury public dock shall be a "no wake" zone.

SAF-C 407.03b - Rafting as defined in RSA 270:42, V, shall be prohibited in the following areas of Lake Sunapee unless covered by one of the exceptions specified in RSA 270:45:

- (1) Along the eastern shore beginning at Owl's Nest Point, running northeast to a point off Soo Nipi Road, a distance of approximately 2,800 feet.
- (2) Along the front of the John Hay National Wildlife Refuge in Newbury. Boat/motor, Seaplane restriction - contact Sunapee for regulations. Public water supply.

Otter Pond - Georges Mills

SAF-C 402.51 - That part of Otter Pond in Georges Mills, in the outlet, from the buoy on the point of the island west to the outlet culvert, shall be a no wake area.

There were no official restrictions filed with the NH Department of Safety for the following lakes and ponds: Morgan Pond, Star Lake, Dutchman Pond, Mountainview Lake, and Chalk Pond.

**Evaluation Criteria:**

	<b>Score:</b>
1) No watercraft permitted	1
2) No motorized watercraft allowed (i.e.: petroleum or electric); sail or oar / paddle powered only	2
3) No petroleum powered watercraft permitted	3
4) Power watercraft permitted but with horsepower restrictions	4
5) No restrictions	5

**Sources:**

"Restricted Bodies of Water." New Hampshire Department of Safety. 2 Nov. 2003  
<<http://www.nh.gov/safety/ss/bodies.html>>

**Assessment of Question:** Specify whether to look only at the major waterbody or include nearby lakes and ponds.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

**Attribute 6:** Restrictions or Prohibited Uses

**Category:** Recreation

**Question F:** Ski craft restrictions.

**Directions:** Consult the list of waterbodies with ski craft-specific restrictions in the *State of NH Restricted Bodies of Water* published by the NH Department of Safety – Division of Safety Services.

**Rationale:** Personal ski craft have dramatically increased in popularity within the past decade. As fast, mobile recreational vehicles, personal ski craft can potentially present a safety hazard if operated irresponsibly or in high densities. These concerns must, however, be balanced with the general public’s recreational desires in addition to protecting water quality and the ecological community. Any restrictions to recreational surface water uses must reflect reasonable solutions capable of gaining wide public support. Per the State of NH, ski craft are defined as “any motorized watercraft or private boat which is less than thirteen feet in length as manufactured, is capable of exceeding a speed of twenty miles per hour, and has the capacity to carry not more than the operator and one other person while in operation”. As defined, this does not pertain to similar ski craft that can carry 3 or more passengers. Finally, under RSA 270:74, the use of ski craft is prohibited on all public bodies in New Hampshire which are less than 75 acres in size.

**Process Followed:** Referenced a copy of the *State of NH Restricted Bodies of Water*.

**Findings and Analysis:**

Lake Sunapee

RSA 270:74-a - All Skicraft operation, including operation at headway speed, within one fourth mile of the public water intake pipe located in Sunapee Harbor banned effective 5/21/90.

**Evaluation Criteria:**

	<b>Score:</b>
1) Personal ski craft prohibited on waterbody	1
2) Personal ski craft restricted to specific areas of the waterbody	3
3) No restrictions	5

**Sources:**

"Restricted Bodies of Water." New Hampshire Department of Safety. 2 Nov. 2003  
<<http://www.nh.gov/safety/ss/bodies.html>>

**Assessment of Question:** This question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

**Attribute 6:** Restrictions or Prohibited Uses

**Category:**

**Question G:** Lake surface areas with restrictions/limitations.

**Directions:** With assistance from DES Lakes Program staff, list any areas on the lake or pond where specific activities are restricted. In particular, identify any areas where non-native aquatic plants have become established. Developing a reference map showing the locations and restriction would be beneficial. You should also consider the size of the waterbody when assessing the number of restrictions.

**Rationale:** These areas are designed to protect against the spread of non-native aquatic plants, promote wildlife inhabitation, and limit specific boating activities.

**Process Followed:** Referenced the 1999 Lake Sunapee Map published and distributed by the Lake Sunapee Protective Association.

**Findings and Analysis:** Lake surface areas with restrictions/limitations include:

- No wake zone/public dock at the southern most tip in Newbury at the Marina
- No wake zone/public launch at the State Park Beach in Newbury
- No rafting zone at the John Hay National Wildlife Refuge in Newbury
- Speed limit/no wake zone just north of Fisher's Bay in Sunapee
- Rocks, navigate with caution in the Isle of Pines in Sunapee
- No swimming/public dock at the Southern tip of Sunapee Harbor in Sunapee
- Speed limit/no wake at the Inner Sunapee Harbor in Sunapee
- No rafting zone near Soo Nipi Park
- Speed limit 6mph near North Point
- Speed limit/no wake in Gardner Bay
- Speed limit 6mph at the inlet of Job's Creek
- No wake in the middle of Job's Creek
- No rafting zone/no skiing near the Twin Islands
- Speed limit/no wake/public dock at the northern most point

Georges Mills is the only area where non-native aquatic plants have become established, which is milfoil, but there are no formal restrictions for Georges Mills. There are other areas on the lake where non-native species have been found, but have not become established; those areas can be referenced on the attached map.

**Evaluation Criteria:**

- 1) No specialized restrictions (other than statewide regulations outlined in the New Hampshire Boater's Guide)
- 2) 1 – 2 restricted areas or activities
- 3) 3 – 4 restricted areas or activities
- 4) 5 – 6 restricted areas or activities
- 5) > 6 restricted areas or activities

**Sources:** 1999 Lake Sunapee Map

**Assessment of Question:** This question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu

**Attribute 6:** Restrictions or Prohibited Uses

**Category:**

**Question H:** Restricted activity times.

**Directions:** Consult the list of waterbodies with watercraft restrictions in the *State of NH Restricted Bodies of Water* as published by the NH Department of Safety and list any activities on the lake or pond that are restricted to certain times of the day.

**Rationale:** “Time zoning” represents one solution that might minimize conflict between user groups and increase the value of their experience. Further, in cases where wildlife disturbance may be of concern, reducing some surface water activities in specific areas may be beneficial to promoting their continued residence.

**Process Followed:** Consulted the NH Department of Safety website, which includes the 2002 list of NH Bodies of Water and Restrictions.

**Findings and Analysis:** There are multiple restrictions for Lake Sunapee activities; however, there are none that are time related. This is important to note because time restrictions could be potential amendments to the restrictions list. Having time restrictions on Lake Sunapee could decrease the amount of light pollution, unwashed boats, and illicit activities on the lake. After dusk and before dawn are times when the lake is hard to patrol due to the lack of daylight. Also, light pollution has presented a problem on the lake and recently residents have been informed that downward, shaded lighting should be used for yards rather than lights that emit outward and up, due to the increase in light pollution.

**Evaluation Criteria:**

- 1) No time restrictions
- 2) 1 time restriction
- 3) 2 or more restrictions

**Sources:**

New Hampshire Department of Safety. Division of Safety Services: Marine Patrol Bureau, 2002 List of Restricted Bodies of Water.  
<http://www.nh.gov/safety/ss/bodies.html> (10 Oct. 2003).

**Assessment of Question:** This question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu

**Attribute 7:** Unique Characteristics

**Category:** Unique or Outstanding Values

**Question A:** Public drinking water supply.

**Directions:** Identify whether the lake serves as a “designated” public water supply, and if so, the approximate population that is served. Consult the NHDES One Stop Database Public Water Systems list for the towns surrounding the waterbody. Record the location of the intake on a map of the waterbody. Note that this does not include any waterbodies from which lakeside residents draw water directly from the lake into their home or cottage.

**Rationale:** Lakes or ponds that serve as a public water supply may need additional protection measures to ensure that it is not contaminated by unnatural activities. In many cases this amounts to a reduction in on-water recreation and close monitoring of shoreline activities. A management plan should identify areas that are deficient in their protection measures or where the current protection measures are loosely enforced.

**Process Followed:** Consulted Aimee Ayers of Lake Sunapee Protective Association who recommended speaking to David Brennan who is the Sunapee Water and Sewage Superintendent. Because Sunapee residents are the only ones to use the lake as a significant drinking water supply, calculations were difficult. Mr. Brennan had the number of accounts serviced by Lake Sunapee, but not an exact number of people. The US Census Web Site was able to give the average persons per house hold in the town of Sunapee. By multiplying the number of accounts by the average number of people per house hold in the watershed, a good estimate was made.

**Findings and Analysis:** An approximation puts the total number of people served by Lake Sunapee water at 1358. There are 480 accounts and approximately 2.83 people per household that draw their water from the lake. Average flow out of Lake Sunapee in 2001 was 534,933 gallons and 586,290 gallons in 2000, a decrease of 10%.

By finding the number of accounts and multiplying it by the average number of people per household, an approximate figure is given. Considering the size of Lake Sunapee and the number of people living around it, this number is surprisingly small. Lake Sunapee is classified as class A drinking water, and also serves as a public water supply for some towns. It was surprising to see that only one of the surrounding towns used water from the lake, and the ski mountain draws water to make snow from the lake.

**Evaluation Criteria:**

**Score:**

1) None	1
2) 1 - 1000 people served	2
3) 1001 - 5000 people served	3
4) 5001 – 10,000 people served	4
5)>10,000 people served	5

**Sources:**

Brennan, David. Phone Interview. 11/17/2003.

"Quick Facts from US Census Bureau." U.S. Census Bureau. 12 Nov 2003

<<http://www.census.gov>>

**Assessment of Question:** This question is adequately stated, however gathering information was rather difficult. The most difficult part was accurately accounting the number of residents that use the lake as a water supply, especially since there is such a variance in seasonal housing.

**Date Completed:** October 2003

**Investigator:** Greg Van Steinburgh

**Attribute 7:** Unique Characteristics

**Category:** Recreation

**Question B:** Historic features in or around the waterbody

**Directions:** Consult the NH division of Historic Preservation and/or a local historic committee to identify any features that are recognized by a local/state/national historic commission which occur in or around the lake or pond.

**Rationale:** Registered landmarks or other similar types of attractions that have historical significance along the waterbody's shoreline, or even submerged structures, can attract interest from regular and occasional visitors. Further, they often serve as important gathering places for permanent residents. A management plan should consider their value and protection.

**Process Followed:** Consulted with Wende Brocke, Reference/Librarian at Colby Sawyer College.

**Findings and Analysis:**

There are two Historical Sites located within the watershed

1. John Hay National Wildlife Refuge  
(Added 2000-Merimack County-Also known as The FELLS  
NH 103A, 2.2 mi. N of jct. of NH 103 and NH 103A, Newbury  
(1640 acres, 4 buildings, 4 structures)
2. Center Meeting House  
(Added-1979)  
Newbury, Intersection of route 100 and route 103A  
(1820 Church)

**Evaluation Criteria:**

	<b>Score:</b>
1) None	1
2) 1 – 2 features	2
3) 3 – 4 features	3
4) 5 – 6 features	4
5)>6 features	5

**Sources:**

Brocke, Wende. E-mail Interview. 10/20/2003.

*National Register of Historic Places-NH*. Retrieved Nov 20, 2003, from National Register of Historic Places,  
<http://www.nationalregisterofhistoricplaces.com/nh/districts.html> *New Hampshire Historical Markers*. 1989. Retrieved Nov 05, 2003, from New Hampshire Division of Historical Resources: <http://www.state.nh.us/markers/table.html>

**Assessment of Question:** This question was surprising, as there is so much history in the area there are relatively few sites. Because of Sunapee has been a popular vacation spot for over 100 years, there should be more historic structure remaining. Due to location and few threats to historic buildings, there may not be as much concern for deteriorating or threatened buildings as in a more populated area.

**Date Completed:** November 2003

**Investigator:** Greg Van Steinburgh

**Attribute 7:** Unique Characteristics

**Category:** Unique or Outstanding Value

**Question C:** Educational facilities or sites.

**Directions:** Record the name(s) and location(s) of any educational facilities or sites that are specifically designed to educate the public about the lake or pond's characteristics.

**Rationale:** Educational facilities or sites will increase the public's awareness of the natural characteristics for the waterbody of interest. Public education is arguably the most important long term component in facilitating wise land use and reducing the potential for negative impacts to water quality.

**Process Followed:** Consulted Aimee Ayers of the Lake Sunapee Protective Association

**Findings and Analysis:**

-Lake Sunapee Protective Association- Non-Profit Educational Facility

The majority of education done by LSPA is for children's classes, as well as invasive species monitoring/education for residents. By informing and involving residents in something that is important to them, they are able to keep up in monitoring efforts because more people are willing to volunteer.

-John Hay Estate and National Wildlife Refuge

The John Hay Estate and National Wildlife Refuge (THE FELLOWS) is also located on the shores of Lake Sunapee. The site is under the control of U.S. Fish and Wildlife Service, but The Friends of the Fellows maintain the property and offer classes and interpretive trails.

There are two educational facilities located within the watershed, though have different focuses. LSPA offers classes mostly for children and has a mission of educating the public about protecting the lake. They are also involved in invasive species monitoring and water quality testing in order to best inform the public. The education of the surrounding public is an extremely important aspect of preservation of the lake. The more people that are informed about the opportunities and problems the lake faces, the more people that are willing to take action to make changes. The integrity of the lake is extremely important to the people of the Lake Sunapee area and these education centers give them an opportunity to see what they can do to help. LSPA has even started volunteer Exotic Species monitoring as well as other ways of involving the public.

**Evaluation Criteria:**

**Score:**

- |   |   |
|---|---|
| 1) <i>No formal educational facilities or sites</i>   | 1 |
| 2) At least one outside trail or waterside area specifically designed to educate the public about the waterbody's natural characteristics     | 3 |
| 3) At least one facility with both outside and inside facilities designed to educate the public about the waterbody's natural characteristics | 5 |

**Sources:**

Ayers, Aimee. Personal Interview. 10/10/2003.

**Assessment of Question:** This question is important and fairly concise. Educational facilities are essential aspects of informing the public and Lake Sunapee has two sites. This question could have been a little more specific as to what kind of educational sites they were looking for. In more populated areas with more environmental problems, there would probably be many more education sites.

**Date Completed:** November 2003

**Investigator:** Greg Van Steinburgh

**Attribute 7:** Unique Characteristics

**Category:**

**Question D:** Research or Scientific study.

**Directions:** Record the name(s) and affiliation(s) or any institutions or organized groups such as universities, conservation groups or government organizations that conduct periodic or regular scientific investigations in or around the lake or pond. For example, specific types of studies commonly undertaken on lakes or ponds include long term ecological research(i.e. >5 years of continuous study) or diagnostic feasibility studies(intensive studies of the lake ecosystem that usually last 1 or 2 years), periodic monitoring as part of a basin wide research program. Consider past and ongoing studies. Do not include volunteer monitoring efforts(See Question E).

**Rationale:** Identifying if any periodic or regular scientific information is collected in or around the lake or pond could help establish a valuable partnership for information sharing and protection efforts.

**Process Followed:** Consulted Aimee Ayers of the Lake Sunapee Protective Association

**Findings and Analysis:** The only current lake study taking place is the watershed inventory being undertaken by Colby-Sawyer College. Past studies have been conducted by the UNH Fisheries and Biology Group, and other local colleges. No other research or studies are currently being conducted on Lake Sunapee.

This is an important question, and it was surprising to find that the Watershed Investigation was the only study being conducted on Lake Sunapee. There are many groups that have interests in the lake and that conduct studies, but most are non-profit and thus volunteer efforts. In the past other colleges and private organizations have done studies on the lake, but none that were regular or extensive. If this body of water was to be threatened or in a more rural area, there would more likely be more interest in studies. The lake seems to be rather stable and there is little besides residential development to provide a threat.

**Sources:**

Ayers, Aimee. Personal Interview. 10/10/2003.

**Assessment of Question:** This question was helpful in realizing the importance and uniqueness of the project underway. If the watershed were in a more populated area, or around a larger university there would probably be more interest in studying the lake. The Coastal region probably has more studies because there are more people with interests in the port, and more for profit establishments to conduct studies.

**Date Completed:** November 2003

**Investigator:** Greg Van Steinburgh

**Attribute 7:** Unique Characteristics

**Category:** Unique or Outstanding Value

**Question E:** Participant in VLAP, LLMP, or an alternative volunteer monitoring program.

**Directions:** Identify if the lake is a part of either DES's VLAP(Voluntary Lake Assessment Program) or UNH's LLMP(Lay Lake Management Program) by contacting the NH department of Environmental Services Watershed Management Bureau or the University of New Hampshire Cooperative Extension. Include any type of regular volunteer monitoring efforts.

**Rationale:** Identifying if the lake undergoes regular volunteer assessment could help establish an information sharing partnership and potential participants for the management plan group. Volunteer monitoring assessment groups have become a valuable tool to simultaneously gather basic information about various lake wide characteristics and raising the awareness of a waterbody as a community resource.

**Process Followed:** Consulted Aimee Ayers of the Lake Sunapee Protective Association

**Findings and Analysis:** The LSPA was founded in 1898 to ensure the environmental quality of the lake Sunapee Watershed. From 1956 till 1982 Lake Sunapee was monitored and protected by private consultant Donald Bent, who was hired by LSPA. In 1982, the UNH Fisheries Biology Group took over monitoring responsibilities and continued until 1985. In 1985 the VLAP was formed and Lake Sunapee joined. The VLAP is an important organization that helps ensure lake preservation through out the state. Because Lake Sunapee has been a member since its inception, preservation efforts may be more evident than in other lakes.

**Evaluation Criteria:**

	<b>Score:</b>
1) Not a participant in a volunteer monitoring program	1
2) Volunteer monitoring program participant for <1 year	2
3) Volunteer monitoring program participant for at least 1 year	3
4) Volunteer monitoring program participant for at least 5 years	4
5) Volunteer monitoring program participant for at least 10 years	5

**Sources:**

Ayers, Aimee. Personal Interview. 10/10/2003.

**Assessment of Question:** The purpose of this question is to try to get an idea of what kind of efforts have already been made to preserve the lake. VLAP is the largest lakes management program in the state, and hopefully it has had a positive impact on the well being of Lake Sunapee. Although the time in which the program has been in effect was stated, it neglects to mention or evaluate the degree of involvement.

**Date Completed:** November 2003

**Investigator:** Greg Van Steinburgh

**Attribute 8:** Shoreland Characteristics

**Category:** Susceptibility to Impairment

**Question A:** Shoreland development and land use.

**Directions:** Construct a map indicating the location and approximate amount of forested, wetland, active agricultural, clear / open, and urban land use types, within 250 feet of the high water mark around the entire waterbody. Town planning or assessing departments, as well as regional planning commissions may be able to offer assistance in generating a map.

**Rationale:** Identifying the percentage of each of these land use types within the shoreland area will help in the development of general and targeted nonpoint source pollution prevention strategies. In cases where nonpoint source pollution is of a lesser concern, knowing the types of each of these land uses will assist in efforts to create public awareness of potential pollutant sources.

**Process Followed:** Developed a land use map using data from New Hampshire GRANIT. The lake was buffered 250 feet to represent the shoreland zone boundary. The type of land use within this boundary was then calculated into percentages based on area within the shoreland zone.

**Findings and Analysis:**

- Forested: 20.9%
- Wetlands: 0.3%
- Urban: 78.8%
- Total % developed: 78.8%

The shoreland of Lake Sunapee has mostly been developed. The undeveloped areas are in part due to be conserved lands. As a result this, the ratio of developed to undeveloped shoreland will most likely remain constant in the future. Further development will not infringe upon these areas, rather increase within the areas already developed.

**Evaluation Criteria:**

**Score:**

Developed : Undeveloped

1)	<10% : >90%	1
2)	10 – 25% : 75 – 90%	2
3)	26 – 50% : 50 – 74%	3
4)	51 – 75% : 25 – 49%	4
5)	>75% : <25%	5

**Sources:**

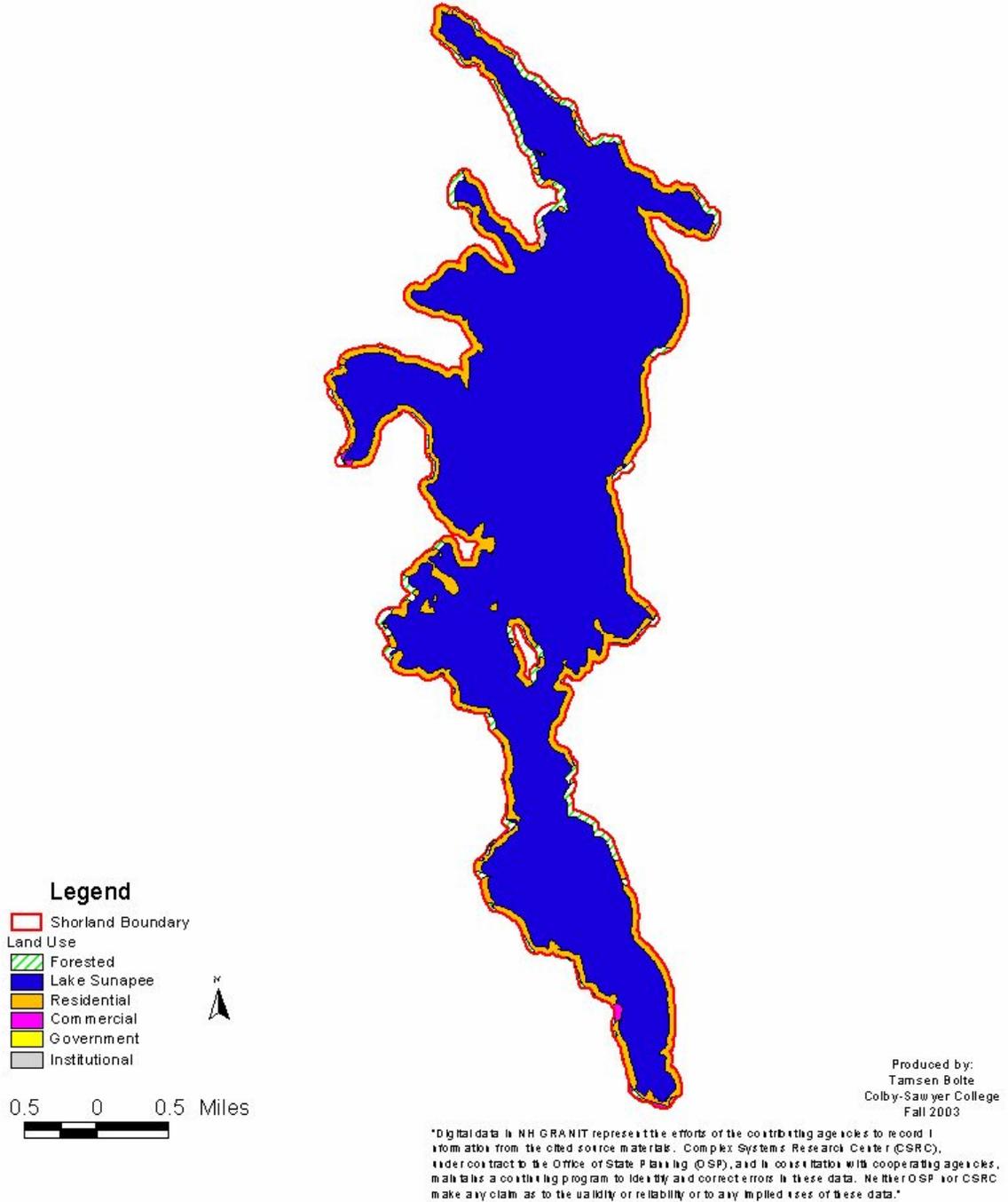
“Granit”. Complex Systems Research Center. University of New Hampshire. 3 Dec. 2003  
<<http://granit.sr.unh.edu/>>.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Tamsen B Bolte

# Attribute 8 A Shoreland Development and Land Use



**Attribute 8:** Shoreland Characteristics

**Category:**

**Question B:** Shoreland ownership

**Directions:** Construct a map indicating the location and approximate amount of forested, wetland, active agricultural, clear / open, and urban land use types, within 250 feet of the high water mark around the entire waterbody. Town planning or assessing departments, as well as regional planning commissions may be able to offer assistance in generating a map.

**Rationale:** Identifying the percentage of each of these land use types within the shoreland area will help in the development of general and targeted nonpoint source pollution prevention strategies. In cases where nonpoint source pollution is of a lesser concern, knowing the types of each of these land uses will assist in efforts to create public awareness of potential pollutant sources.

**Process Followed:** Using GIS, a map was created with a 250 foot boarder showing the land use. An estimation of the amount of public land and private land was derived using the map.

**Findings and Analysis:**

**Evaluation Criteria:**

- 1) all private; no public land
- 2) all public; no private land
- 3) **mix of public and private land**

If (3), then what is the approximate percent of public and private land?

Public:   10   %

Private:   90   %

**Sources:**

"GRANIT Metadata Database." The New Hampshire Geographically Referenced Analysis and Information Transfer System . 01 Dec. 2003  
<<http://www.granit.sr.unh.edu/>>

**Assessment of Question:** The question is fine as stated.

**Date Completed:** November 2003

**Investigator:** Beau Etter-Garrette

**Attribute 8:** Restrictions or Prohibited Uses

**Category:** Susceptibility to Impairment

**Question C:** Lake Protected land or land not available for development within the shoreland area.

**Directions:** Using a land use map or the GRANIT *Conservation Lands Viewer*, identify all land that is protected from future development within the shoreland area including state owned conservation properties, town owned conservation properties, private conservation organization properties, and conservation easements. An estimate should identify the amount of lake frontage (feet) and shoreland area (acres). The *New Hampshire Lakes and Ponds Inventory* may help to identify shoreline length. Note who owns the land.

**Rationale:** Identifying the percentage of land protected from future development will provide guidance for monitoring changes in shoreland use and the associated levels of nonpoint source pollution that a lake or pond receives. By identifying who owns the lands you recognize potential partnerships for future lake management.

**Process Followed:** Created a map of Lake Sunapee and the conserved lands with shoreland and lake frontage using Granit and GIS. With the information downloaded from Granit, the amount of lake frontage and shoreland area was calculated.

**Findings and Analysis:**

<b>Conservation Name</b>	<b>Ownership</b>	<b>Lake Frontage (feet)</b>	<b>Shoreland Acreage</b>
Frank and Dot Gordon	Ausbon Sargent Land Preservation Trust	1474.362	7.932
Lincoln Gordon	Ausbon Sargent Land Preservation Trust	711.12	3.93
John Hay National Wildlife Refuge	US Department of Interior, Fish and Wildlife Service	4883.634	27.055
Sunapee State Park	D.R.E.D.	2741.879	14.253
Gordon	Ausbon Sargent Land Preservation Trust	1649.529	8.71
Gordon WMA	New Hampshire Fish and Game	1509.673	9.325
Dewey Beach	Town of Sunapee	253.325	1.433
Boat Launch	Town of Sunapee	175.69	0.883
Birch Point Circle	Town of Sunapee	0	0.212
Gazebo/Bandstand	Town of Sunapee	0	0.53
Town of New London	Ausbon Sargent Land Preservation Trust	0	3.93
Brown Hill Farm	Town of Sunapee	0	0.931
Estate of Marguerite	Ausbon Sargent Land Preservation Trust	0	9.235
	<b>Total Conserved Lake Frontage</b>	<b>11924.85</b>	<b>88.359</b>
	<b>Total Percentage</b>	<b>16%</b>	<b>10%</b>

In response to the amount of protected and/or un-developable land within the shoreland zone of Lake Sunapee, the percentage represents the environmental awareness that is shared within the watershed community. The 16% of shoreland frontage that is presently protected is an adequate amount compared to the rate and type of development that the lake has seen. It must also be noted that this percentage only represents what land is protected within the 250 foot shoreland boundary. The parcels of conserved lands extend beyond this boundary and therefore offer the lake additional buffering from development.

Please note: Red water Creek Alliance- 120 acres wetland, between state beach and Sunapee on 103b, Ausbon Sergeant and LSPA is not yet designated on the map.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 0%	5
2) 1 – 10%	3
3) 11 – 25%	3
4) 26 – 50%	2
5) >50%	1

**Sources:**

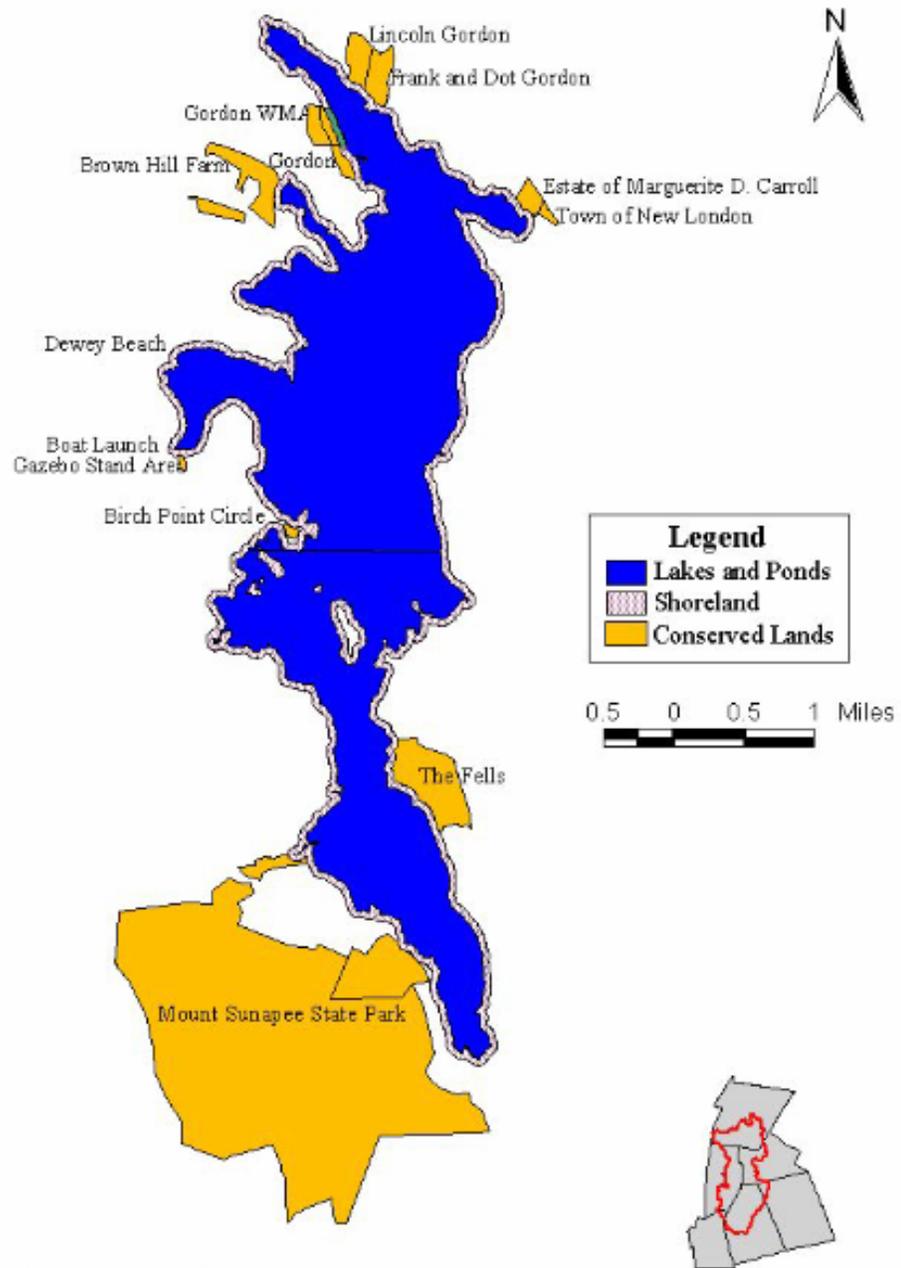
GRANIT. (2002). The New Hampshire Geographically Referenced Analysis and Information Transfer System. *Metadata Database*. <http://www.granit.sr.unh.edu> (5 Nov. 2003).  
Applegate, Arthur. (1996). Neuron Data, Inc. (1995) & Environmental Systems Research Institute. ArcView GIS. Version 3.2a. (2000).

**Assessment of Question:** The question is very important, but it is should also important to ask how large the entire lot of conserved land is, not just the amount with shoreland or lakefront property. This is important because there is a lot of land conserved. These parcels extend out; therefore, the total amounts of conserved shoreland do not accurately summarize the amount of conserved land around the lake. Another thing to note is that there is no information to compare this with, which makes it hard to analyze the information. This lake has 16% of its shoreland conserved, which seems impressive, but how does it compare to other lakes? The directions to this question should add where to go to get such information pertaining to other lakes and conserved shoreland.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu and Tamsen Bolte

## Protected Lands within the Shoreland Area



Digital data from GIS/RS/RS/NT requires a license of the processing system or other software from the user or creator. Colby-Sawyer College (CSC) and the Office of State Planning (OSP) and its associated web mapping system, are not a processing system or software and are not a license. Under OSP and CSC and its web mapping system, the user or creator is responsible for any copyright or other data.

**Attribute 8:** Restrictions or Prohibited Uses

**Category:** Unique/Outstanding Value

**Question C:** Lake Protected land or land not available for development within the shoreland area.

**Directions:** Using a land use map or the GRANIT *Conservation Lands Viewer*, identify all land that is protected from future development within the shoreland area including state owned conservation properties, town owned conservation properties, private conservation organization properties, and conservation easements. An estimate should identify the amount of lake frontage (feet) and shoreland area (acres). The *New Hampshire Lakes and Ponds Inventory* may help to identify shoreline length. Note who owns the land.

**Rationale:** Identifying the percentage of land protected from future development will provide guidance for monitoring changes in shoreland use and the associated levels of nonpoint source pollution that a lake or pond receives. By identifying who owns the lands you recognize potential partnerships for future lake management.

**Process Followed:** Created a map of Lake Sunapee and the conserved lands with shoreland and lake frontage using Granit and GIS. With the information downloaded from Granit, the amount of lake frontage and shoreland area was calculated.

**Findings and Analysis:**

<b>Conservation Name</b>	<b>Ownership</b>	<b>Lake Frontage (feet)</b>	<b>Shoreland Acreage</b>
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Gordon	Ausbon Sargent Land Preservation Trust	1649.529	8.71
Gordon WMA	New Hampshire Fish and Game	1509.673	9.325
Dewey Beach	Town of Sunapee	253.325	1.433
Boat Launch	Town of Sunapee	175.69	0.883
Birch Point Circle	Town of Sunapee	0	0.212
Gazebo/Bandstand	Town of Sunapee	0	0.53
Town of New London	Ausbon Sargent Land Preservation Trust	0	3.93
Brown Hill Farm	Town of Sunapee	0	0.931
Estate of Marguerite	Ausbon Sargent Land Preservation Trust	0	9.235
	<b>Total Conserved Lake Frontage</b>	<b>11924.85</b>	<b>88.359</b>
	<b>Total Percentage</b>	<b>16%</b>	<b>10%</b>

In response to the amount of protected and/or un-developable land within the shoreland zone of Lake Sunapee, the percentage represents the environmental awareness that is shared within the watershed community. The 16% of shoreland frontage that is presently protected is an adequate amount compared to the rate and type of development that the lake has seen. It must also be noted that this percentage only represents what land is protected within the 250 foot shoreland boundary. The parcels of conserved lands extend beyond this boundary and therefore offer the lake additional buffering from development.

Please note: Red water Creek Alliance- 120 acres wetland, between state beach and Sunapee on 103b, Ausbon Sergeant and LSPA is not yet designated on the map.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) 0%	1
2) 1 – 10%	2
3) 11 – 25%	3
4) 26 – 50%	4
5) >50%	5

**Sources:**

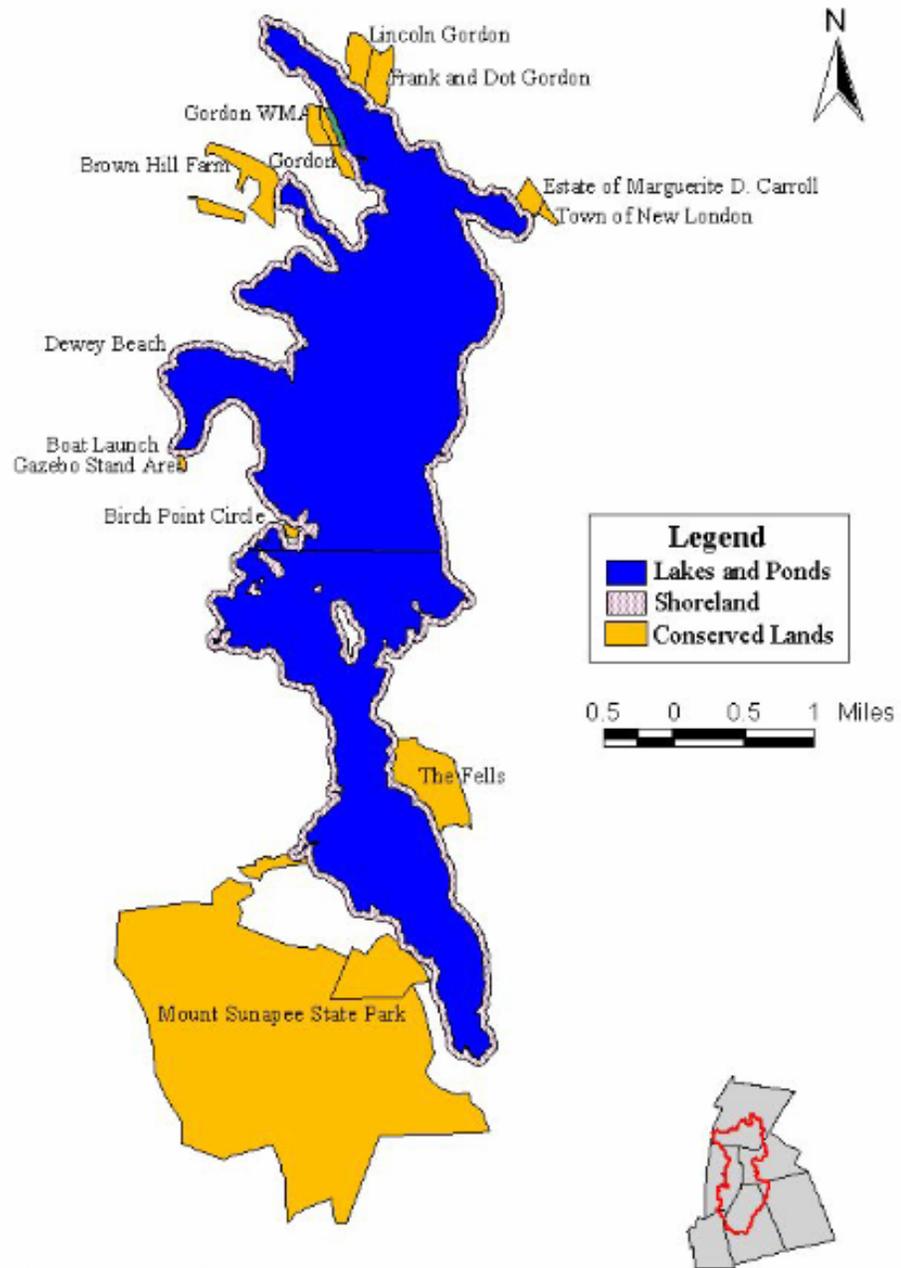
GRANIT. (2002). The New Hampshire Geographically Referenced Analysis and Information Transfer System. *Metadata Database*. <http://www.granit.sr.unh.edu> (5 Nov. 2003).  
Applegate, Arthur. (1996). Neuron Data, Inc. (1995) & Environmental Systems Research Institute. ArcView GIS. Version 3.2a. (2000).

**Assessment of Question:** The question is very important, but it is should also important to ask how large the entire lot of conserved land is, not just the amount with shoreland or lakefront property. This is important because there is a lot of land conserved. These parcels extend out; therefore, the total amounts of conserved shoreland do not accurately summarize the amount of conserved land around the lake. Another thing to note is that there is no information to compare this with, which makes it hard to analyze the information. This lake has 16% of its shoreland conserved, which seems impressive, but how does it compare to other lakes? The directions to this question should add where to go to get such information pertaining to other lakes and conserved shoreland.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu and Tamsen Bolte

# Protected Lands within the Shoreland Area



Digital data from GIS/RS/RS/NT requires a license of the processing system or other software from the user or creator. Colby-Sawyer College (CSC) and the Office of State Planning (OSP) and its associated web mapping system, are not a processing system or software and are not a license. Under OSP and CSC and its web site or the related system or software is not a license of the data.

**Attribute 8:** Shoreland Characteristics

**Category:**

**Question D:** Percent of impervious surface within the shoreland.

**Directions:** Contact the DES Lakes Program staff for assistance with constructing a map that indicates the amount of impervious surface (i.e. roadways, rooftops, driveways, parking lots) within the shoreland area.

**Rationale:** The amount of impervious area is important in determining stormwater runoff quantity and quality. Shoreland areas that provide little area for stormwater infiltration (i.e. high percentage of impervious surfaces) into the soil will convey high quantities of stormwater runoff into surface waters. Impervious surfaces can also compromise water quality by transferring oils, greases, heavy metals, and excess nutrients from pavement and rooftops to nearby tributaries and drainage ditches. Stormwater retention facilities and vegetated buffer strips can be effective mitigation measures for controlling stormwater quantity and quality. A management plan should identify the percentage of impervious surfaces in need of stormwater control mechanisms within the shoreland boundaries.

**Process Followed:**

Impervious Surface Methodology

Steps

Use remote sensing images to identify impervious surfaces

1. Printed a large copy of the orthophoto layer for the entire watershed from 1998. Students individually identified areas that appeared distinctly similar on the photo layer and labeled them. (E.g. all areas with houses surrounded by woods were one category, homes that were very dense with little to no trees were another category). This was done individually to avoid group influence and to aid in reliability.
2. Compared results and developed categories. The group compared the results of the individual categories and developed specific descriptions for each category. (E.g. all areas of dense development along the shoreline were labeled as one category, all rural development as another category). The result of this exercise was the definition of 12 different categories.

- Dense Residential Shoreland
- Rural Residential Shoreland
- Dense Residential Offshore
- Rural Residential Offshore
- Commercial Shoreland
- Commercial Offshore
- Parking Shoreland

- Parking Offshore
  - Golf Courses (Baker Hill)
  - Lumber Yard (Durgin & Crowell)
  - Power & Light Utility (Hemphill)
  - Roads
3. Ground truth. The next step was to confirm if the land cover was consistent with the description of the category. This was done by visiting the site by vehicle and confirming the observation. It was also done by prior knowledge of the major landmarks in the watershed and identifying them on the orthophoto.

#### Calculate imperviousness

1. The first step was to select a few samples from the list of categories. Specific descriptions of each sample site and the methodology followed at each sample site are attached.

#### Categories and listed Samples:

- **Dense Residential Shoreland =7**
  - Dense Shoreland, Blodgett's Landing
  - Dense Shoreland, Lake Ave #1 Sunapee
  - Dense Shoreland, Lake Ave #2 Sunapee
  - Dense Shoreland, Old Mill Rd Sunapee
  - Dense Shoreland, Bay Point Rd Sunapee
  - Dense Shoreland, Hammel Rd Sunapee
  - Dense Shoreland, Fernwood Jobs Creek Rd.
- **Rural Residential Shoreland = 3**
  - Rural Shoreland, Little Lake Sunapee Rd
  - Rural Shoreland, Herrick Cove New London
  - Rural Shoreland, Bowles Rd. Newbury
- **Dense Residential Offshore = 2**
  - Dense Offshore, Chalk Pond Newbury
  - Dense Offshore, Hilltop New London
- **Rural Residential Offshore = 4**
  - Rural Offshore, Blye Hill Newbury
  - Rural Offshore, Stony Brook Rd Newbury
  - Rural Offshore, Rollins Rd. Newbury
  - Rural Offshore, Soo Nipi Park Rd. New London
- **Commercial Shoreland = 3**
  - Commercial Shoreland, Sunapee
  - Commercial Shoreland, Georges Mills Sunapee
  - Commercial Shoreland, Newbury
- **Commercial Offshore = 1**
  - Commercial Offshore, Sunapee
- **Parking Shoreland =2**
  - Parking Shoreland, Sunapee State Beach
  - Parking Shoreland, Bucklin Beach

- **Parking Offshore = 1**
  - Parking Offshore, New London
- **Golf Courses = 1**
  - Baker Hill, Newbury
- **Lumber Yard = 1**
  - Durgin & Crowell
- **Power & Light Utility = 1**
  - Hemphill, Springfield
- **Roads = All**
  - Entire watershed

2. Sample sites were divided into those where the Effective Impervious Area (EIA) was measured and those where the Total Impervious Area (TIA) was measured. Total Impervious Area involved measuring the total impervious area of a large surface. Examples included big parking areas, Hemphill Power & Light, and Durgin & Crowell lumber mill and yard. Effective Impervious Area included areas where a certain percentage of the area was impervious.
3. Effective Impervious Area samples sites were identified for categories and teams of two students visited the site to measure the imperviousness. The first step was to identify a “box” around the area. (E.g. in a dense development the box to include the homes would be 100 ft from the road and 500 ft along the road.). All the impervious surfaces inside this “box” were calculated – mostly driveways and roofs. The results would be a percentage impervious surface for the sample plot. Refer to sheets and spreadsheet.
4. Data from all samples were entered in a spreadsheet and the percentage imperviousness calculated as a percentage per acre. There was high level of correspondence between samples of the same category. The averages of the samples were taken to get an imperviousness rating per category.

Dense Residential Shoreland	54.03
Rural Residential Shoreland	11.28
Dense Residential Offshore	78.20
Rural Residential Offshore	7.09
Commercial Shoreland	80.15
Commercial Offshore	55.4
Parking Shoreland	100.00
Parking Offshore	100.00
Baker Hill Golf Course	2.16
Durgin & Crowell Lumber	100.00
Hemphill Power & Light	100.00
Roads	100.00

## Digitizing

The next step was to identify all areas with similar characteristics on a map and to digitize all areas with imperviousness.

1. The students were divided into three different groups to ensure reliability. Each group worked independently on identifying the location of categories.
2. Each group worked on a large copy of a topographical map with a clear layer of Mylar over the top. To avoid groupthink the students worked separately on designating each area with the previously defined categories. Once each had completed their own map, they regrouped to compare outcomes. Similarities between each were kept the same, and differences were thoroughly discussed and finally resolved to result in one complete map of designated areas to sample and digitize.
3. All the areas were digitized in GIS. An attribute table was developed that indicated the category and the percent imperviousness for each polygon.

## Comments

**Golf Course.** The fairways and open areas on the golf course were treated as pervious surfaces, but we acknowledge that this surface does not have the same characteristics as a forested surface. The golf cart paths, parking areas, and buildings are impervious surfaces. The result of this approach is that the golf course has an imperviousness of 2.16% over its total area.

**Mt. Sunapee.** There are several large parking areas and some big buildings in the ski area. We took the total area where these parking lots and building occur (about 24 acres) and calculated the percentage imperviousness. The resulting cover is not very high (it is 55%) but it is important to recognize that these big parking areas contribute to direct runoff into storm water and streams and runoff is probably high in salt and oil spills.

**Roads.** We did not include roads in the calculation of the impervious cover of the different categories. Roads were digitized, the total surface calculated based on a measurement of the width of the road, and it is treated as a separate impervious category. Class 1 roads (Interstate 89) were calculated as 70' wide; class 2 (generally state roads) were calculated as 30' wide, and class 3 & 4 roads (generally town and private roads) were calculated as 20' wide.

**Findings and Analysis:** We found the impervious surface in the shoreland buffer of 250' to be 28.22%. This is a relatively high number and classifies Lake Sunapee's shoreland as being 'impacted'. This percentage is very close from falling in the range of over 30%, which is classified as 'degraded'. The amount of impervious surface is due to the fact that numerous homes abut the lake and several commercial areas are also on the shoreland or extremely close to it. Lake Sunapee has very little conserved shoreland,

with the John Hay Estate making up most of the undeveloped shoreland. There is little that can be done to reverse these developed areas and therefore the best plan of action is to make sure the rest of the watershed stays fairly undeveloped. With NH being the fastest growing state in New England, in addition to the vast area available for development, we must pay close attention to how much additional impervious will be created with new development in the watershed. Another concern about impervious surface in the watershed lies in the amount of impervious surface located high in the watershed (in terms of elevation) where the runoff coefficient is higher than on flatter areas. We didn't capture the data to calculate this, but it may be worth looking into as a watershed initiative is developed.

**Evaluation Criteria:**

- 1) >25%
- 2) 16-25%
- 3) 5-15%
- 4) 1-5%
- 5) no impervious shoreland within 250' of highwater mark

**Sources:**

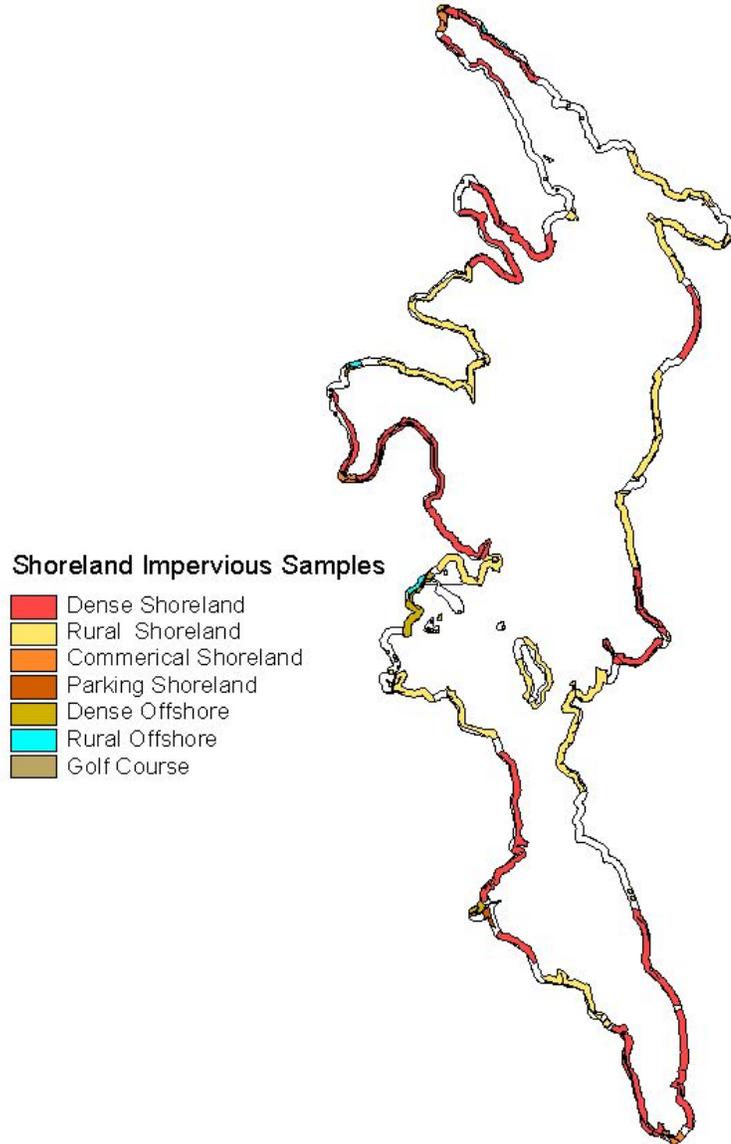
"Welcome to NH Granit." NH Granit. 10 Feb 2003. <<http://www.granit.sr.unh.edu/>>.

**Assessment of Question:** The methodology used for answering this question was developed by the class. It was a good faith effort to answer the question but additional methodologies should be tested for this question.

**Date Completed:** May 2003

**Investigator:** Matt Cummings & Stacey Philbrook

# Shoreland Impervious Areas



**Attribute 8:** Shoreland Characteristics

**Category:**

**Question E:** Permanent or seasonal water dependent structures.

**Directions:** Using the shoreline structure survey instructions located in Appendix B, estimate the density (number / 1,000 feet) of water dependent structures (e.g. docks, boathouses, breakwaters) on the lake or pond. Be sure to exclude marinas and other similar types of commercial docking facilities from the count.

**Rationale:** The density of water dependent structures is useful for assessing the waterbody's popularity. It may also assist in future use assessments to determine if their prevalence has increased or decreased. Encroachment on or alteration of the natural shoreline may negatively impact the littoral zone biological community. For example, a fully developed shoreline may modify the natural sediment characteristics of the littoral zone in turn interfering with fish spawning habitat

**Process Followed:** Data was gathered about the amount of boat houses, docks and break waters from the summer of 2003 Shoreline Structure Survey of Lake Sunapee that was conducted by the Lake Sunapee Protection Association. The sum of the boat houses, docks and break waters was compiled then divided by the length of the shoreline. The shore line information was found in the lakes and pond inventory. The sum of the structures was then divided by length of the shoreline. Finally, multiply the previous answer by 1000 to get the amount of structures per thousand feet.

**Findings and Analysis:**

<b>Structures</b>	<b>Shoreline length</b> -47600 meters (converted to feet, meters * 3.2808)
Boat houses-212	-156167.979 rounded to 156168 feet
Docks-840	
Breakwaters-6	
<b>Total structures</b> - 1058	

$1058/156168 \text{ feet} = 0.0067$ ,  $0.0067 * 1000 = 6.7$  rounded that to 7  
(Answer 7 structures/ 1000 feet)

Analysis: From the findings it can be determined that the shoreline is popular and is fairly developed which could lead to negative impacts on the littoral zone, thus increasing the need of monitoring the zoning ordnances already in place.

**Evaluation Criteria:**

- 1) >10 structures / 1,000 feet of shoreline
- 2) 7-9 structures / 1,000 feet of shoreline
- 3) 4-6 structures / 1,000 feet of shoreline
- 4) 1-3 structures / 1,000 feet of shoreline
- 5) No boathouses, docks, or breakwaters; continuous natural shoreline

**Sources:**

Lakes and Ponds Inventory: Department of Environmental Services Data gathered  
November 21 2003

State of New Hampshire Department of Environmental Services: Water Supply and  
Pollution Control Division- Biology Bureau. New Hampshire Lakes and Ponds  
Inventory, Vol 4

Ayers, Aimee. Personal Interview. November 2003

**Assessment of Question:** This question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

**Attribute 8:** Shoreland Characteristics

**Category:**

**Question F:** Shoreland Topography.

**Directions:** Contact the DES Lakes Program staff for assistance with identifying those areas that have a slope greater than 15%.

**Rationale:** The topography, or slope, of a watershed draining into the lake or pond is an important natural characteristic controlling the rate and amount of direct storm water a waterbody receives. A steeply sloped watershed will convey storm water more quickly to nearby tributaries than a watershed with a relatively flat landscape. As a result, storm water runoff for lakes and ponds that have a steep shoreland grade will have a lower chance of infiltrating the soil, limiting the potential for natural pollutant retention.

**Process Followed:** The process taken to complete this question was accomplished by bringing in Digital Elevation models into the ArcView GIS 3.2 program. From there a map was constructed by changing the values of the Digital Elevation models to suit the appropriate values required. Then a buffer of 250 feet around the lake was created to represent the shoreland area.

**Findings and Analysis:** the findings found consist of the watershed having approximately:

- 51-75% of the Shoreland area has a slope level less than 8%
- 26-50% of the Shoreland area has a slope level of 9-15%
- 1-25% of the Shoreland area has a slope level of 16-25%
- 1-25% of the Shoreland area has a slope level greater than 25%
- 1-25% of the Shoreland area has a slope level greater than 15%
- Also see maps for estimations.

With Analysis of the findings of the shoreland slope it can be determined that the land is relatively flat.

**Evaluation Criteria:**

- 1) >75% of the shoreland area has a slope in excess of 15%
- 2) 51-75% of the shoreland area has a slope in excess of 15%
- 3) 26-50% of the shoreland area has a slope in excess of 15%
- 4) 1-25% of the shoreland area has a slope in excess of 15%
- 5) None of the shoreland area has a slope in excess of 15%

**Sources:**

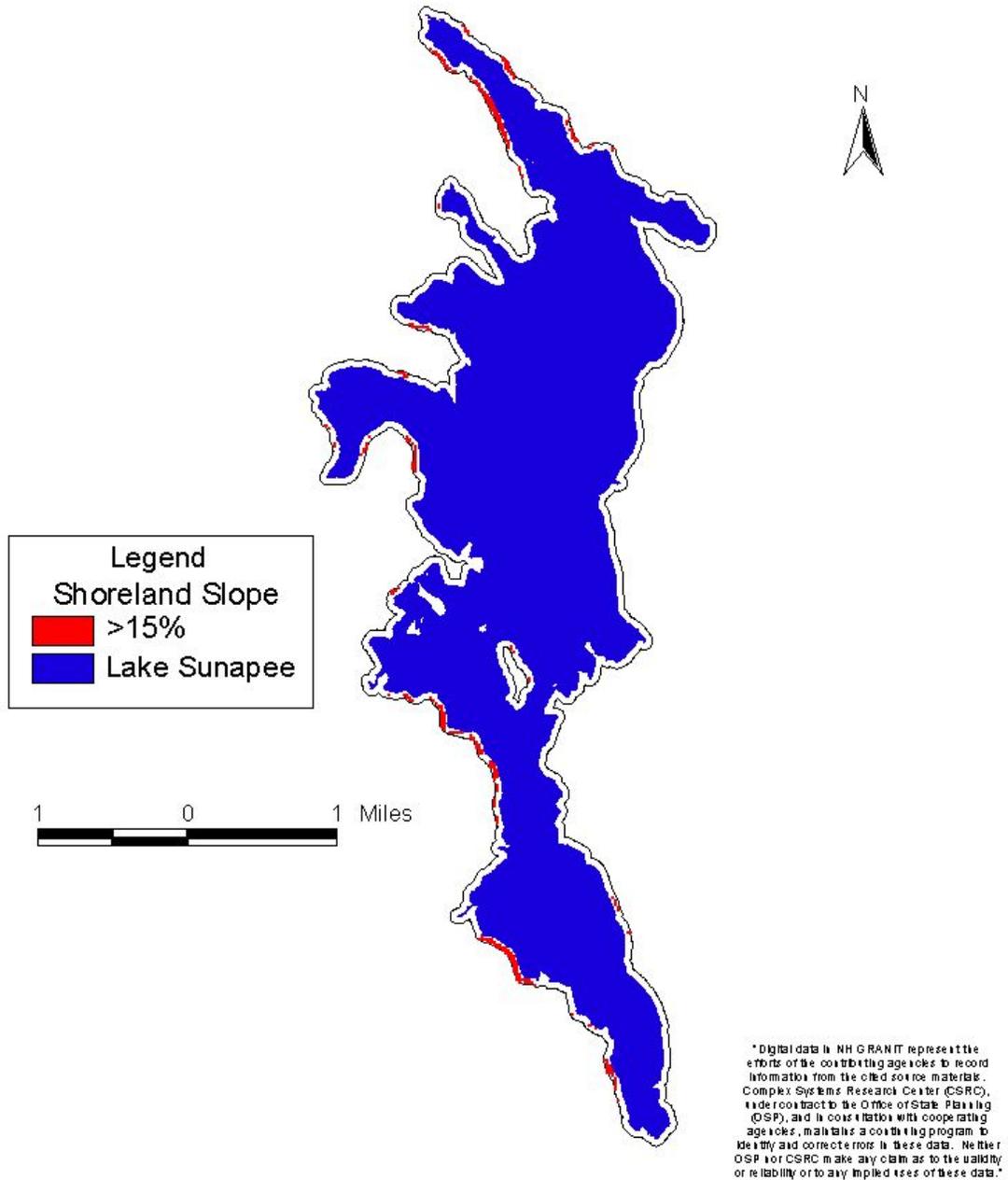
"Welcome to NH Granit." 10 Nov. 2003 <<http://www.granit.sr.unh.edu>>

**Assessment of Question:** The question needs to be state more clearly what slopes are needed to answer question properly. There was confusion between the attributes questions table and written directions.

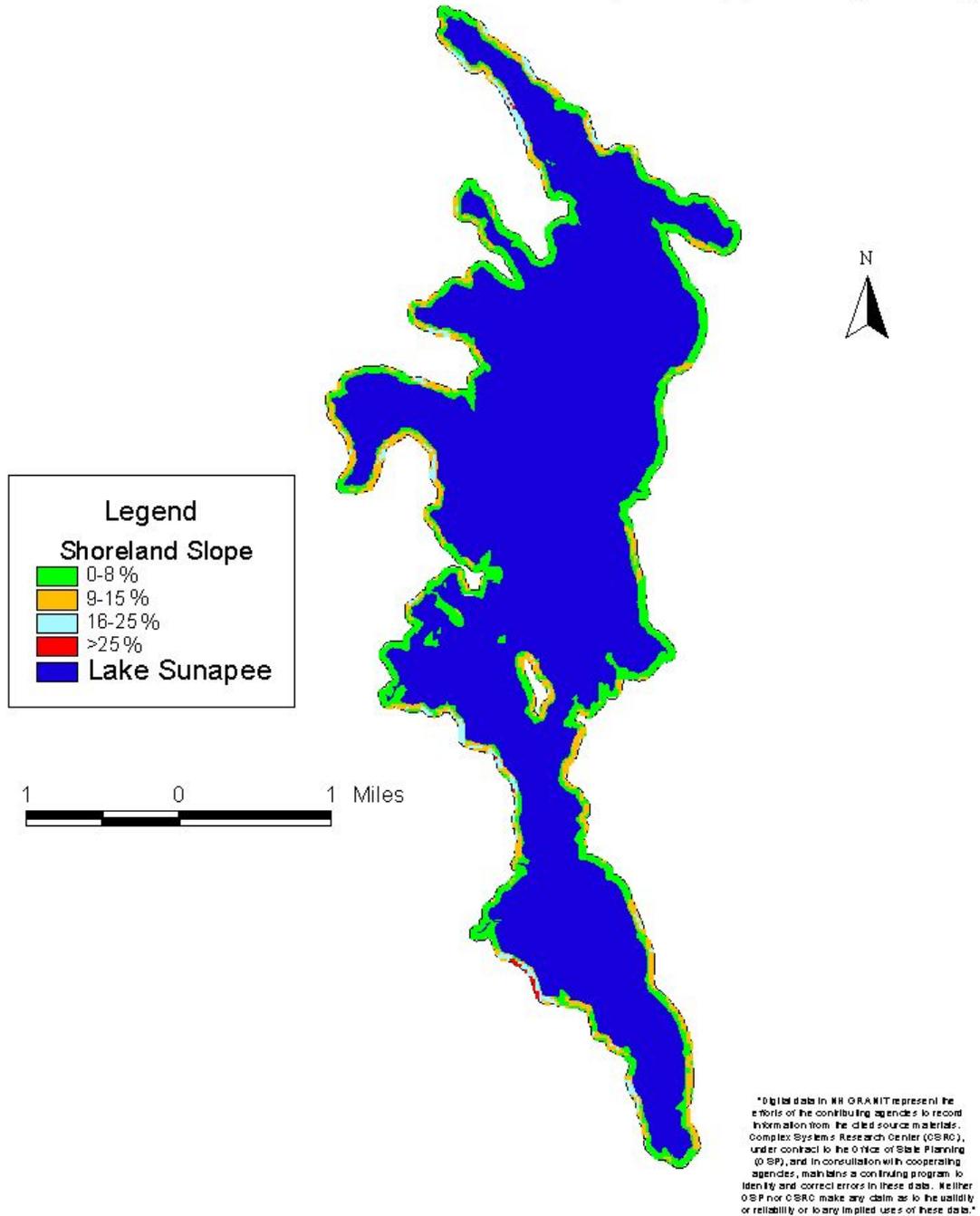
**Date Completed:** November 2003

**Investigator:** Matt Cummings, Stacey Philbrook

# ShoreLand Topography



# ShoreLand Topography



**Attribute 8:** Shoreland Characteristics

**Category:** Recreation

**Question G:** Shoreland geology and soils.

**Directions:** Consult the DES Lakes Program staff for assistance with identifying the percentages of bedrock and hydric soils in the shoreland area.

**Rationale:** The geology and soils of the shoreland area are important characteristics to inventory because they dictate what type and where development can and should occur. For example, if bedrock were present it would be difficult or cost prohibitive to excavate a foundation for a home. Along the same lines, if wetland soils are present, then septic system placement should be prohibited.

**Process Followed:** Received a GIS data layer from Paul Susca, member of the Department of Environmental Services. Using ArcView, a computer mapping program, sort the data by its muname and separate out hydric soils and bedrock. By accessing the New Hampshire Soils Attribute Data Dictionary on the web at: [http://www.nh.nrcs.usda.gov/Soil\\_Data/Soil\\_Data](http://www.nh.nrcs.usda.gov/Soil_Data/Soil_Data); note the names of the soils that are classified as hydric and apply this to the data set. For bedrock, under the category of bedrock shallow, separate out only those which had a value of zero, which indicates that the bedrock is above ground. Using ArcView, calculate the area of hydric soils/bedrock inside a 250 foot buffer zone.

**Findings and Analysis:**

Hydric Soil Types Include:	Ossipee mucky peat
Borochemists ponded	Pillsbury loam 0-3 percent slopes
Chocorua mucky peat	Pillsbury stony loam 0-3 percent slopes
Limerick silt loam	Pillsbury stony loam 3-8 percent slopes
Lyme-moosilauke loams 0-3 percent slopes	Rayham silt loam
Lyme-moosilauke stony loams 0-3 percent slopes	Rumney loam
Lyme-moosilauke stony loams 3-8 percent slopes	Saco silt loam
Naumburg loamy sand	Saco variant mucky silt loam
	Stissing silt loam 0-5 percent slope
	Stissing stony silt loam 0-3 percent slope
	Stissing stony silt loam 3-8 percent slope

Amount of hydric soil in Lake Sunapee's Shoreland = 399.330 acres or 5.5 %

Amount of bedrock in Lake Sunapee's Shoreland = 14.878 acres or 1.6 %

\*calculations based on Lake Sunapee Shoreland totaling 916 acres

\*\*note this calculation includes the area of Lake Sunapee itself

**Disclaimer for Soils Information (July, 2003)**

This Merrimack County Soils GIS coverage was produced by the USDA, Natural Resources Conservation Service (NRCS). It is a draft product and is being made available as a conditional interim release. It is subject to change and not finalized or deemed official for public distribution. This data is being distributed to Planning Commissions only and should not be distributed to others. Data users are responsible for obtaining the most current copy of the data.

This data was compiled at a scale of 1:24,000. Delineations depict the dominant soils occurring on the landscape at that scale. Inclusions of other soils too small to be delineated are present within delineations. There is no information on the specific locations of inclusions within delineations. Enlargements of these maps to scales greater than 1:24,000 is a misuse of the product and can cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soil that could have been shown at a larger scale. This soil information and interpretations derived from it are intended for broad planning purposes only. For site specific information, onsite sampling, testing and detailed studies are necessary.

For further information, contact the NRCS State Soil Scientist, Steve Hundley at (603)868-7581.

**Evaluation Criteria:**

**% of soils with impediments to development:**

- 1) 0%; all shoreland soils could be suitable for development
- 2) <10%
- 3) 11-25%
- 4) 26-50%
- 5) >50%

Bedrock	5.5 %
Hydric Soils	1.6 %

**Sources:**

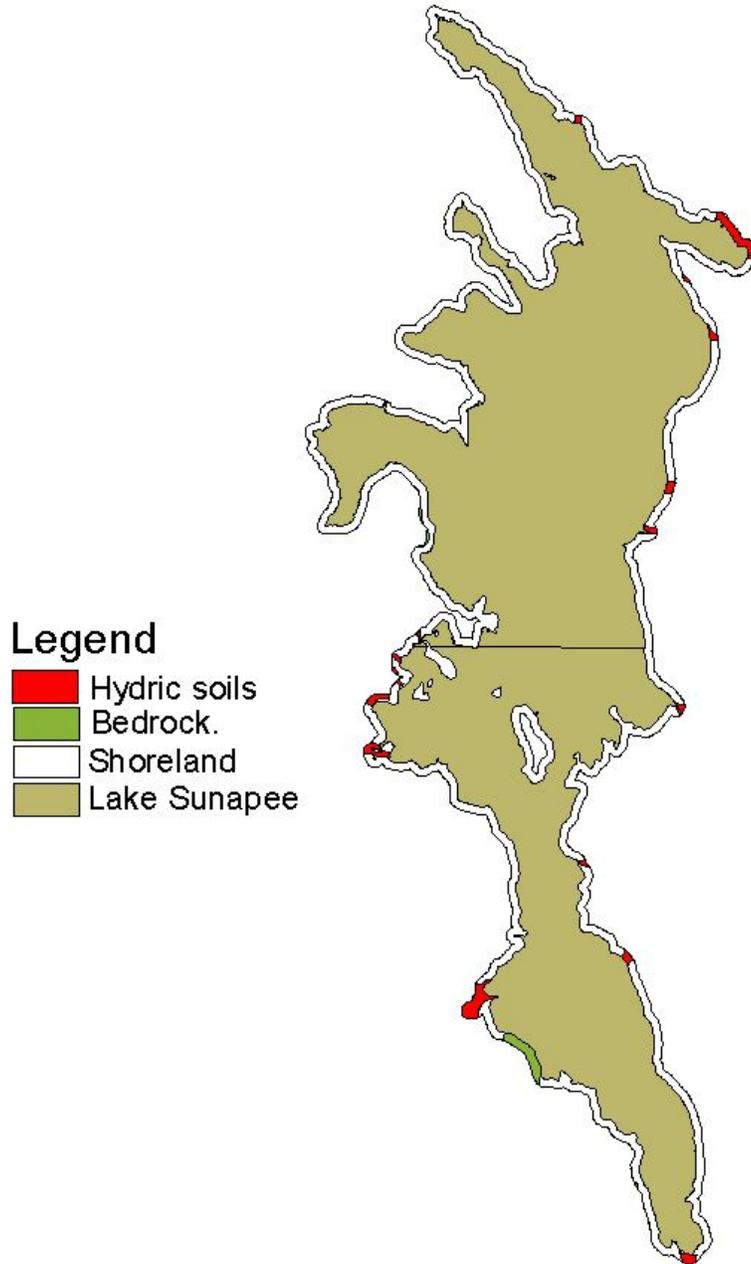
Gagne, Deynce. (dgagneA@uvlsrpc.org). "soils." E-mail to Stacey Philbrook (sphilbrook@colby-sawyer.edu). 10 Nov. 2003  
Susca, Paul. E-mail to John Callewaert (jcallewaert@colby-sawyer.edu). 26 April. 2004.

**Assessment of Question:** This question was difficult because completed soils maps for the entire state of New Hampshire do not exist at this time.

**Date Completed:** May 2003

**Investigator:** Matt Cummings & Stacey Philbrook

# Shoreland Hydric Soils/Bedrock



**Attribute 8:** Restrictions or Prohibited Uses

**Category:** Susceptibility to Impairment

**Question H:** Local land use regulatory measures.

**Directions:** Review the regulatory measures for land use and development for each of the municipalities within the shoreland area to determine if there are any ordinances designed to protect the natural waterbody characteristics.

**Rationale:** Reviewing town land use and development ordinances will hopefully increase local awareness of, and compliance with, the measures already in place to protect surface water quality. This process will identify certain land use practices or activities that are of particular concern so that the surrounding communities can address them in the future.

**Process Followed:** Referenced the town zoning ordinances of Goshen, Newbury, New London, Springfield, Sunapee, and Sutton.

**Findings and Analysis:** Each town has different districts and ordinances specified to regulate activities that occur within the town. One area of concern is shoreland because these lands require conservation and land management practices that minimize environmental and aesthetic degradation. For most of the towns within the watershed there is either an overlay district or specific regulations set forth regarding the shorelands of the town. This is important because the shoreland regulations directly effect Lake Sunapee; more regulations means Lake Sunapee is more protected. The regulations for each town are as follows:

Goshen: There are no ordinances protecting the natural waterbody characteristics of Lake Sunapee. Goshen has the least amount of land within the watershed, none of which is shoreland; therefore, Goshen does not need shoreland regulations protecting the natural waterbody characteristics of Lake Sunapee.

New London: The following regulations are as stated in New London's Zoning Ordinances, Article XVI: Shore Land Overlay District, section C: Permitted Uses. (This Ordinance is authorized by RSA 674:21 (j), Innovative Land Use Controls, Environmental Characteristics Zoning).

1. Docks for boating, boathouses and swimming facilities, are permitted subject to required state permits and standards.
2. Single Family Residence and accessory structures and uses provided that all buildings and structures shall be set back a minimum of 50 feet from the normal high water level and constructed in accordance with the erosion control requirements of Section F. No construction or land disturbance whatsoever will be permitted within the vegetative buffer 50 feet from normal high water, except as provided in Section C.4., D.2. and F.2.e. below. Unless special construction practices ensure that no land disturbance will occur in the 50 foot vegetative

buffer as a result construction activities, all structures must be set back a minimum of 10 feet from the 50 foot vegetative buffer to accommodate land disturbance resulting from such activities.

3. Sub-surface sewage disposal facilities provided that they shall be set back in accordance with state requirements.
4. Stairways and walkways with a maximum width of 4 feet are permitted within the first 50 feet from normal high water provided adequate soil erosion control measures are implemented as outlined in Section F.
5. Replenishment of existing beaches as provided in section D.2. below.  
Construction of a new beach or expansion of an existing beach is not permitted. Replenishment of an existing beach is permitted only under the following conditions.
  - a. No more than 6 cubic yards of replenishment material is permitted to be added in any 8 year period;
  - b. Beach replenishment is permitted only above normal high water; beach replenishment is not permitted below normal high water in the water body;
  - c. Beach replenishment material must be washed before installation to remove sediments;
  - d. Material used for beach replenishment shall match the material which comprises the existing beach (i.e. an existing gravel beach can be replenished with gravel, but not with sand);
  - e. Beach replenishment requires approval of an erosion and sediment control plan for a minor land disturbance in accordance with Section F. below. The erosion control plan shall show and explain what measures exist or are proposed to reduce the erosion of the beach area. Installation of materials to slow down and dissipate water runoff such as railroad ties and/or the planting of indigenous species of shrubs and bushes on the uphill edge of the beach is encouraged; and
  - f. The property owner shall notify the Board of Selectmen in writing of the date and quantity of material deposited for beach replenishment.

Newbury: The following regulations are as stated in Newbury's Zoning Ordinances, Article VII: Shoreland Overlay District.

**7.3 Site Requirements:**

**7.3.1 Lake/Pond Shore Frontage Requirement:** Every new lot shall have lake/pond shore frontage of not less than two hundred (200) feet per dwelling.

**7.3.2 Setback from a lake or a permanent stream:** Permanent, temporary or portable buildings and structures and septic systems shall be setback a minimum of seventy-five (75) feet from normal high water of lakes and from the shoreline of streams except as provided herein. The Planning Board may require greater than a seventy-five (75) foot setback for a building and septic system according to the suitability of the shore land.

**7.4 Zoning Compliance for Alteration:**

**7.5 Alteration and Reconstruction of Non-conforming Buildings**

**7.6 Buffer Zone:** A buffer zone consisting of natural shore land landscape will be required for at least fifty (50) feet in depth along the shores of lakes and streams in this overlay district. The preservation of natural vegetation on the shore land is important for the ecological balance of Newbury lakes and ponds, for the protection of water quality, for the preservation of the aesthetic quality of the shore land and for erosion control.

**7.7 Shore Land Rights**

**7.8 Erosion Control**

**7.8.1 Plans for Temporary Control:** Erosion and sedimentation control plans shall be required for all construction, filling, grading, dredging, and other activities requiring land disturbance, including well drilling, within three hundred (300) feet of normal high water of Newbury lakes and the shores of permanent streams. Erosion and sedimentation control plans shall be prepared and designed in accordance with the standards and specifications outlined in the *Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire*.

Springfield: The following regulations are as stated in Springfield's Zoning Ordinances, Article V: Special Provisions; section A: Waterfront Development.

1. Waterfront area: The minimum area of any waterfront lot shall not be less than 1.5 acres for each dwelling unit in accordance with Article III B.3.a.
2. Water Frontage: Said lot shall have not fewer than 150 linear feet of shore frontage, with an additional 8 linear feet of shore frontage for each additional dwelling unit over 12 units; or for a group development, the provision of 2 additional linear feet per person for whom the facility is proposed.
3. Building Setback from Ponds and Lakes: Structures shall be set back 50 feet from the normal high water mark of lakes and ponds. Existing natural vegetation shall be maintained as a buffer where possible. In the case of commercial and/or multi-unit buildings and clusters, they shall be set back a minimum of 150 feet from the high water mark.
4. Parking: An area of 400 square feet for parking shall be reserved for each dwelling unit; or for each four persons in the case of a group development or beach use that is planned. For other uses, the provisions of Article IV B apply. Paved parking areas larger than 400 square feet shall be located at least 500 feet from the high water mark.
5. Septic Systems: No part of a septic system (septic tank, connection, distribution box, or leach field) shall be permitted within 150 feet of any lake, pond marsh, or within 100 feet of any stream or other non-temporary body of water. All septic systems that do not involve the up grading of present systems on land bordering on or within 150 feet of such bodies of water shall conform at a minimum without exception or exemption to the written rules and regulations of the Water Supply and Pollution Control Commission of the State of New Hampshire as published in *Subdivision and Individual Sewage Disposal System Design Rules, September 1983*, or as later amended.

Sunapee: The following regulations are as stated in the Sunapee Zoning Ordinances, Water Resources Overlay Districts.

1. Wetlands: The Wetlands Overlay District is defined as those areas delineated as very poorly and poorly drained soils by the U.S. Department of Agriculture. Soil Conservation Service, in the Soil Survey of Sullivan County contiguous to surface waters such as lakes, ponds and streams, subjected to high water tables for extended periods of time and includes, but are not necessarily limited to, all such areas delineated as Wetlands on the current Wetlands Overlay District Map, which is on file in the office of the Planning Board. Where it is alleged that an area has been incorrectly delineated as a wetland, or that an area is not so designated meets the criteria for Wetlands designation, the Planning Board shall determine whether the regulations contained herein have application. The Planning Board shall make their judgment under this section only upon the determination by a qualified wetland or soil scientist on the basis of additional on-site investigation or other suitable research that the information contained on the Wetlands Overlay District Map is incorrect. This evidence shall be acceptable only when presented in written form by said scientist to the Planning Board. Any such investigation, including soil tests, shall be conducted at the expense of the landowner or developer.
2. Aquifers: The Aquifer Overlay District shall be defined as the areas having a high, medium or low potential to yield groundwater as shown on the Aquifer Overlay District Map on file in the Office of the Planning Board.
3. Shorelines: The Shoreline Overlay District shall be defined as all lands within 300' feet of lakes and ponds greater than 10 acres as shown on the Shoreline Overlay District Map on file in the Office of the Planning Board.

Sutton: The following regulations are as stated in Sutton's Zoning Ordinances, Article V: Rural-Agricultural District, section D: Shoreland Requirements.

1. All permanent, temporary, or portable buildings and structures shall be set back a minimum of seventy-five feet from normal high water of any wetland, as defined by the National Cooperative Soil Survey as poorly drained and very poorly drained soils, or surface water including lakes, ponds, rivers and streams. Accessory structures of less than 150 square feet in area may be granted Special Exception.
2. Septic systems are prohibited within 75 feet of any wetland, as defined by NCSS poorly drained and very poorly drained soils or rivers, streams and ponds. In the case of Group 1/Excessively Well-Drained Soils as defined by NHDES/WSPCD the leach field setback shall be 100 feet.
3. Septic tanks and leaching portions of septic systems for all new construction shall be set back from any soils defined by the National Cooperative Soil Survey as poorly or very poorly drained, 50 and 75 feet, respectively. Adjacent to streams and rivers which flow year-round as shown on the most current version of the US Geological Survey 7 ½ minute topographic maps, setbacks shall be as follows:
  - a. Where the receiving soil down gradient of the leaching portions of a septic system is a porous sand and gravel material with a percolation rate faster

than two minutes per inch, the setback shall be at least 125 feet from the ordinary high water mark (as defined in RSA 483-B4, paragraph XVIc).

- b. For soils with restrictive layers within 18 inches of the natural soil surface, the setback shall be at least 100 feet from the ordinary high water mark. For all other soil conditions, the setback shall be at least 75 feet from the ordinary high water mark.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) No municipality has an ordinance specifically to protect the lake or pond; only state and federal standards apply	5
2) At least 1 municipality has 1 ordinance to protect the lake or pond	4
3) Two municipalities have at least 1 ordinance to protect the waterbody OR 1 municipality has 2 ordinances to protect the lake or pond	3
4) Three or more municipalities have at least 1 ordinance or 1 municipality has 3 or more ordinances	2
5) Each of the municipalities has numerous (2 or more) ordinances to protect the lake or pond.	1

**Sources:**

Town of Goshen. Zoning Ordinance. Goshen: Town of Goshen, 2002.

Town of New London. Zoning Ordinance. New London: Town of New London, 2001.

Town of Newbury. Zoning Ordinance. Newbury: Town of Newbury, 2003.

Town of Springfield. Zoning Ordinance. Springfield: Town of Springfield, 1997.

Town of Sunapee. "Zoning Ordinance - Planning and Zoning." Sunapee, New Hampshire Dataspoke. 01 Dec. 2003

<<http://www.town.sunapee.nh.us/planzone/zoningregs.htm>>

Town of Sutton. Zoning Ordinance. Sutton: Town of Sutton, 2002.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Tamsen B Bolte

**Attribute 8:** Restrictions or Prohibited Uses

**Category:** Unique/Outstanding Value

**Question H:** Local land use regulatory measures.

**Directions:** Review the regulatory measures for land use and development for each of the municipalities within the shoreland area to determine if there are any ordinances designed to protect the natural waterbody characteristics.

**Rationale:** Reviewing town land use and development ordinances will hopefully increase local awareness of, and compliance with, the measures already in place to protect surface water quality. This process will identify certain land use practices or activities that are of particular concern so that the surrounding communities can address them in the future.

**Process Followed:** Referenced the town zoning ordinances of Goshen, Newbury, New London, Springfield, Sunapee, and Sutton.

**Findings and Analysis:** Each town has different districts and ordinances specified to regulate activities that occur within the town. One area of concern is shoreland because these lands require conservation and land management practices that minimize environmental and aesthetic degradation. For most of the towns within the watershed there is either an overlay district or specific regulations set forth regarding the shorelands of the town. This is important because the shoreland regulations directly effect Lake Sunapee; more regulations means Lake Sunapee is more protected. The regulations for each town are as follows:

Goshen: There are no ordinances protecting the natural waterbody characteristics of Lake Sunapee. Goshen has the least amount of land within the watershed, none of which is shoreland; therefore, Goshen does not need shoreland regulations protecting the natural waterbody characteristics of Lake Sunapee.

New London: The following regulations are as stated in New London's Zoning Ordinances, Article XVI: Shore Land Overlay District, section C: Permitted Uses. (This Ordinance is authorized by RSA 674:21 (j), Innovative Land Use Controls, Environmental Characteristics Zoning).

6. Docks for boating, boathouses and swimming facilities, are permitted subject to required state permits and standards.
7. Single Family Residence and accessory structures and uses provided that all buildings and structures shall be set back a minimum of 50 feet from the normal high water level and constructed in accordance with the erosion control requirements of Section F. No construction or land disturbance whatsoever will be permitted within the vegetative buffer 50 feet from normal high water, except as provided in Section C.4., D.2. and F.2.e. below. Unless special construction practices ensure that no land disturbance will occur in the 50 foot vegetative

buffer as a result construction activities, all structures must be set back a minimum of 10 feet from the 50 foot vegetative buffer to accommodate land disturbance resulting from such activities.

8. Sub-surface sewage disposal facilities provided that they shall be set back in accordance with state requirements.
9. Stairways and walkways with a maximum width of 4 feet are permitted within the first 50 feet from normal high water provided adequate soil erosion control measures are implemented as outlined in Section F.
10. Replenishment of existing beaches as provided in section D.2. below.  
Construction of a new beach or expansion of an existing beach is not permitted. Replenishment of an existing beach is permitted only under the following conditions.
  - g. No more than 6 cubic yards of replenishment material is permitted to be added in any 8 year period;
  - h. Beach replenishment is permitted only above normal high water; beach replenishment is not permitted below normal high water in the water body;
  - i. Beach replenishment material must be washed before installation to remove sediments;
  - j. Material used for beach replenishment shall match the material which comprises the existing beach (i.e. an existing gravel beach can be replenished with gravel, but not with sand);
  - k. Beach replenishment requires approval of an erosion and sediment control plan for a minor land disturbance in accordance with Section F. below. The erosion control plan shall show and explain what measures exist or are proposed to reduce the erosion of the beach area. Installation of materials to slow down and dissipate water runoff such as railroad ties and/or the planting of indigenous species of shrubs and bushes on the uphill edge of the beach is encouraged; and
  - l. The property owner shall notify the Board of Selectmen in writing of the date and quantity of material deposited for beach replenishment.

Newbury: The following regulations are as stated in Newbury's Zoning Ordinances, Article VII: Shoreland Overlay District.

**7.4 Site Requirements:**

**7.4.1** Lake/Pond Shore Frontage Requirement: Every new lot shall have lake/pond shore frontage of not less than two hundred (200) feet per dwelling.

**7.4.2** Setback from a lake or a permanent stream: Permanent, temporary or portable buildings and structures and septic systems shall be setback a minimum of seventy-five (75) feet from normal high water of lakes and from the shoreline of streams except as provided herein. The Planning Board may require greater than a seventy-five (75) foot setback for a building and septic system according to the suitability of the shore land.

**7.9 Zoning Compliance for Alteration:**

**7.10** Alteration and Reconstruction of Non-conforming Buildings

**7.11** Buffer Zone: A buffer zone consisting of natural shore land landscape will be required for at least fifty (50) feet in depth along the shores of lakes and streams in this overlay district. The preservation of natural vegetation on the shore land is important for the ecological balance of Newbury lakes and ponds, for the protection of water quality, for the preservation of the aesthetic quality of the shore land and for erosion control.

**7.12** Shore Land Rights

**7.13** Erosion Control

**7.13.1** Plans for Temporary Control: Erosion and sedimentation control plans shall be required for all construction, filling, grading, dredging, and other activities requiring land disturbance, including well drilling, within three hundred (300) feet of normal high water of Newbury lakes and the shores of permanent streams. Erosion and sedimentation control plans shall be prepared and designed in accordance with the standards and specifications outlined in the *Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire*.

Springfield: The following regulations are as stated in Springfield's Zoning Ordinances, Article V: Special Provisions; section A: Waterfront Development.

6. Waterfront area: The minimum area of any waterfront lot shall not be less than 1.5 acres for each dwelling unit in accordance with Article III B.3.a.
7. Water Frontage: Said lot shall have not fewer than 150 linear feet of shore frontage, with an additional 8 linear feet of shore frontage for each additional dwelling unit over 12 units; or for a group development, the provision of 2 additional linear feet per person for whom the facility is proposed.
8. Building Setback from Ponds and Lakes: Structures shall be set back 50 feet from the normal high water mark of lakes and ponds. Existing natural vegetation shall be maintained as a buffer where possible. In the case of commercial and/or multi-unit buildings and clusters, they shall be set back a minimum of 150 feet from the high water mark.
9. Parking: An area of 400 square feet for parking shall be reserved for each dwelling unit; or for each four persons in the case of a group development or beach use that is planned. For other uses, the provisions of Article IV B apply. Paved parking areas larger than 400 square feet shall be located at least 500 feet from the high water mark.
10. Septic Systems: No part of a septic system (septic tank, connection, distribution box, or leach field) shall be permitted within 150 feet of any lake, pond marsh, or within 100 feet of any stream or other non-temporary body of water. All septic systems that do not involve the up grading of present systems on land bordering on or within 150 feet of such bodies of water shall conform at a minimum without exception or exemption to the written rules and regulations of the Water Supply and Pollution Control Commission of the State of New Hampshire as published in *Subdivision and Individual Sewage Disposal System Design Rules, September 1983*, or as later amended.

Sunapee: The following regulations are as stated in the Sunapee Zoning Ordinances, Water Resources Overlay Districts.

4. Wetlands: The Wetlands Overlay District is defined as those areas delineated as very poorly and poorly drained soils by the U.S. Department of Agriculture. Soil Conservation Service, in the Soil Survey of Sullivan County contiguous to surface waters such as lakes, ponds and streams, subjected to high water tables for extended periods of time and includes, but are not necessarily limited to, all such areas delineated as Wetlands on the current Wetlands Overlay District Map, which is on file in the office of the Planning Board. Where it is alleged that an area has been incorrectly delineated as a wetland, or that an area is not so designated meets the criteria for Wetlands designation, the Planning Board shall determine whether the regulations contained herein have application. The Planning Board shall make their judgment under this section only upon the determination by a qualified wetland or soil scientist on the basis of additional on-site investigation or other suitable research that the information contained on the Wetlands Overlay District Map is incorrect. This evidence shall be acceptable only when presented in written form by said scientist to the Planning Board. Any such investigation, including soil tests, shall be conducted at the expense of the landowner or developer.
5. Aquifers: The Aquifer Overlay District shall be defined as the areas having a high, medium or low potential to yield groundwater as shown on the Aquifer Overlay District Map on file in the Office of the Planning Board.
6. Shorelines: The Shoreline Overlay District shall be defined as all lands within 300' feet of lakes and ponds greater than 10 acres as shown on the Shoreline Overlay District Map on file in the Office of the Planning Board.

Sutton: The following regulations are as stated in Sutton's Zoning Ordinances, Article V: Rural-Agricultural District, section D: Shoreland Requirements.

4. All permanent, temporary, or portable buildings and structures shall be set back a minimum of seventy-five feet from normal high water of any wetland, as defined by the National Cooperative Soil Survey as poorly drained and very poorly drained soils, or surface water including lakes, ponds, rivers and streams. Accessory structures of less than 150 square feet in area may be granted Special Exception.
5. Septic systems are prohibited within 75 feet of any wetland, as defined by NCSS poorly drained and very poorly drained soils or rivers, streams and ponds. In the case of Group 1/Excessively Well-Drained Soils as defined by NHDES/WSPCD the leach field setback shall be 100 feet.
6. Septic tanks and leaching portions of septic systems for all new construction shall be set back from any soils defined by the National Cooperative Soil Survey as poorly or very poorly drained, 50 and 75 feet, respectively. Adjacent to streams and rivers which flow year-round as shown on the most current version of the US Geological Survey 7 ½ minute topographic maps, setbacks shall be as follows:
  - a. Where the receiving soil down gradient of the leaching portions of a septic system is a porous sand and gravel material with a percolation rate faster

than two minutes per inch, the setback shall be at least 125 feet from the ordinary high water mark (as defined in RSA 483-B4, paragraph XVIc).

- b. For soils with restrictive layers within 18 inches of the natural soil surface, the setback shall be at least 100 feet from the ordinary high water mark. For all other soil conditions, the setback shall be at least 75 feet from the ordinary high water mark.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) No municipality has an ordinance specifically to protect the lake or pond; only state and federal standards apply	1
2) At least 1 municipality has 1 ordinance to protect the lake or pond	2
3) Two municipalities have at least 1 ordinance to protect the waterbody OR 1 municipality has 2 ordinances to protect the lake or pond	3
4) Three or more municipalities have at least 1 ordinance or 1 municipality has 3 or more ordinances	4
5) Each of the municipalities has numerous (2 or more) ordinances to protect the lake or pond.	5

**Sources:**

Town of Goshen . Zoning Ordinance. Goshen: Town of Goshen, 2002.

Town of New London. Zoning Ordinance. New London: Town of New London, 2001.

Town of Newbury. Zoning Ordinance. Newbury: Town of Newbury, 2003.

Town of Springfield. Zoning Ordinance. Springfield: Town of Springfield, 1997.

Town of Sunapee. "Zoning Ordinance - Planning and Zoning." Sunapee, New Hampshire Dataspoke. 01 Dec. 2003

<<http://www.town.sunapee.nh.us/planzone/zoningregs.htm>>

Town of Sutton. Zoning Ordinance. Sutton: Town of Sutton, 2002.

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Jenni Beaulieu

**Attribute 8:** Restrictions or Prohibited Uses

**Category:** Unique and Outstanding Value

**Question I:** Local land use regulatory measures.

**Directions:** Consult town planning boards, town Master Plans, regional planning commissions, or the NH Office of State Planning to obtain an estimate of the rate of development within the most recent 10 year period and within the shoreland area. Note whether the estimate is based upon acre or building permits/year.

**Rationale:** Knowing the rate of shoreland development in the local communities can help prioritize planning goals and objectives. Establishing development guidance priorities is the most efficient use of limited resources and is beneficial in protecting the natural characteristics of the waterbody.

**Process Followed:** Two processes were followed in developing the final conclusions about the rate of development within the watershed, which included a windshield survey and a collection of new home building permits from each of the six towns. The windshield survey incorporated the use of a 1987 USGS Topographic map that displayed existing buildings and roads. The next step was to cover the entire watershed by vehicle and map new development and new roads on the 1987 map. After completing the windshield survey, the newly gathered information was digitized onto the original topographic map. This gave us a visual representation of where development is occurring, and with this information the number of new homes could be calculated and measured against the number of homes present 17 years ago. We used this data to look at the development in the entire watershed, and just in the shoreland using a 250' buffer.

The next step in assessing rate of development was to examine new home building permits issued by each of the towns in the watershed. We had hoped to gather this data back to 1987 to correlate to the windshield survey, but found that to be impossible because of the way individual towns keep track of their building permit records. For some towns, gathering information from the town halls concerning building permits was available as far back as 1987, however some towns only had information backed up to 1997. In order to be consistent, we examined the number of building permits from 1997 to 2003 for each of the towns. We were not able to determine in-the-watershed and out-of-the-watershed development. Instead the building permits were collected for the entire town in all six towns. One limitation to our data is that the town of Springfield does not keep their building permits separate for new construction and other types of building requiring permits, whereas all of the other towns represent permits issued for new homes. The reader should keep in mind then, that our numbers could be overstating the number of new homes in this town.

**Findings and Analysis:** The total number of homes on the 1987 topographic map is 2,324, of that number, 773 are on the shoreland; this means that the shoreland represents 33% of the development within the watershed. This is important to note for future

planning because shoreland is more vulnerable to destruction/erosion and also acts as a direct route for pollutants to shed into the lake. The percent increase from 1987 to 2004, a 17 year period, is approximately 3%. This appears to be only a slight increase in 17 years, but also note that the shoreland was densely developed in 1987; therefore, a 3% increase can have a significant effect because the land is even denser now.

**Evaluation Criteria:**

- 1) >25% / year
- 2) 15 – 25% / year
- 3) 7 – 15% / year
- 4) 0 – 7% / year
- 5) None within the past 5 years

**Sources:**

Goshen Town Office, Building Permit Records  
Newbury Town Office, Building Permit Records  
New London Town Office, Building Permit Records  
Sunapee Town Office, Building Permit Records  
Sutton Town Office, Building Permit Records  
Springfield Town Office, Building Permit Records  
"Welcome to NH Granit." 10 Nov. 2003 <<http://www.granit.sr.unh.edu>>

**Assessment of Question:** This question requires more complex research and evaluation than the directions offer. There are inconsistencies among town offices and the other resources offered, which make it difficult to obtain accurate results. One of the major issues found was that most town offices did not give a percentage; rather they responded with, "high," "medium," or "low," which can not be measured. To avoid any misleading results, the process followed was the best attempt at obtaining the most accurate results.

Another difficulty encountered involves the evaluation criteria because it only asks for the percent increase per year. This was unattainable information; therefore, the criterion was not used.

**Date Completed:** April 2004

**Investigator:** Jenni Beaulieu

**Attribute 9:** Watershed Characteristics

**Category:** Recreation

**Question A:** Watershed development and land use.

**Directions:** Construct a map indicating the location and approximate amount of forested, wetland, active agricultural, clear/open, and urban land use types in the immediate watershed area. Town planning or assessing departments, as well as regional planning commissions may be able to offer assistance in generating a map. The immediate watershed would include any land area that drains directly into the waterbody or a tributary flowing to that waterbody. Do not include those sections of the watershed that drain into an upland lake or pond prior to flowing into the waterbody being analyzed. Likewise, do not include those sections of the watershed that drain the watershed below the lake or pond.

**Rationale:** Identifying the percent of each of these land use types within the immediate watershed will help in the development of general and targeted nonpoint source pollution prevention strategies. In addition, knowing the location and distribution of various land use types will assist in identifying those lands available for future development or land use conversion.

**Process Followed:** Contacted the Upper Valley Lake Sunapee Regional Planning Commission to obtain a GIS map. Used Arc View to modify the map in order to answer the question.

**Findings and Analysis:** Almost 75% of the land that is bordering Lake Sunapee is classified as urban, or developed land. Despite this, development only extends on average much less than ½ a mile out and away from the shoreline. Abutting the urban land use is forested area in roughly the entire immediate watershed. Active agriculture is found lightly scattered in several different locations. It is necessary for there to be some urban area on a lake that can provide an access point for recreational uses such as boat launching and public swimming. Nearby forested land can add to recreational appeal allowing opportunity for hiking and sightseeing. See attached map.

Actual Values

Water: 42%  
Forested: 44%  
Wetlands: ---  
Active  
Agricultural: 1%  
Urban: 13%

**Evaluation Criteria:**

**Score:**

<b>%developed</b>	<b>: % undeveloped</b>	
1) >75%	: <25%	1
2) 51 - 75%	: 25 - 49%	2
3) 26 - 50%	: 50 - 74%	3
4) 10 - 25%	: 75 - 90%	4
5) <10%	: >90%	5

**Sources:**

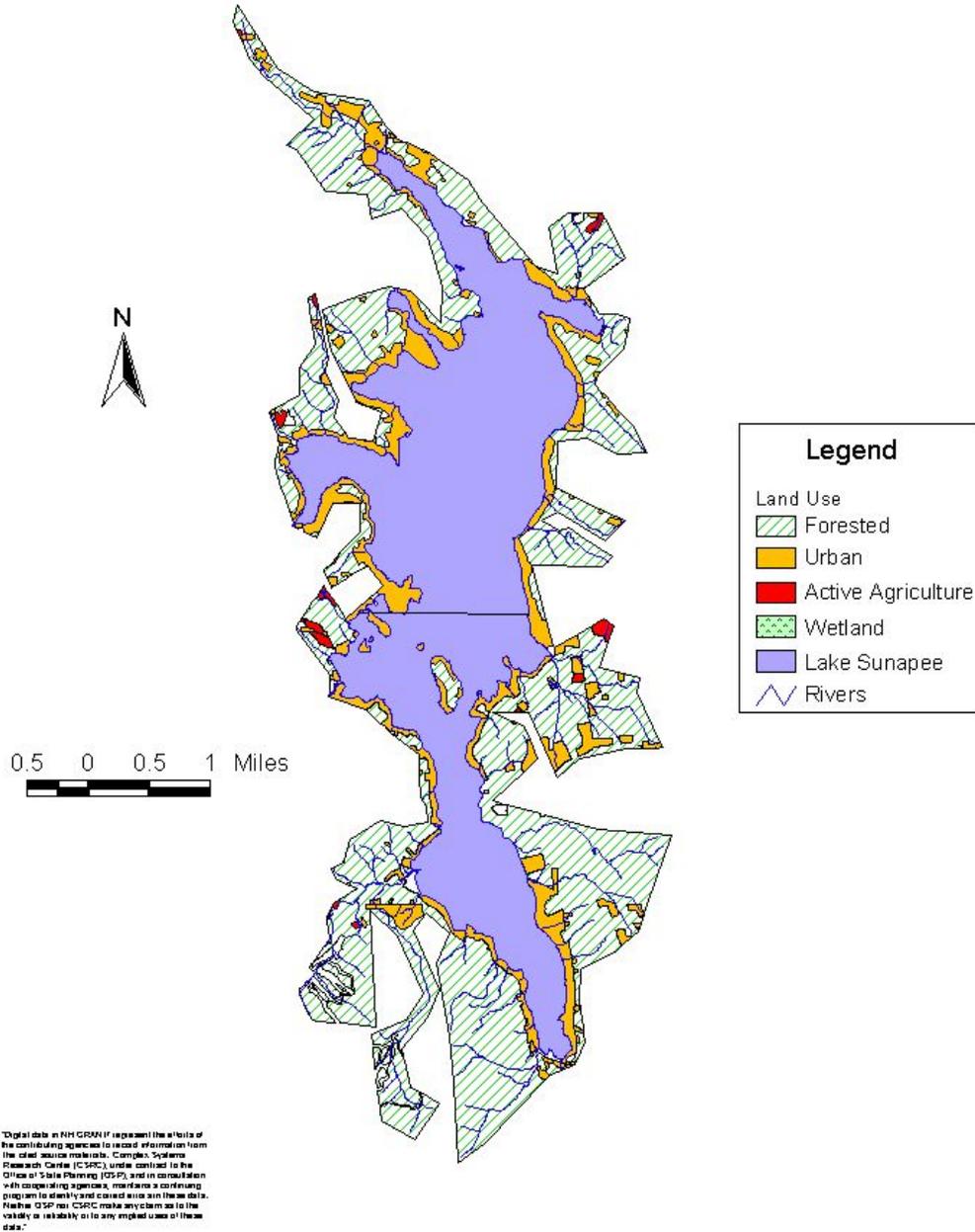
Gagne, Deynce. (dgagneA@uvlsrc.org). "GIS data layers." E-mail to Stacey Philbrook (sphilbrook@colby-sawyer.edu). 10 Nov. 2003.

**Assessment of Question:** Some difficulty arose in locating a map that included all five areas of interest (forested, wetland, active agricultural, clear / open, and urban). Combining maps was necessary. A map that included clear / open areas was not found.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

# Immediate Watershed Development and Land Use



**Attribute 9:** Watershed development and land use.

**Category:** Susceptibility to Impairment

**Question A:** Watershed development and land use. A map showing watershed boundaries and the land usage is necessary.

**Directions:** Construct a map indicating the location and approximate amount of forested, wetland, active agricultural, clear / open, and urban land use types in the immediate watershed area. Town planning or assessing departments, as well as regional planning commissions may be able to offer assistance in generating a map.

**Rationale:** Identifying the percent of each of these land use types within the immediate watershed will help in the development of general and targeted nonpoint source pollution prevention strategies. In addition, knowing the location and distribution of various land use types will assist in identifying those lands available for future development or land use conversion.

**Process Followed:** Constructed a map with Stacey Philbrook and Matthew Cummings. Using GIS, imported appropriate layers from the GRANIT website. Used the GIS program to calculate the Forested, Urban, Active Agriculture, and the Lake parcels of land within the immediate watershed.

\*Note: Cleared/open and urban land parcels were compared. There is no distinction to what land is used for.

**Findings and Analysis:** Found the following percentages of land use and development:

- Forested 44%
- Urban 13%
- Active Agriculture 1%
- Lake Sunapee 47%

As expected, the land immediately surrounding the waterbody is where the majority of the development is located. The rest was left as either forested land or the actual lake. This is important in the protection of the lake with non-developed land acting as a natural buffer. This buffer limits sediments and pollutants from reaching the waterbody.

<b>Evaluation Criteria:</b>	<b>Score:</b>
<b>% developed : % undeveloped</b>	
1) >75% : <25%	5
2) 51 – 75% : 25 – 49%	4
3) 26 – 50% : 50 – 74%	3
4) 10 – 25% : 75 – 90%	2
5) <10% : >90%	1

**Sources:**

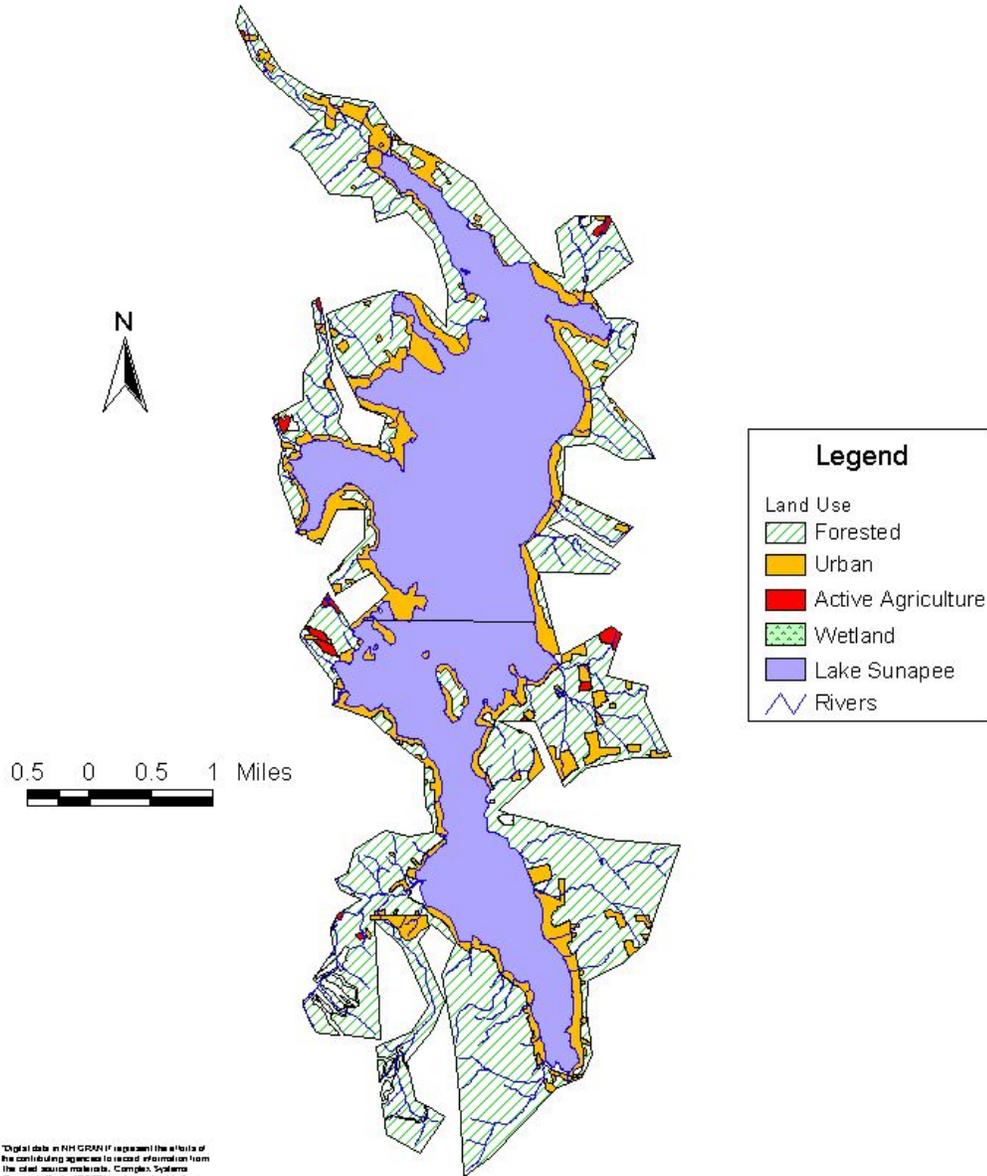
"GRANIT." Complex Systems Research Center, Institute for the Study of Earth, Oceans, and Space, and University of New Hampshire. 22 Oct 2003  
<http://www.granit.sr.unh.edu/>>

**Assessment of Question:** This is an important question because it deals with the immediate watershed and what occupies the land. This question should also consider what the immediate watershed has for land use and development because this acts as a natural buffer in the protection of the waterbody. Consideration needs to go into the protection and non-development of the land to maintain this buffer and the habitat it offers.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings, Stacey Philbrook, Matthew Cummings

# Immediate Watershed Development and Land Use



"Digital data in this GIS map represent the efforts of the contributing agencies to record information from the original source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability of any individual use of these data."

**Attribute 9:** Watershed Characteristics

**Category:**

**Question B:** Watershed land ownership.

**Directions:** Develop a map of the immediate watershed showing the amount and location of lands held in private and public ownership. Calculate the percentage of each ownership type. Town planning or assessing departments, as well as regional planning commissions may be able to offer assistance in generating a map.

**Rationale:** Strategies for nonpoint source pollution prevention may differ among public and private lands depending on their use. Private lands will consist of residential, commercial, and agricultural uses, while public land may serve primarily as recreational or silvicultural uses. In addition, tracking the distribution and location of public and private lands over time will help in documenting changes in land use.

**Process Followed:** Used GIS layers from Granit website primarily the Conserved/Public Lands data. Created a polygon overlay to include immediate streams and exclude lakes or ponds in the watershed. Created a list of all conserved/public lands that fell in the immediate watershed then contacted owners to find out if public access was permitted. Using ArcView, found the amount of private land in the immediate watershed by excluding the lake and the public lands. Calculated percentages of private and public land by dividing by the total amount of land in the immediate watershed.

**Findings and Analysis:** There was a close mix of private and public lands in the immediate watershed. The Sunapee State Park and the John Hay Wildlife Refuge/Management area were the two largest sections of public land. Both are beneficial to the lake and to recreation because they provide forested land that is saved from development. Most of the land that borders the lakefront is private land.

**Evaluation Criteria:**

- 1) all private; no public
- 2) all public; no private
- 3) mix of public and private

**Public:** 30.3%

**Private:** 69.7%

**Sources:**

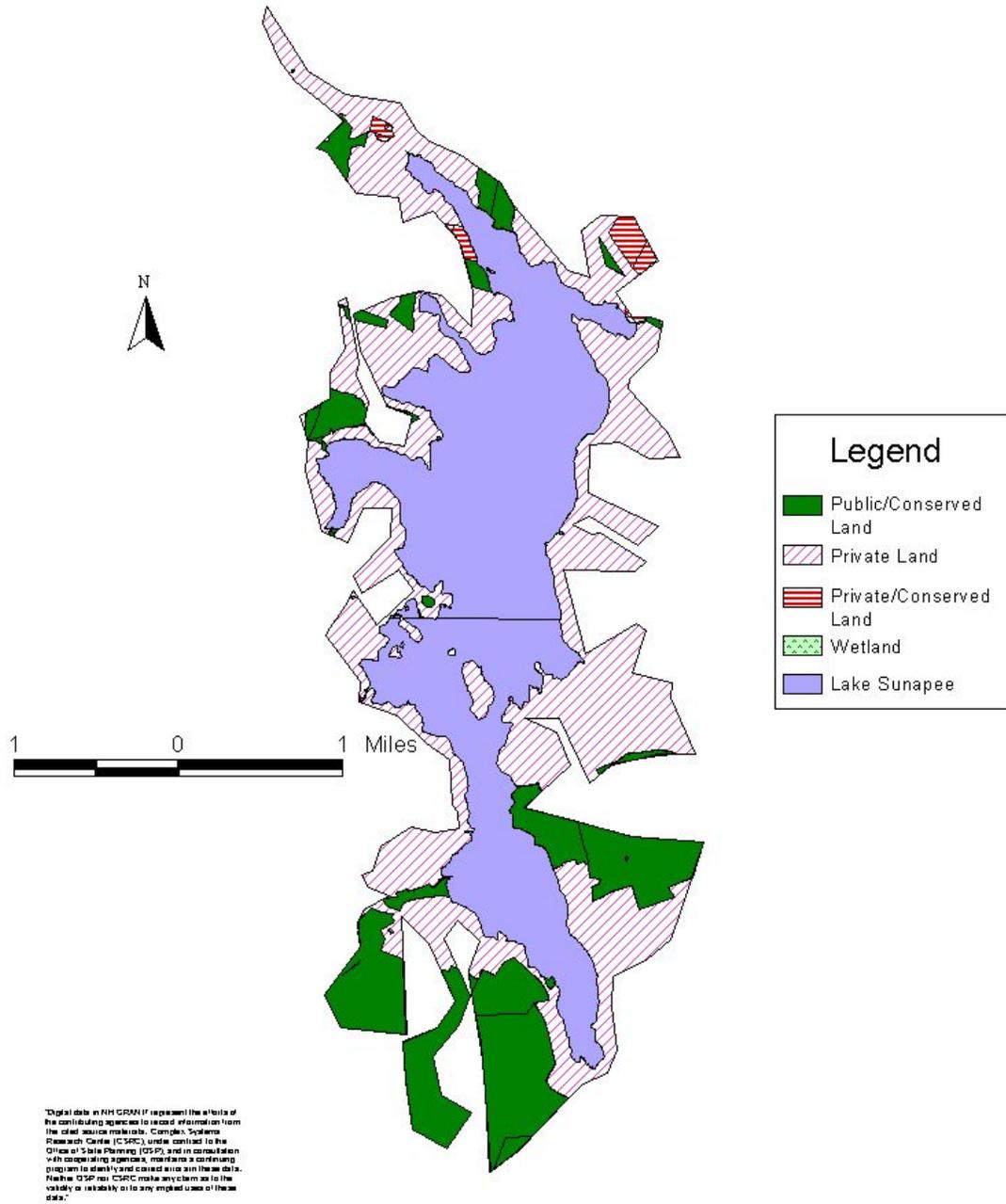
"Welcome to NH Granit." 15 Nov. 2003 <<http://www.granit.sr.unh.edu>>

**Assessment of Question:** Some public lands allow only partial access while others allow full access. Specify whether to include, as a public land, a parcel of land that permits only partial access to the public.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

# Immediate Watershed Land Ownership



**Attribute 9:** Biological/ Ecological Characteristics

**Category:** Susceptibility to Impairment

**Question C:** Protected land or land not available for development within the watershed.

**Directions:** Using a land use map, identify all land that is protected from future development within this watershed including state owned properties, town owned properties, private conservation organization properties, and conservation easements. Note ownership of the land.

**Rationale:** Identifying the percentage of land protected from future development will provide guidance for monitoring changes in shoreland usage and the associated levels of nonpoint source pollution that a lake or pond receives. By identifying who owns the lands you recognize potential partnerships for future lake management.

**Process Followed:** A map was constructed through the use of GIS showing the conserved lands that are presented in the watershed. Detailed tables regarding land ownership and the size of each protected parcel were also provided by GIS. Many of the table features were coded and needed to be deciphered before being accumulated. A table was made using Microsoft Excel to display the area of the parcels as well as the type of easement and the owner of each parcel. The coded attributes were interpreted using Granit Conservation/ Public Lands Identification Information from their website and added to the table.

**Findings and Analysis:** By determining the watershed acreage in GIS and the conserved lands acreage in the chart, the end result came to be 20% of conserved land. See attached map and table titled “Protected Lands or Lands not Available for development.”

<b>Evaluation Criteria:</b>	<b>Source:</b>
1) 0%	5
2) 1 – 10%	4
3) 11 – 25%	3
4) 26 – 50%	2
5) >50%	1

**Sources:**

GIS data was used from [www.granit.sr.unh.edu](http://www.granit.sr.unh.edu) and compiled using ESRI GIS Arcview computer program.

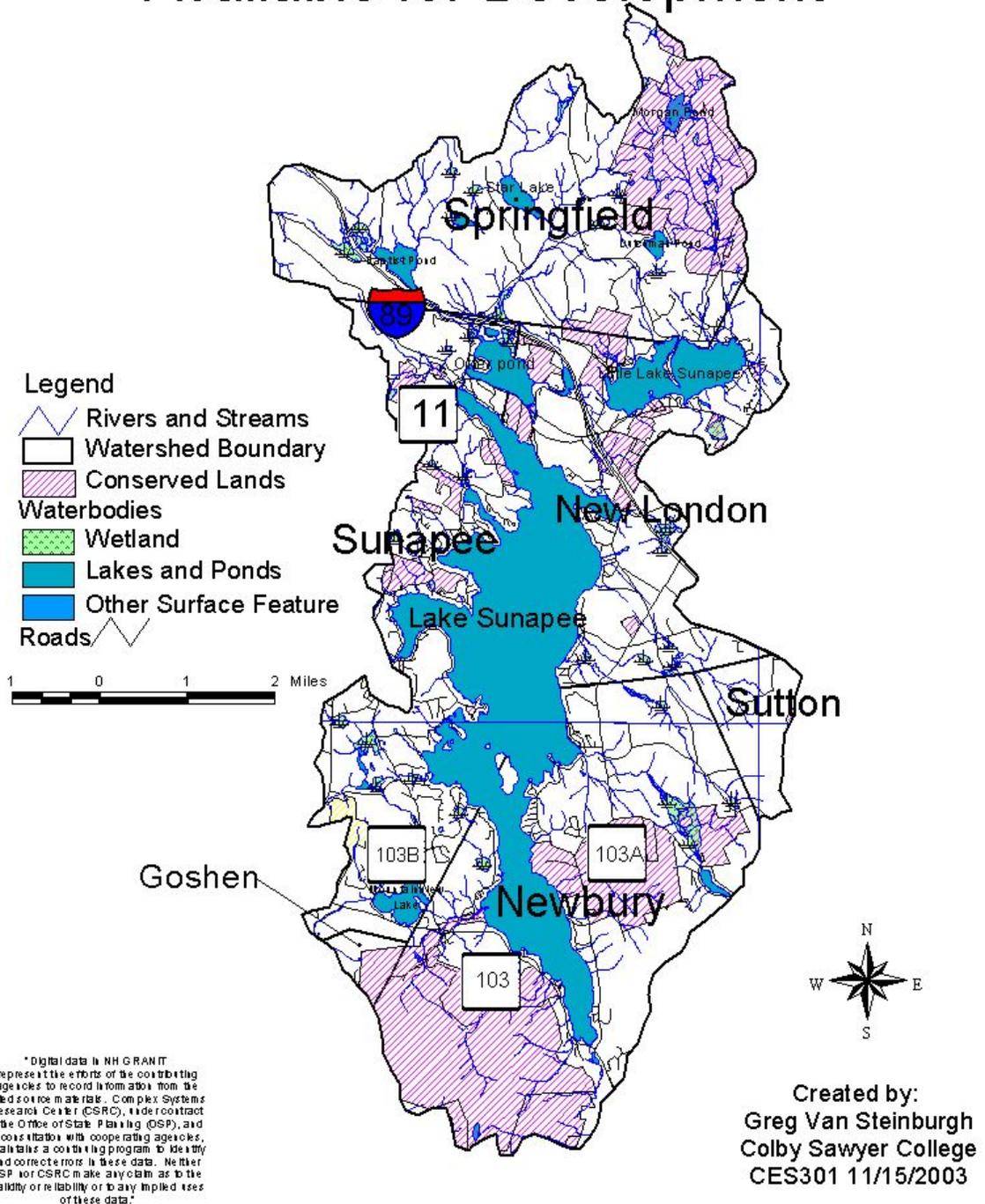
Steinburgh, Greg Van. “Protected Lands or Lands not Available for Development.” 15, Nov. 2003.

**Assessment of Question:** Conserved lands are an important because they provide corridors for wildlife and maintain a balanced ecosystem. The conserved lands are lands that are not available for development, which limits the amount of people within the watershed.

**Date Completed:** March 2004

**Investigator:** Sarah M. Young

# Protected Lands or Lands not Available for Development



Lake Sunapee Watershed Project Portfolio – Comprehensive Lake Inventory

**Protected Lands or Lands Not Available for Development**

<b>Name</b>	<b>Area(Acres)</b>	<b>Under Easement by</b>	<b>Parcel Type</b>
Badmington	12.04	D.R.E.D.	Conserved Easement
Baptist Pond Island	0.473	D.R.E.D.	Fee Ownership
Bartlett-Tyler Lot	47.952	Town of Sunapee	Fee Ownership
Bessie N Philips	9.564	Ausbon Sargent Land Preservation Trust	Conserved Easement
Birch Point Circle	4.698	Town of Sunapee	Fee Ownership
Boat Launch	0.886	Town of Sunapee	Fee Ownership
Bohanon	8.926	Ausbon Sargent Land Preservation Trust	Conserved Easement
Brown Hill Farm	68.549	Town of Sunapee	Conserved Easement
Carroll	20.247	Ausbon Sargent Land Preservation Trust	Conserved Easement
Cundey Easement	2.62	Ausbon Sargent Land Preservation Trust	Conserved Easement
Davis Easement	18.857	Ausbon Sargent Land Preservation Trust	Conserved Easement
Denny Beach Realty Trust	5.269	Ausbon Sargent Land Preservation Trust	Conserved Easement
Dewey Beach	1.444	Town of Sunapee	Fee Ownership
Dewey Woods	103.985	Town of Sunapee	Fee Ownership
Estate of Marguerite D. Carroll	22.46	Ausbon Sargent Land Preservation Trust	Conserved Easement
Frank and Dot Gordon	47.543	Ausbon Sargent Land Preservation Trust	Conserved Easement
Gazebo/Bandstand Area	3.414	Town of Sunapee	Fee Ownership
Georges Mills Water Works Easement	4.26	Epsom Village Water Precinct	Protective Easement
Georges Mills Water Works Land	11.787	Georges Mills Water Works	Fee Ownership
Gile State Forest	1388.187	D.R.E.D.	Fee Ownership
Gordon	21.533	Ausbon Sargent Land Preservation Trust	Conserved Easement
Gordon WMA	39.8	NH Fish and Game	Fee Ownership
Hay Forestry + Wildlife Management Area	729.476	Society for the Protection of New Hampshire Forests	Fee Ownership
John Hay National Wildlife Refuge	164.97	US Dept. of Interior, Fish and Wildlife Service	Fee Ownership
Kentlands Boathouse	2.08	Ausbon Sargent Land Preservation Trust	Conserved Easement
King Hill Reservation	7.453	Ausbon Sargent Land Preservation Trust	Conserved Easement
Ledge Pond Properties	79.688	Town of Sunapee	Fee Ownership
Lincoln Gordon	38.417	Ausbon Sargent Land Preservation Trust	Conserved Easement
Little Sunapee Associates Memorial Forest	115.762	New England Forestry Foundation	Fee Ownership
Morgan Pond	236.877	New London-Springfield Water Systems Precinct	Fee Ownership
Otter Pond Protective Association	1.93	Georges Mills Water Works	Conserved Easement
Parkhurst and Sjostrom	42	Ausbon Sargent Land Preservation Trust	Conserved Easement
Parkhurst Easement	3.454	Ausbon Sargent Land Preservation Trust	Conserved Easement
Philbrick-Cricenti Bog	35.909	Town of New London	Fee Ownership
Phillips	106.88	Ausbon Sargent Land Preservation Trust	Conserved Easement
Philips Memorial Preserve	71.444	Town of New London	Fee Ownership
Pillsbury State Park	12.949	D.R.E.D.	Conserved Easement
Pillsbury-Sunapee Corridor	56.103	D.R.E.D.	Fee Ownership
Reed Parcel	4.592	Town of New London	Fee Ownership
Spaulding Parcel	4.708	Town of Sunapee	Fee Ownership
Spaulding Property	4.199	Town of Sunapee	Fee Ownership
Springfield Town Forest-Dutchman Pond	52.729	Town of Springfield	Fee Ownership
Springfield Town Forest-Royal Arch Lot	47.694	Town of Springfield	Fee Ownership
Stanley Farm Association	14.659	Ausbon Sargent Land Preservation Trust	Conserved Easement
Stanley Point Trust	11.181	Ausbon Sargent Land Preservation Trust	Conserved Easement
Stoney Brook Wildlife Sanctuary	217.203	Audubon Society of New Hampshire	Fee Ownership

Lake Sunapee Watershed Project Portfolio – Comprehensive Lake Inventory

Sunapee State Park	2341.661	D.R.E.D.	Fee Ownership
Tatum	23.22	Ausbon Sargent Land Preservation Trust	Conserved Easement
The Donovan Family Trust	90.538	Ausbon Sargent Land Preservation Trust	Conserved Easement
Town of New London	7.564	Ausbon Sargent Land Preservation Trust	Conserved Easement
Verne Morse Lot	4.713	Town of Sunapee	Fee Ownership
Water Precinct Reservoirs	20.872	New London-Springfield Water Systems Precinct	Fee Ownership
Webb Woods	100.335	Town of Sunapee	Conserved Easement
	6495.754		

Greg Van Steinburgh  
Colby-Sawyer College  
CES301 11/15/2003

**Attribute 9:** Watershed Characteristics

**Category:** Unique or Outstanding Value

**Question C:** Protected land or land not available for development within the watershed.

**Directions:** Using a land map, identify all land that is protected from future development within this watershed including state owned properties town owned properties private properties private conservation organization properties and conservation easements. Note ownership of the land.

**Rationale:** Identify the percentage of land protected from future development will provide guidance for monitoring changes in shore land usage and the associated levels of non-point source pollution that a lake or pond receives. By identifying who owns the lands you recognize potential partnership for future lake management.

**Process Followed:** Using GIS, a map was made showing the conserved lands that are present in the watershed GIS also provided detailed tables regarding land ownership and the size of each protected parcel. Many of the table attributes were coded, and needed to be deciphered before being compiled. Using Microsoft Excel, a table was created to display the area of the parcels as well as the type of easement and the owner of each parcel. The coded attributes were interpreted using the Granit Conservation/Public Lands Identification Information from their web site and added to the table.

**Findings and Analysis:** See attached map and table titled “Protected Lands or Lands not Available for Development”

<b>Evaluation Criteria:</b>	<b>Score:</b>
<b>As percent of immediate watershed area:</b>	
3) 0%	1
4) 1 – 10%	2
5) 11 – 25%	3
6) 26 – 50%	4
5) >50%	5

**Sources:**

"GRANIT DATA." NH GRANIT. 25 10 2003 [www.granit.sr.unh.edu](http://www.granit.sr.unh.edu)

**Assessment of Question:** This question is important when looking at the potential build out and zoning regulations within the watershed. Conserved lands are lands that are not available for development, thus limiting the amount of people within the watershed. Conserved lands are an important part of maintaining a balanced ecosystem as well as providing natural travel corridors for wildlife.

**Date Completed:** November 2003

**Investigator:** Greg Van Steinburgh

## Lake Sunapee Watershed Project Portfolio – Comprehensive Lake Inventory

### **Protected Lands or Lands Not Available for Development**

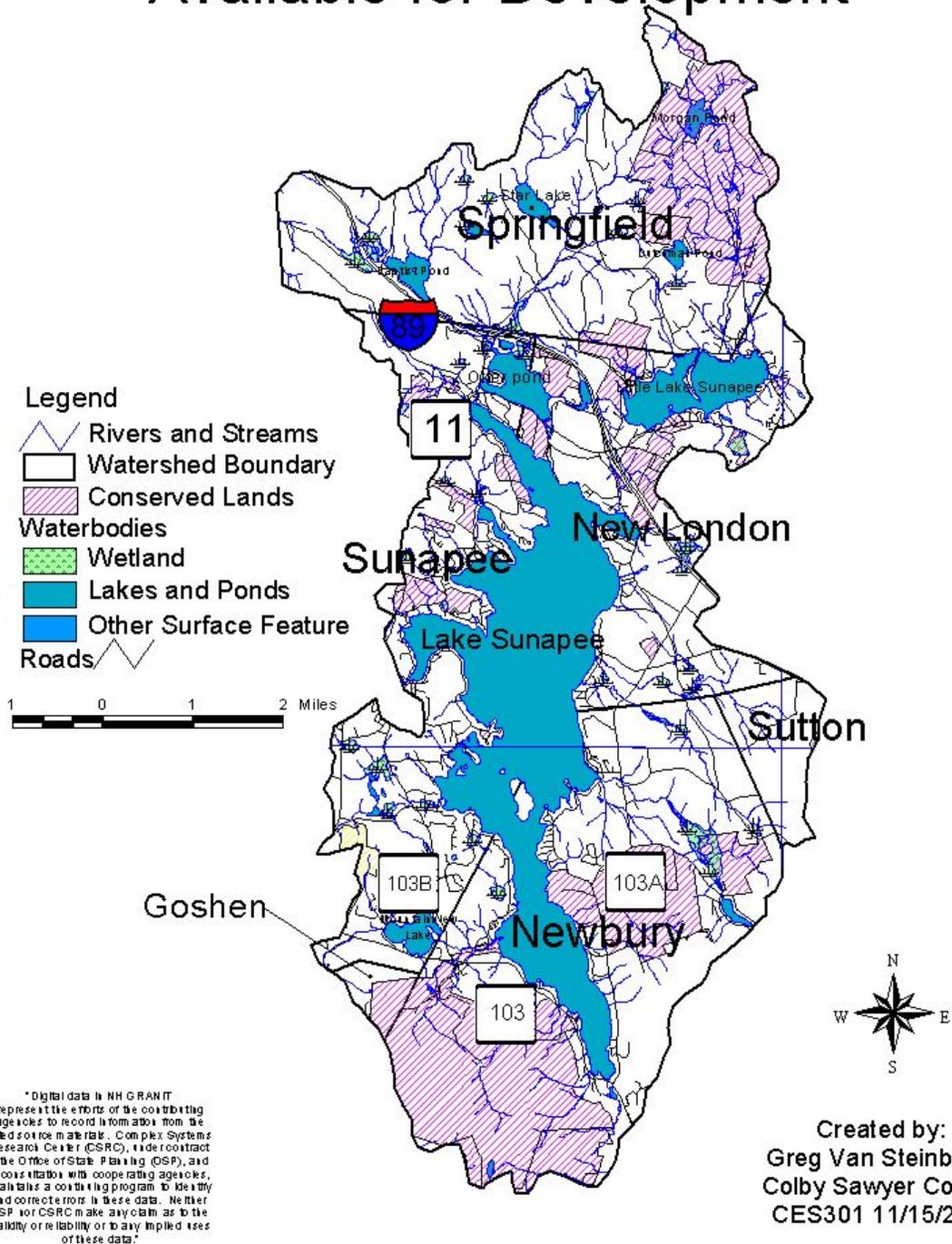
<b>Name</b>	<b>Area(Acres)</b>	<b>Under Easement by</b>	<b>Parcel Type</b>
Badmington	12.04	D.R.E.D.	Conserved Easement
Baptist Pond Island	0.473	D.R.E.D.	Fee Ownership
Bartlett-Tyler Lot	47.952	Town of Sunapee	Fee Ownership
Bessie N Philips	9.564	Ausbon Sargent Land Preservation Trust	Conserved Easement
Birch Point Circle	4.698	Town of Sunapee	Fee Ownership
Boat Launch	0.886	Town of Sunapee	Fee Ownership
Bohanon	8.926	Ausbon Sargent Land Preservation Trust	Conserved Easement
Brown Hill Farm	68.549	Town of Sunapee	Conserved Easement
Carroll	20.247	Ausbon Sargent Land Preservation Trust	Conserved Easement
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Philips Memorial Preserve	71.444	Town of New London	Fee Ownership
Pillsbury State Park	12.949	D.R.E.D.	Conserved Easement
Pillsbury-Sunapee Corridor	56.103	D.R.E.D.	Fee Ownership
Reed Parcel	4.592	Town of New London	Fee Ownership
Spaulding Parcel	4.708	Town of Sunapee	Fee Ownership
Spaulding Property	4.199	Town of Sunapee	Fee Ownership
Springfield Town Forest-Dutchman Pond	52.729	Town of Springfield	Fee Ownership
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Stanley Farm Association	14.659	Ausbon Sargent Land Preservation Trust	Conserved Easement
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Lake Sunapee Watershed Project Portfolio – Comprehensive Lake Inventory

Stoney Brook Wildlife Sanctuary	217.203	Audubon Society of New Hampshire	Fee Ownership
Sunapee State Park	2341.661	D.R.E.D.	Fee Ownership
Tatum	23.22	Ausbon Sargent Land Preservation Trust	Conserved Easement
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Webb Woods	100.335	Town of Sunapee	Conserved Easement
	6495.754		

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# Protected Lands or Lands not Available for Development



**Attribute 9:** Watershed Characteristics

**Category:** Unique and Outstanding Value

**Question D:** Percent of impervious surface within the watershed

**Directions:** Contact the DES Lakes Program staff for assistance with constructing a map that indicates the amount of impervious surface within the watershed.

**Rationale:** The amount of impervious surface is important in determining stormwater runoff quantity and quality. Watersheds that are highly developed tend to have a higher percentage of impervious surfaces. Impervious surfaces reduce natural stormwater soil infiltration and convey high quantities of runoff directly to the nearest tributary. Impervious surfaces can also compromise water quality by transferring oils, greases, heavy metals, pathogens, and excess nutrients to tributaries and drainage ditches. The installation of stormwater retention facilities can assist in mitigating some of the negative impacts. A management plan should identify the percentage of impervious surfaces and areas in need of stormwater control mechanisms with the shoreland boundaries.

**Process Followed:**

Impervious Surface Methodology

Steps

Use remote sensing images to identify impervious surfaces

1. Printed a large copy of the orthophoto layer for the entire watershed from 1998. Students individually identified areas that appear distinctly similar on the photo layer and label them. (E.g. all areas with houses surrounded by woods were one category, homes that were very dense with little to no trees were another category). This was done individually to avoid group influence and to aid to reliability.
2. Compare results and develop categories. The group compared the results of the individual categories and developed specific description for each category. (E.g. all areas of dense development along the shoreline were labeled as one category, all rural development as another category). The result of this exercise was the definition of 12 different categories.

- Dense Residential Shoreland
- Rural Residential Shoreland
- Dense Residential Offshore
- Rural Residential Offshore
- Commercial Shoreland
- Commercial Offshore
- Parking Shoreland
- Parking Offshore
- Golf Courses (Baker Hill)

- Lumber Yard (Durgin & Crowell)
- Power & Light Utility (Hemphill)
- Roads

3. Ground truth. The next step was to confirm if the land cover was consistent with the description of the category. This was done by visiting the site by vehicle and confirming the observation. It was also done by prior knowledge of the major landmarks in the watershed and identifying them on the orthophoto.

#### Calculate imperviousness

1. The first step was to select a few samples from the list of categories. Specific descriptions of each sample site and the methodology followed at each sample site are attached.

#### Categories and listed Samples:

- **Dense Residential Shoreland =7**
  - Dense Shoreland, Blodgett's Landing
  - Dense Shoreland, Lake Ave #1 Sunapee
  - Dense Shoreland, Lake Ave #2 Sunapee
  - Dense Shoreland, Old Mill Rd Sunapee
  - Dense Shoreland, Bay Point Rd Sunapee
  - Dense Shoreland, Hammel Rd Sunapee
  - Dense Shoreland, Fernwood Jobs Creek Rd.
- **Rural Residential Shoreland = 3**
  - Rural Shoreland, Little Lake Sunapee Rd
  - Rural Shoreland, Herrick Cove New London
  - Rural Shoreland, Bowles Rd. Newbury
- **Dense Residential Offshore = 2**
  - Dense Offshore, Chalk Pond Newbury
  - Dense Offshore, Hilltop New London
- **Rural Residential Offshore = 4**
  - Rural Offshore, Blye Hill Newbury
  - Rural Offshore, Stoney Brook Rd Newbury
  - Rural Offshore, Rollins Rd. Newbury
  - Rural Offshore, Soo Nipi Park Rd. New London
- **Commercial Shoreland = 3**
  - Commercial Shoreland, Sunapee
  - Commercial Shoreland, Georges Mills Sunapee
  - Commercial Shoreland, Newbury
- **Commercial Offshore = 1**
  - Commercial Offshore, Sunapee
- **Parking Shoreland =2**
  - Parking Shoreland, Sunapee State Beach
  - Parking Shoreland, Bucklin Beach
- **Parking Offshore =1**
  - Parking Offshore, New London
- **Golf Courses = 1**

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- Baker Hill, Newbury
  - **Lumber Yard = 1**
    - Durgin & Crowell
  - **Power & Light Utility = 1**
    - Hemphill, Springfield
  - **Roads = All**
    - Entire watershed
2. Sample sites were divided into those where the Effective Impervious Area (EIA) was measured and those where the Total Impervious Area (TIA) was measured. Total Impervious Area involved measuring the total impervious area of a large surface. Examples include big parking areas, Hemphill Power & Light, and Durgin & Crowell lumber mill and yard. Effective Impervious Area included areas where a certain percentage of the area was impervious.
3. Effective Impervious Area sample sites were identified for categories and teams of two students visited the site to measure the imperviousness. The first step was to identify a “box” around the area. (E.g. in a dense development the box to include the homes would be 100 ft from the road and 500 ft along the road.). All the impervious surfaces inside this “box” were calculated – mostly driveways and roofs. The results would be a percentage impervious surface for the sample plot. Refer to sheets and spreadsheet.
4. Data from all samples were entered in a spreadsheet and the percentage imperviousness calculated as a percentage per acre. There was high level of correspondence between samples of the same category. The averages of the samples were taken to get an imperviousness rating per category.

Dense Residential Shoreland	54.03
Rural Residential Shoreland	11.28
Dense Residential Offshore	78.20
Rural Residential Offshore	7.09
Commercial Shoreland	80.15
Commercial Offshore	55.4
Parking Shoreland	100.00
Parking Offshore	100.00
Baker Hill Golf Course	2.16
Durgin & Crowell Lumber	100.00
Hemphill Power & Light	100.00
Roads	100.00

## Digitizing

The next step was to identify all areas with similar characteristics on a map and to digitize all areas with imperviousness.

1. The students were divided into three different groups to ensure reliability. Each group worked independently on identifying the location of categories.
2. Each group worked on a large copy of a topographical map with a clear layer of Mylar over the top. To avoid groupthink the students worked separately on designating each area with the previously defined categories. Once each had completed their own map, they regrouped to compare outcomes. Similarities between each were kept the same, and differences were thoroughly discussed and finally resolved to result in one complete map of designated areas to sample and digitize.
3. All the areas were digitized in GIS. An attribute table was developed that indicated the category and the percent imperviousness for each polygon.

## Comments

**Golf Course.** The fairways and open areas on the golf course were treated as pervious surfaces, but we acknowledge that this surface does not have the same characteristics as a forested surface. The golf cart paths, parking areas, and buildings are impervious surfaces. The result of this approach is that the golf course has an imperviousness of 2.16% over its total area.

**Mt. Sunapee.** There are several large parking areas and some big buildings in the ski area. We took the total area where these parking lots and building occur (about 24 acres) and calculated the percentage imperviousness. The resulting cover is not very high (it is 55%) but it is important to recognize that these big parking areas contribute to direct runoff into storm water and streams and runoff is probably high in salt and oil spills.

**Roads.** We did not include roads in the calculation of the impervious cover of the different categories. Roads were digitized, the total surface calculated based on a measurement of the width of the road, and it is treated as a separate impervious category. Class 1 roads (Interstate 89) was calculated as 70' wide; Class 2 roads (generally state roads) were calculated as 30' wide, and Class 3& 4 roads (generally town and private roads) were calculated as 20' wide.

**Findings and Analysis:** We found the impervious surface in the entire watershed to be 5.8%. This is a relatively low number and classifies Lake Sunapee's watershed as being 'protected.' The amount of impervious surface is largely offset by the amount of forests, conserved lands, and recreational areas such as Mt. Sunapee and numerous large golf courses. Though the percentage is low, it does not mean impervious surfaces in the watershed is not a concern. With NH being the fastest growing state in New England, in

addition to the vast area available for development, we must pay close attention to the allowed increase in impervious surfaces in the watershed. Therefore, developing a watershed management plan is the best option to keeping this area 'protected'.

**Evaluation Criteria:**

- 1) >50%
- 2) 26-50%
- 3) 10-25%
- 4) 1-10%
- 5) 0%

**Sources:**

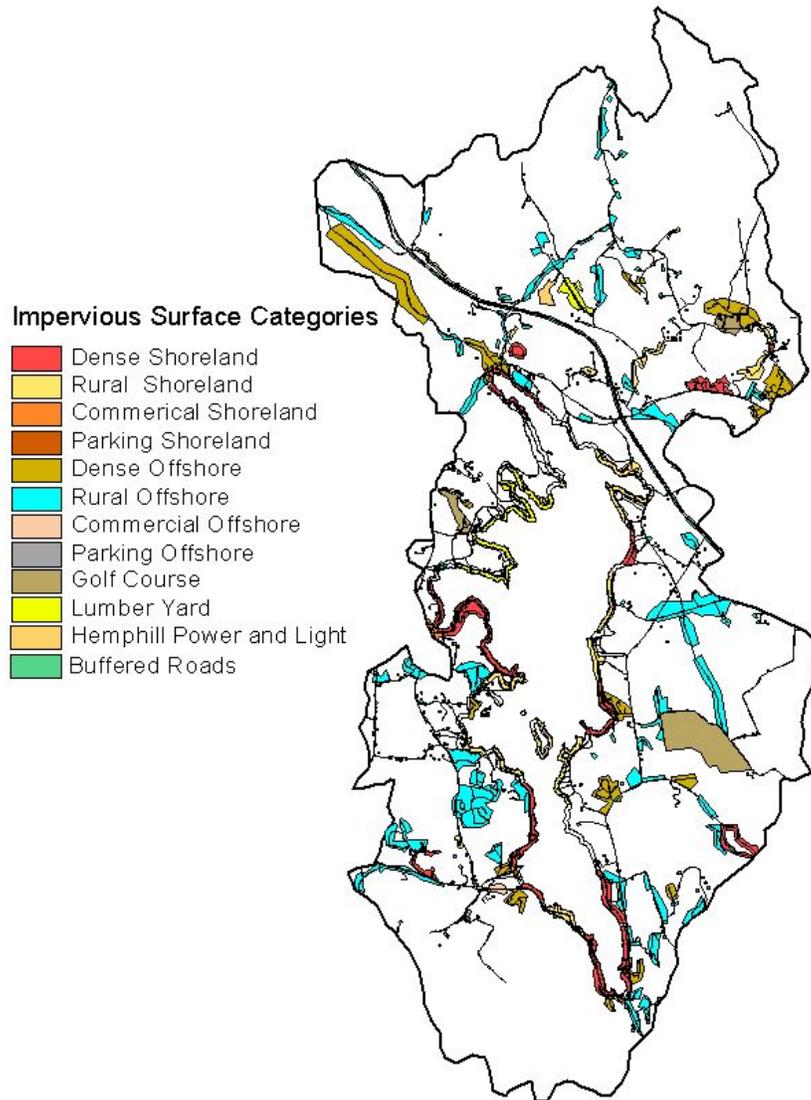
"Welcome to NH Granit." NH Granit. 10 Feb 2003. <<http://www.granit.sr.unh.edu/>>.

**Assessment of Question:** The methodology used for answering this question was developed by the class. It was a good faith effort to answer the question but additional methodologies should be tested for this question.

**Date Completed:** May 2003

**Investigator:** Stacey Philbrook & Matt Cummings

# Impervious Surface Areas



**Attribute 9:** Watershed Characteristics

**Category:**

**Question E:** Land use adjacent to perennial streams.

**Directions:** Construct a map that identifies the locations and amounts of forested, wetland, active agricultural, clear / open, and urban land use types within 250 feet on each side of the most significant tributaries that *drain into* the lake or pond. Town planning or assessing departments, as well as regional planning commissions may be able to offer assistance in generating a map.

**Rationale:** The inlets that drain into a waterbody act as conduits for pollutant transport from the land that surrounds them. Different land use types are associated with different pollutant types and quantities and must be considered when developing a nonpoint source pollution investigation or prevention program. In addition, when assessing land use in the areas surrounding the largest tributaries, estimate the pollutant load delivered to the lake or pond of interest.

**Process Followed:** Using GIS and information downloaded from GRANIT a map was constructed to show the specified land use within 250 feet of streams. The streams that were selected for the map are ones that flow directly into Lake Sunapee, without passing through other lakes or wetlands. Then estimations were made as to how much of each type of land cover was within the 250 buffers on the entire body of rivers that were mapped.

**Findings and Analysis:** forested: 87 %  
wetlands: 2 %  
active agriculture: 3 %  
cleared / open: 3 %  
urban: 5 %

Total % developed (add last 3 categories): 11 %

**Evaluation Criteria:**

% developed: % undeveloped

- 1) 75 – 100% : <25%
- 2) 50 – 75% : 25 – 50%
- 3) 25 – 50% : 50 – 75%
- 4) 10 – 25% : 75 – 90%
- 5) < 10% : > 90%

**Sources:**

GRANIT. (2002). The New Hampshire Geographically Referenced Analysis and Information Transfer System. *Metadata Database*.  
<<http://www.granit.sr.unh.edu>> (5 Nov. 2003).

**Assessment of Question:** The question is adequate as stated.

**Date Completed:** December 2003

**Investigator:** Beau Etter-Garrette

**Attribute 9:** Watershed Characteristics

**Category:**

**Question F:** Watershed Topography.

**Directions:** Contact the DES Lakes Program staff for assistance with identifying those areas that have a slope greater than 15%.

**Rationale:** The topography, or slope, of a watershed draining into the lake or pond is an important natural characteristic controlling the rate and amount of direct storm water a waterbody receives. A steeply sloped watershed will convey storm water more quickly to nearby tributaries than a watershed with a relatively flat landscape.

**Process Followed:** The process taken to complete this question was accomplished by bringing in Digital Elevation models into the ArcView GIS 3.2 program. From there a map was constructed by changing the values of the Digital Elevation models to suit the appropriate values required.

**Findings and Analysis:** the findings found consist of the watershed having approximately

- 51-75% of the watershed area has a slope level less than 8%
- 26-50% of the watershed area has a slope level of 9-15%
- 1-25% of the watershed area has a slope level of 16-25%
- 1-25% of the watershed area has a slope level greater than 25%
- 1-25% of the watershed area has a slope level greater than 15%
- Also see maps for estimations.

With Analysis of the findings of the watershed slope it can be determined that there are both opportunities for recreation that uses a flatter slope of land to a recreation that uses a steeper slope of land example would be skiing at mount Sunapee.

**Evaluation Criteria:**

- 1) >75% of the watershed area has a slope in excess of 15%
- 2) 51-75% of the watershed area has a slope in excess of 15%
- 3) 26-50% of the watershed area has a slope in excess of 15%
- 4) 1-25% of the watershed area has a slope in excess of 15%
- 5) None of the watershed area has a slope in excess of 15%

**Sources:** "Welcome to NH Granit." 10 Nov. 2003 <<http://www.granit.sr.unh.edu>>

**Assessment of Question:** Question needs to be state clearly what slopes are needed to answer question properly. There was confusion between the

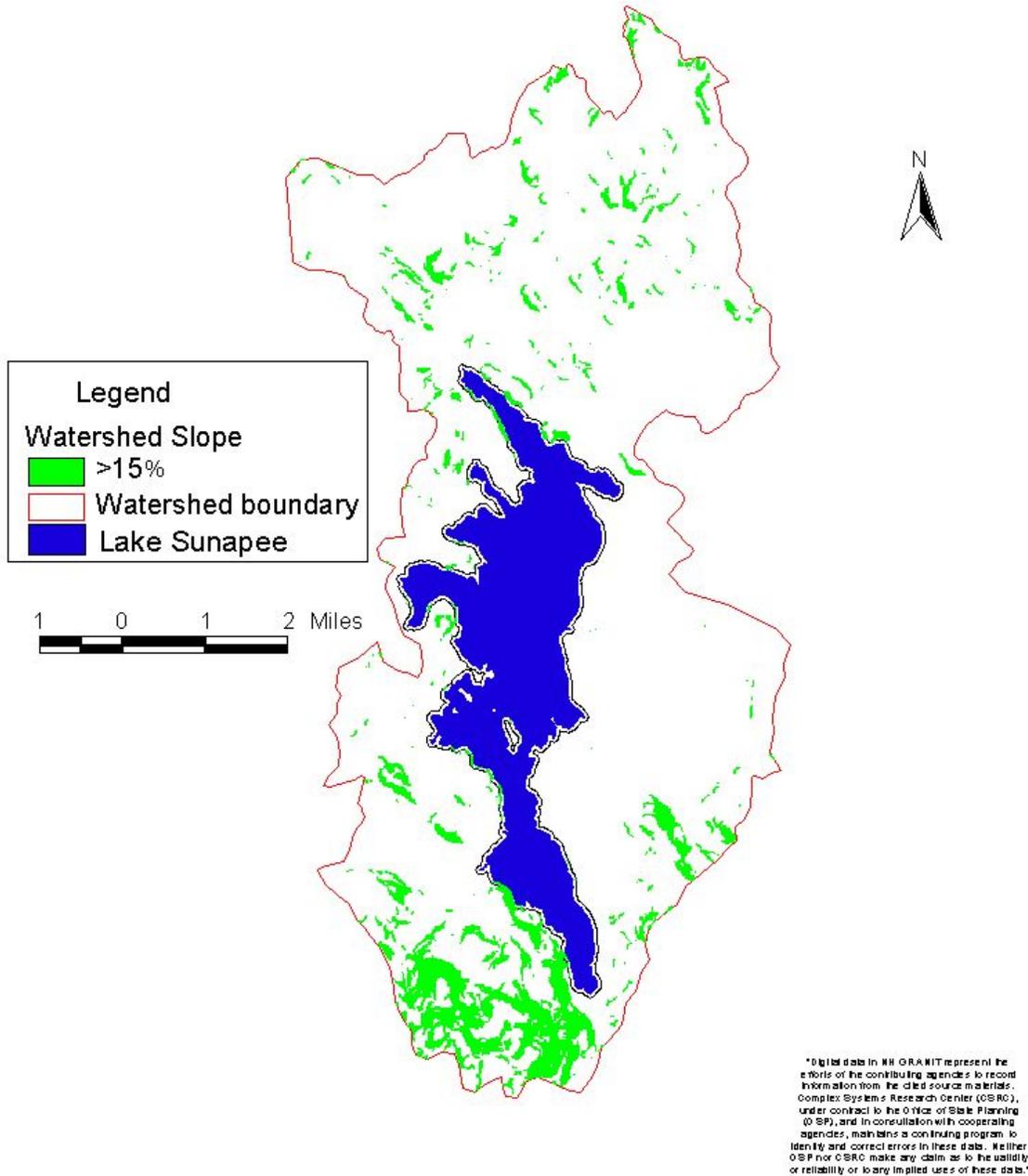
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Attributes questions table and written directions.

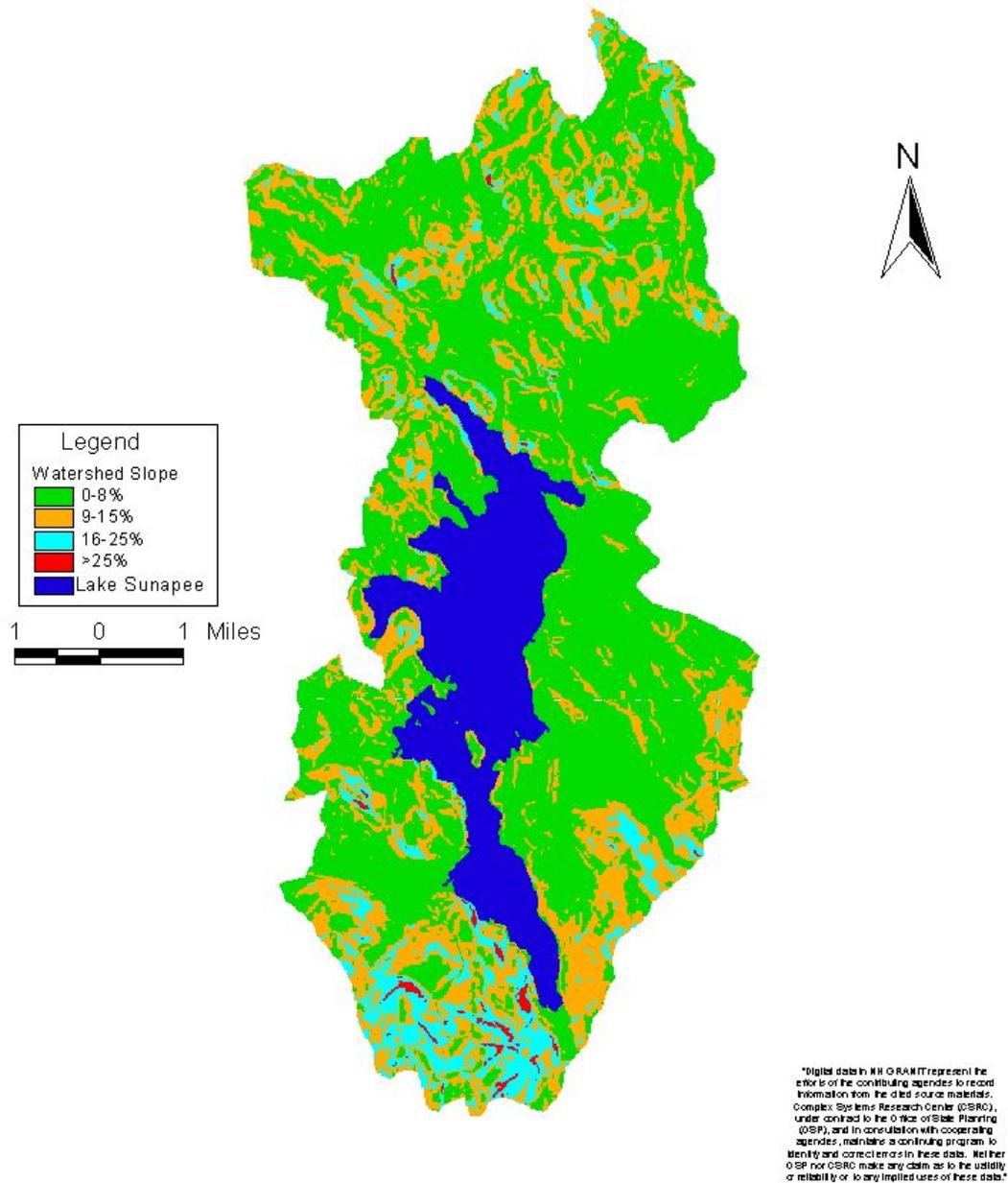
**Date Completed:** November 2003

**Investigator:** Matt Cummings, Stacey Philbrook

# Watershed Topography



# Watershed Topography



**Attribute 9:** Watershed Characteristics

**Category:** Recreation

**Question G:** Watershed geology and soils.

**Directions:** Contact the DES Lakes Program staff for assistance with identifying the percentages of bedrock and hydric soils in the shoreland area.

**Rationale:** The geology and soils within the watershed area are important characteristics to inventory because they dictate what type and where development can and should occur. For example, if bedrock were present it would be difficult or cost prohibitive to excavate a foundation for a home. Along the same lines, if wetland soils are present, then septic system placement should be prohibited.

**Process Followed:** Received a GIS data layer from Paul Susca, member of the Department of Environmental Services. Using ArcView, a computer mapping program, sort the data by its muname and separate out hydric soils and bedrock. By accessing the New Hampshire Soils Attribute Data Dictionary on the web at: [http://www.nh.nrcs.usda.gov/Soil\\_Data/Soil\\_Data](http://www.nh.nrcs.usda.gov/Soil_Data/Soil_Data); note the names of the soils that are classified as hydric and apply this to the data set. For bedrock, under the category of bedrock shallow, separate out only those which had a value of zero, which indicates that the bedrock is above ground. Using ArcView, calculate the area of hydric soils/bedrock.

**Findings and Analysis:**

Hydric Soil Types Include:

Borohemists ponded  
Chocorua mucky peat  
Limerick silt loam  
Lyme-moosilauke loams 0-3 percent slopes  
Lyme-moosilauke stony loams 0-3 percent slopes  
Lyme-moosilauke stony loams 3-8 percent slopes  
Naumburg loamy sand  
Ossipee mucky peat  
Pillsbury loam 0-3 percent slopes  
Pillsbury stony loam 0-3 percent slopes  
Pillsbury stony loam 3-8 percent slopes  
Rayham silt loam  
Rumney loam  
Saco silt loam  
Saco variant mucky silt loam  
Stissing silt loam 0-5 percent slope  
Stissing stony silt loam 0-3 percent slope  
Stissing stony silt loam 3-8 percent slope

Amount of hydric soil in Lake Sunapee Watershed = 2,602.999 acres or 4.14%

Amount of bedrock in Lake Sunapee Watershed = 1,281.878 acres or 8.41%

\*calculations based on Lake Sunapee Watershed totaling 30,947.739 acres

**Disclaimer for Soils Information (July, 2003)**

This Merrimack County Soils GIS coverage was produced by the USDA, Natural Resources Conservation Service (NRCS). It is a draft product and is being made available as a conditional interim release. It is subject to change and not finalized or deemed official for public distribution. This data is being distributed to Planning Commissions only and should not be distributed to others. Data users are responsible for obtaining the most current copy of the data.

This data was compiled at a scale of 1:24,000. Delineations depict the dominant soils occurring on the landscape at that scale. Inclusions of other soils too small to be delineated are present within delineations. There is no information on the specific locations of inclusions within delineations. Enlargements of these maps to scales greater than 1:24,000 is a misuse of the product and can cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soil that could have been shown at a larger scale. This soil information and interpretations derived from it are intended for broad planning purposes only. For site specific information, onsite sampling, testing and detailed studies are necessary.

For further information, contact the NRCS State Soil Scientist, Steve Hundley at (603)868-7581.

**Evaluation Criteria:**

**% of soils with impediments to development:**

- 1) 0%; based on soils only, entire watershed is suitable for development
- 2) <10%
- 3) 11 – 25%
- 4) 26 – 50%
- 5) >50%

Bedrock        4.14 %  
Hydric Soils    8.41 %

**Sources:**

Gagne, Deynce. (dgagneA@uvlsrc.org). "soils." E-mail to Stacey Philbrook (sphilbrook@colby-sawyer.edu). 10 Nov. 2003

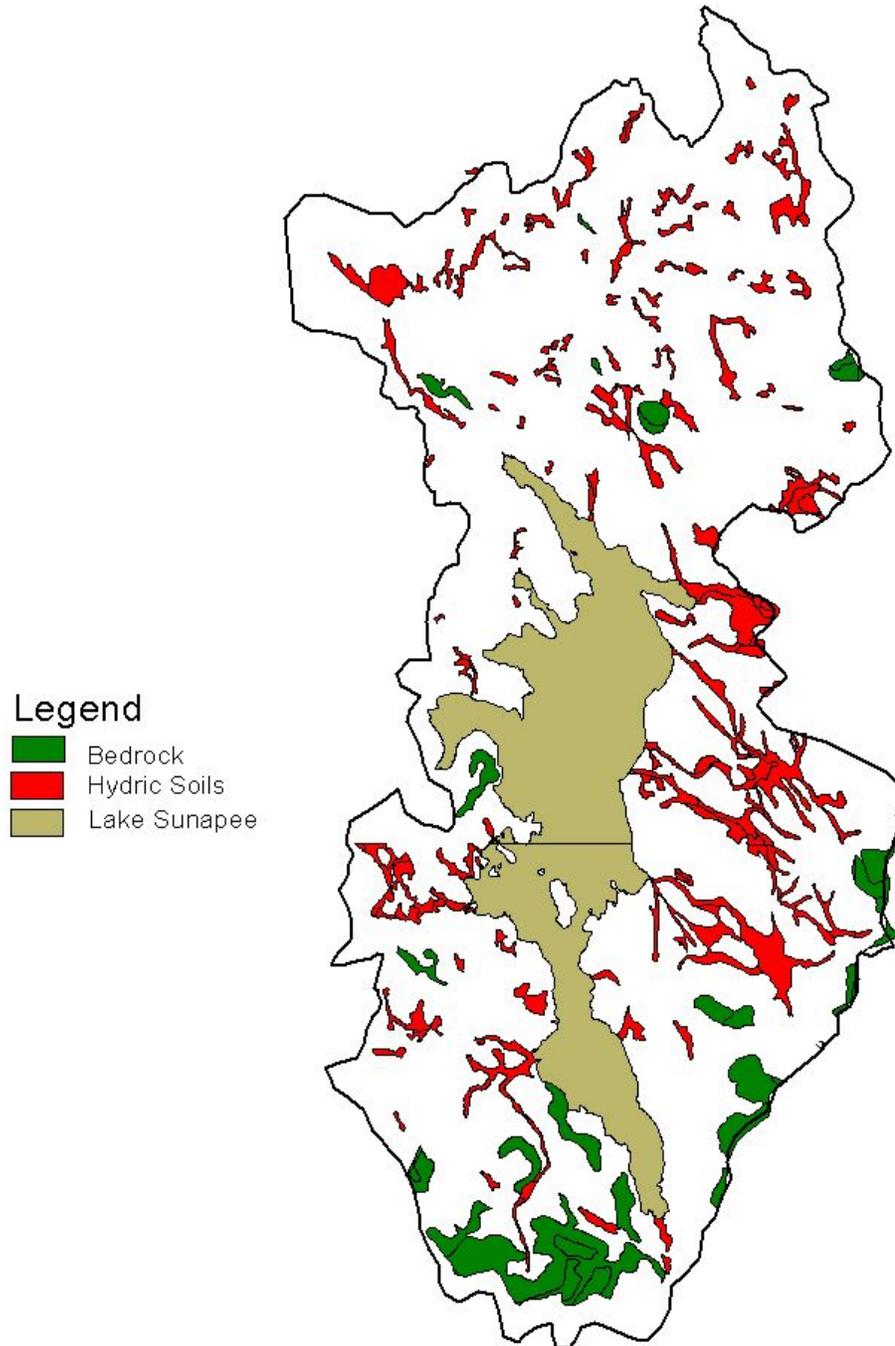
Susca, Paul. E-mail to John Callewaert (jcallewaert@colby-sawyer.edu). 26 April. 2003

**Assessment of Question:** This question was difficult because completed soils maps for the entire state of New Hampshire do not exist.

**Date Completed:** May 2003

**Investigator:** Matt Cummings & Stacey Philbrook

# Watershed Hydric Soils/Bedrock



**Attribute 9:** Watershed Characteristics

**Category:** Susceptibility to Impairment

**Question H:** Local land use regulatory measures.

**Directions:** Contact each of the municipalities immediately surrounding the watershed or consult the Office of State Planning to determine if the local floodplain, aquifer, wetland, and shoreland ordinances meet or exceed state standards. Listed below are potential protection measures that may be in place for some of the municipalities within the watershed. Complete the list for each of the municipalities within the watershed in order to assess the adequacy of the surface water protection measures.

**Rationale:** A comparison of local and state protection measures that apply to the lake or pond will provide an indication of the regulatory measures currently in place to ensure wise shoreland development and use. Also, reviewing town land use and development ordinances will hopefully increase local awareness of, and compliance with, the measures already in place to protect surface water quality. It may be important to identify certain land use practices or activities that are of particular concern so that the surrounding communities can address them in the future

**Process Followed:** Reviewed each town's zoning regulations and organized appropriate information into an Excel spreadsheet. Also obtained statewide regulations to make comparisons of whether the towns had adequate regulations.

**Findings and Analysis:** Refer to following chart for land use regulatory measures for the six towns involved in the Lake Sunapee Watershed, and for the state of New Hampshire's regulations. For the most part, the towns had established appropriate land use regulations, which either meet or exceed state requirements. The towns had a variety of emphasis on land use regulations. Towns that have lakefront property have regulations concerning such setbacks, whereas towns without shoreland do not share this emphasis. There were some instances where the town did not even have an existing regulation as a result of their geographical location. In the cases where regulations were non-existent, N/A (not applicable) was recorded. Although there are a few towns with 'N/A' filled in for an area of regulation, it does not necessarily mean that the town has inadequate regulations.

The towns either had adequate or exceptional land use regulations. By meeting and/or exceeding state regulations, these towns have recognized the potential for environmental impacts and with the establishment of such land use regulations are limiting the negative consequences. The difficulty in defining the adequacy of these regulations is that each town has slightly different objectives within the watershed. With three out of the six towns physically having waterfront property, their regulations are more focused on this aspect whereas the other three towns have minimal regulations as far as setbacks (which do not even pertain to Lake Sunapee). Also these regulations are established based on the entire town, not just what is in the watershed boundary. In rating the regulations of each town, not only were the setbacks compared to state

setbacks, but also the relativity of the land to the lake. N/A does not mean a town has inadequate regulations, merely that such regulations do not exist as a result of not having a reason to make such a regulation.

<b>Evaluation Criteria:</b>	<b>Score:</b>
1) One or more municipalities within the watershed has inadequate local land use regulations (i.e. only state and federal regulations apply)	5
2) All municipalities within the watershed have adequate local land use regulations (i.e. town ordinances comply with minimum state standard)	3
3) One or more municipalities within the watershed has exceptional land use regulations that exceed state standards	1

**Sources:**

Town of Goshen. Zoning Ordinance. Goshen: Town of Goshen, 2002.  
Town of New London. Zoning Ordinance. New London: Town of New London, 2001.  
Town of Newbury. Zoning Ordinance. Newbury: Town of Newbury, 2003.  
Town of Springfield. Zoning Ordinance. Springfield: Town of Springfield, 1997.  
Town of Sunapee. "Zoning Ordinance - Planning and Zoning." Sunapee, New Hampshire Dataspoke. 01 Dec. 2003  
<<http://www.town.sunapee.nh.us/planzone/zoningregs.htm>>  
Town of Sutton. Zoning Ordinance. Sutton: Town of Sutton, 2002.

**Assessment of Question:** The eight categories (lake and stream setback, shoreland setback, wetland setback, building setback, septic setback, erosion control provisions, minimum lot size, and slope development) seemed to be the most appropriate areas to examine if the towns met or exceeded state building regulations. Towns vary in how their regulations are setup and what types of land use regulations are emphasized. For towns not having lakefront property, it was difficult to write off that regulation as N/A.

While each town may have certain land use regulations, it is unknown if these regulations are enforced. The towns may have setback requirements, yet if there are no fines or consequences then property owners do not feel obliged to follow these zoning ordinances. A follow up to this question could include the consequences of not following town regulations. It should also be noted if land owners whether or not having lakefront property are made aware of their presence in the watershed and aware of all these regulations. In reference to the health of the lake system, these regulations are important for towns to follow.

**Date Completed:** November 2003

**Investigator:** Tamsen B Bolte

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

**Town Zoning**

	<b>Goshen</b>	<b>Newbury</b>	<b>New London</b>	<b>Springfield</b>	<b>Sunapee</b>	<b>Sutton</b>	<b>State</b>
<b>Lake and Stream Setback</b>	N/A	Min. of 50 ft.	N/A	50 ft.	N/A	150 ft.	50 ft.
<b>Shoreland Setback</b>	N/A	200 ft.	200 ft.	150 ft.	200 ft.	250 ft.	250 ft. (changed from 150 ft.)
<b>Wetland Setback</b>	N/A	None	Min of 100-200 ft. depending on wetland designation	N/A	N/A	75 ft.	N/A
<b>Building Setback</b>	N/A	75 ft.	50 ft.	N/A	50 ft.		50 ft.
<b>Septic Setback</b>	State Regulations	125 ft. (75 ft. w/ soil provisions)	125 ft. (75 ft. w/ soil provisions)	150 ft of any waterbody, 100 ft. of streams	125 ft. (75 ft. w/ soil provisions)	75, 100 or 125 ft. depending on soil type	125 ft. (75 ft. w/ soil provisions)
<b>Erosion Control Provisions</b>	N/A	Erosions and Sediment plan for all disturbances within 300 ft of lakes and streams	Erosion control plan for all disturbances within 50 ft. of shoreline	Ordinary erosion control by owner	Control plans for all land disturbances within shoreland overlay district	Detailed ECP	All projects must be "designed and constructed to prevent release of surface runoff across exposed mineral soils"
<b>Minimum Lot Size</b>	3 acres (Subdivisions can be <2)	Dependant on Soil Type	2, 4, 10, 25 acres for each zoning district	1.5 acres	.5, 1, 1.5, 3 acres for each zoning district	2 acres	N/A
<b>Slope Development</b>	not exceed 15-25%	not exceed 25% (except for Mt. Sunapee Recreation Overlay District)	not exceed 25%	Provisions for each slope percentage and soil type	N/A	N/A	not exceed 25%
<b>Rating of Regulations</b>	Inadequate	Adequate	Exceptional	Adequate	Adequate	Exceptional	

**Attribute 9:** Watershed Characteristics

**Category:** Unique or Outstanding Value

**Question H:** Local land use regulatory measures.

**Directions:** Contact each of the municipalities immediately surrounding the watershed or consult the Office of State Planning to determine if the local floodplain, aquifer, wetland, and shoreland ordinances meet or exceed state standards. Listed below are potential protection measures that may be in place for some of the municipalities within the watershed. Complete the list for each of the municipalities within the watershed in order to assess the adequacy of the surface water protection measures.

**Rationale:** A comparison of local and state protection measures that apply to the lake or pond will provide an indication of the regulatory measures currently in place to ensure wise shoreland development and use. Also, reviewing town land use and development ordinances will hopefully increase local awareness of, and compliance with, the measures already in place to protect surface water quality. It may be important to identify certain land use practices or activities that are of particular concern so that the surrounding communities can address them in the future

**Process Followed:** Compiled each town's zoning regulations and organized the pertinent information in to an Excel spreadsheet. By finding the state regulations, each town could be compared to see if they meet or exceed state regulations..

**Findings and Analysis:** See Table Titled “Town Zoning”

The six towns in the Lake Sunapee watershed have for the most part developed land use and zoning measures that meet or exceed state regulations. Any town that didn't have any regulations on record for the particular field was given a rating of N/A, or not applicable. After examining all of the different ratings and using the grading scale listed in the inventory, each town was rated accordingly.

Each town in the watershed that has adequate or exceptional ratings has recognized the threat on the environment that new buildings propose. It was difficult to rate each town because each town has different natural features and goals as far as future development. With only three of six towns even having property on Lake Sunapee, waterfront setbacks are somewhat irrelevant. The town of Goshen was the only one that was given a rating of inadequate, because there were no lakes and streams, shoreland, or wetland setbacks. However, there is no shoreland or lake front in Goshen within the small piece within the watershed that could be found. So, although they don't have proper regulations, some are not applicable. These regulations are also for the entire town, not just the area within the watershed

**Evaluation Criteria:**

- 1) One or more municipalities within the watershed has inadequate local land use regulations (i.e. only state and federal regulations apply)

**Score:**

1

- |   |   |
|---|---|
| 2) All municipalities within the watershed have adequate local land use regulations (i.e. town ordinances comply with minimum state standard) | 3 |
| 3) One or more municipalities within the watershed has exceptional land use regulations that exceed state standards                           | 5 |

**Sources:**

Town of Goshen . Zoning Ordinance. Goshen: Town of Goshen, 2002.  
Town of New London. Zoning Ordinance. New London: Town of New London, 2001.  
Town of Newbury. Zoning Ordinance. Newbury: Town of Newbury, 2003.  
Town of Springfield. Zoning Ordinance. Springfield: Town of Springfield, 1997.  
Town of Sunapee, . "Zoning Ordinance - Planning and Zoning." Sunapee, New Hampshire Dataspoke. 01 Dec. 2003  
<<http://www.town.sunapee.nh.us/planzone/zoningregs.htm>>  
Town of Sutton. Zoning Ordinance. Sutton: Town of Sutton, 2002.

**Assessment of Question:** This question helps to show what towns are doing to help prevent irresponsible building practices, as well as environmental preservation. More detailed building requirements and setbacks, will promote environmentally conscious building and preservation of resources. The hardest part about these limitations are enforcing them, and making sure offenders are properly reprimanded. Another important aspect of this issue is, what are the penalties and who is responsible for enforcing them?

**Date Completed:** November 2003

**Investigator:** Greg Van Steinburgh

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

**Town Zoning**

	<b>Goshen</b>	<b>Newbury</b>	<b>New London</b>	<b>Springfield</b>	<b>Sunapee</b>	<b>Sutton</b>	<b>State</b>
<b>Lake and Stream Setback</b>	N/A	Min. of 50 ft.	N/A	50 ft.	N/A	150 ft.	50 ft.
<b>Shoreland Setback</b>	N/A	200 ft.	200 ft.	150 ft.	200 ft.	250 ft.	250 ft. (changed from 150 ft.)
<b>Wetland Setback</b>	N/A	None	Min of 100-200 ft. depending on wetland designation	N/A	N/A	75 ft.	N/A
<b>Building Setback</b>	N/A	75 ft.	50 ft.	N/A	50 ft.		50 ft.
<b>Septic Setback</b>	State Regulations	125 ft. (75 ft. w/ soil provisions)	125 ft. (75 ft. w/ soil provisions)	150 ft of any waterbody, 100 ft. of streams	125 ft. (75 ft. w/ soil provisions)	75, 100 or 125 ft. depending on soil type	125 ft. (75 ft. w/ soil provisions)
<b>Erosion Control Provisions</b>	N/A	Erosions and Sediment plan for all disturbances within 300 ft of lakes and streams	Erosion control plan for all disturbances within 50 ft. of shoreline	Ordinary erosion control by owner	Control plans for all land disturbances within shoreland overlay district	Detailed ECP	All projects must be "designed and constructed to prevent release of surface runoff across exposed mineral soils"
<b>Minimum Lot Size</b>	3 acres (Subdivisions can be <2)	Dependant on Soil Type	2, 4, 10, 25 acres for each zoning district	1.5 acres	.5, 1, 1.5, 3 acres for each zoning district	2 acres	N/A
<b>Slope Development</b>	not exceed 15-25%	not exceed 25% (except for Mt. Sunapee Recreation Overlay District)	not exceed 25%	Provisions for each slope percentage and soil type	N/A	N/A	not exceed 25%
<b>Rating of Regulations</b>	Inadequate	Adequate	Exceptional	Adequate	Adequate	Exceptional	

**Attribute 9:** Watershed Characteristics

**Category:**

**Question I:** Drainage Network (stream order classification)

**Directions:** Contact the DES Lakes Program staff for assistance with determining the stream or river draining into the waterbody with the highest “order” ranking.

**Rationale:** In completing this question it is hoped that you will gain a better understanding of the lake or pond’s relative position (order) in transferring water to its ultimate destination. Answering this question will increase awareness of the waterways that supply and receive the water to and from the waterbody, respectively.

**Process Followed:** Used Arc View, to construct a map of Lake Sunapee and all tributary streams. Counted total number of each tributary stream category, and recorded it below.

**Findings and Analysis:**

Tributary Stream Ranking	Number Found
1 <sup>st</sup> Order	120
2 <sup>nd</sup> Order	33
3 <sup>rd</sup> Order	7

The lake qualifies as a “stream-fed” lake, because no single defining stream or river feeds into it. This is a good thing because many different waterbodies are contributing to one large waterbody. This lowers the chance of a point pollution crisis.

**Evaluation Criteria:**

**Highest order rank or stream or river:**

- 1) 1<sup>st</sup>
- 2) 2<sup>nd</sup>
- 3) 3<sup>rd</sup>
- 4) 4<sup>th</sup>
- 5) 5th or higher

**Sources:**

Estabrook, Robert, NH DES. Phone Interview. November 2003.

"GRANIT." Complex Systems Research Center, Institute for the Study of Earth, Oceans, and Space, and University of New Hampshire. 22 Oct 2003  
<http://www.granit.sr.unh.edu/>

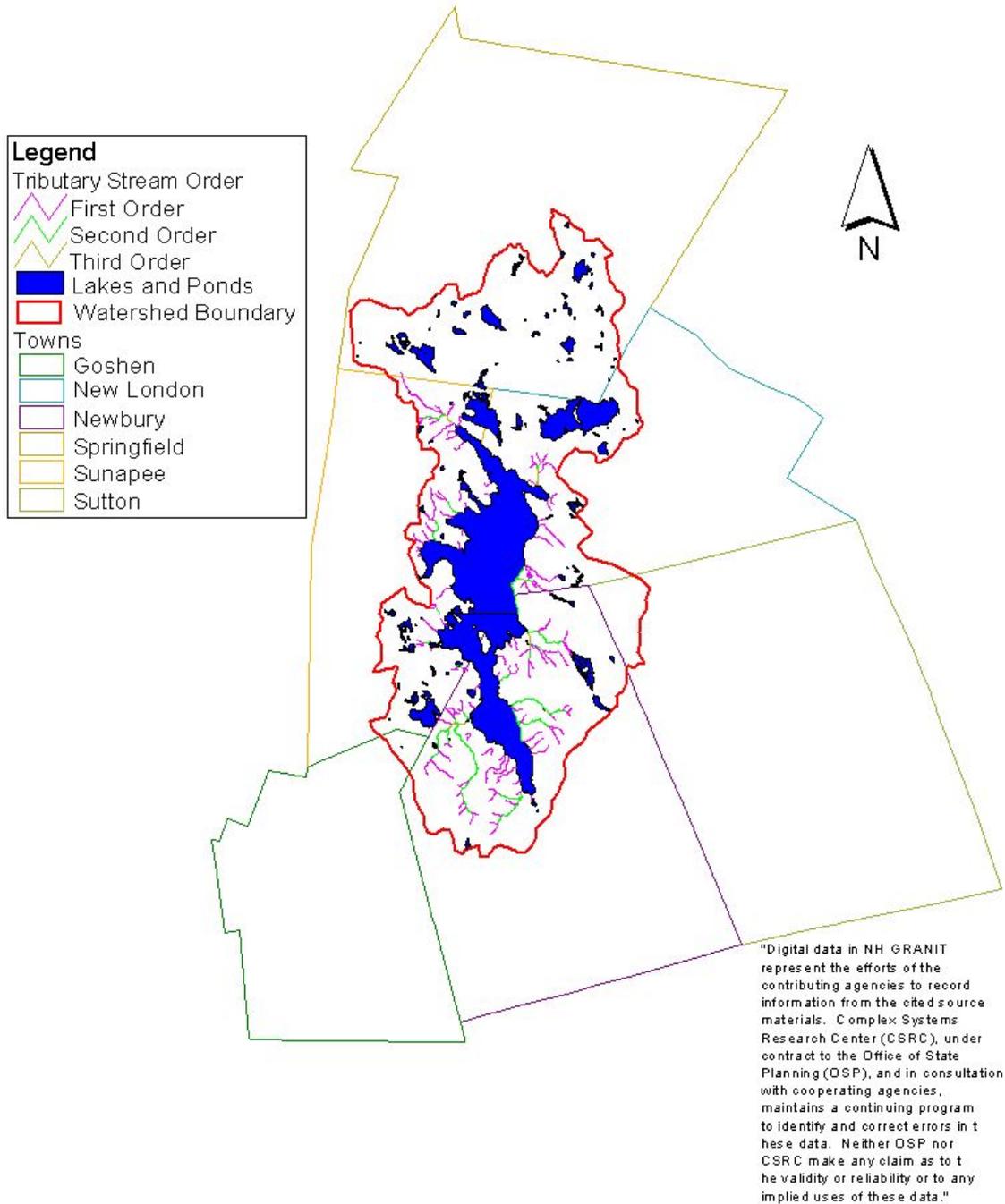
**Assessment of Question:** The question is adequate as stated.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings

Institute for Community and Environment  
Colby-Sawyer College

# Tributary Stream Order



**Attribute 9:** Watershed Characteristics

**Category:** Susceptibility to Impairment

**Question J:** Rate of watershed development.

**Directions:** Consult town planning boards, town Master Plans, regional planning commissions, or the NH Office of State Planning to obtain an estimate of the rate of development within the most recent 10 year period and within the immediate watershed area. Note whether the estimate is based upon acre/year or building permits/year.

**Rationale:** Knowing the rate of development within the watershed can help prioritize planning goals and objectives. Establishing development guidance priorities is the most efficient use of limited resources and is beneficial in protecting the natural characteristics of the waterbody.

**Process Followed:** Two processes were followed in developing the final conclusions about the rate of development within the watershed, which included a windshield survey and a collection of new home building permits from each of the six towns. The windshield survey incorporated the use of a 1987 USGS Topographic map that displayed existing buildings and roads. The next step was to cover the entire watershed via vehicle and map new development and new roads on the same map. In completing the windshield survey, the new information was digitized onto the original topographic map. This allows for a visual representation of where the development is occurring. With this information the number of new homes can also be calculated and measured against the number of homes present 17 years ago.

The next step in assessing rate of development was to examine new home building permits issued by each of the towns in the watershed. Ultimately gathering this data back from 1987 until the present was the objective, as to as most accurately display rate of development. However due to different methods in how individual towns keep track of their building permit records; adjustments had to be made in conjunction with the information that was obtainable. For some towns, receiving information from the town halls concerning building permits was available as far back as 1987, however some towns only had information backed up to 1997. In order to satisfy the needs of consistency, examining the number of building permits from 1997 to 2003 was instituted. Another adjustment that had to be accommodated for was that building permits could not be divided into in-the-watershed and out-of-the-watershed development. Instead the building permits were collected for the entire town in all six towns. One more key factor in looking at the number of permits by town is that with the exception of Springfield, all of the other towns represent permits issued for new homes. Springfield does not keep records of what the building permits were issued for; therefore these numbers are an overestimated of the actual number of new homes in this town.

**Findings and Analysis:** The Lake Sunapee Watershed has experienced approximately a 24% increase in the number of homes, from 2,324 in 1987 to 2,865 in 2004. . The total number of new building permits issued from 1997 to 2003 was 1,126. This total number needs to be carefully taken into consideration, since this number represents the number of new homes in the six town's entire area, within and outside the watershed boundary. Although there is this variable, the overall growth can still display the increase in development for the land around the watershed. Below is a table of the number of building permits issued by town and the totals:

	<b>Goshen</b>	<b>Newbury</b>	<b>New London</b>	<b>Springfield</b>	<b>Sunapee</b>	<b>Sutton</b>	<b>Totals</b>
<b>1997</b>	2	15	30	44	25	2	118
<b>1998</b>	4	16	34	43	24	10	131
<b>1999</b>	5	26	27	66	15	15	154
<b>2000</b>	11	25	23	74	30	25	188
<b>2001</b>	9	28	14	64	22	12	149
<b>2002</b>	6	33	25	61	20	32	177
<b>2003</b>	9	46	32	68	30	24	209
<b>Totals</b>	<b>46</b>	<b>189</b>	<b>185</b>	<b>420</b>	<b>166</b>	<b>120</b>	<b>1126</b>

There is an attached graph to display this growth by town.

2004 Total Homes	2,865
1987 Total Homes	2,324
<b>Difference</b>	<b>541</b>
<b>Percent Change in 17 years</b>	<b>24%</b>

Attached is a graph of that displays the total number of new homes for all the towns in conjunction with the Dow Jones Industrial. It is interesting to follow the peaks and dips in the stock market with the number of new homes being built. Overall there is a trend of the number of new homes being on the rise per year. This trend is what needs to be watched for future development, which also implies more degradation to the lake system.

What is useful to note for future planning, more so than the percent increase, is where the development is taking place. This can be examined by using the older topographic maps with the addition of the new homes. Highlighting them in a different color will enable for a visual assessment of where the development is taking place.

**Evaluation Criteria:**

- 1) >25%/year
- 2) 15-15%/ year
- 3) 7-15%/year
- 4) 0-7%/ year
- 5) None within the past 5 years

**Sources:**

Goshen Town Office, Building Permit Records  
Newbury Town Office, Building Permit Records  
New London Town Office, Building Permit Records  
Sunapee Town Office, Building Permit Records  
Sutton Town Office, Building Permit Records  
Springfield Town Office, Building Permit Records  
"Welcome to NH Granit." 10 Nov. 2003 <<http://www.granit.sr.unh.edu>>

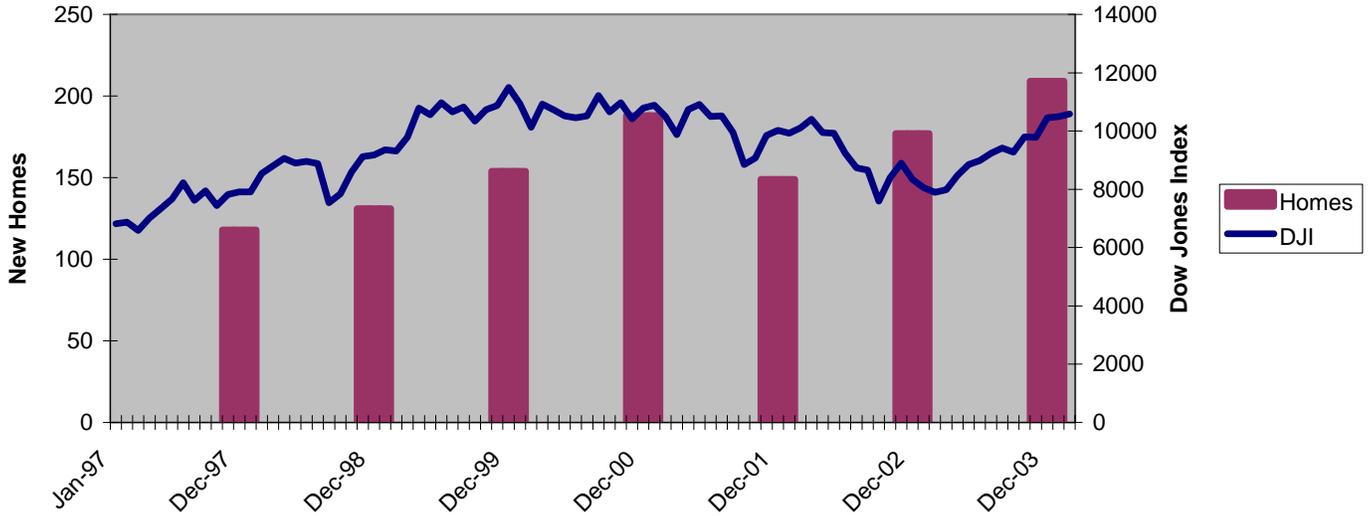
**Assessment of Question:** This question requires more complex research and evaluation than the directions offer. There are inconsistencies among town offices and the other resources offered, which make it difficult to obtain accurate results. One of the major issues found was that most town offices did not give a percentage; rather they responded with, "high," "medium," or "low," which can not be measured. To avoid any misleading results, the process followed was the best attempt at obtaining the most accurate results.

Another difficulty encountered involves the evaluation criteria because it only asks for the percent increase per year. This was unattainable information; therefore, the criterion was not used. A different measurement needs to be instituted to make this question more valuable.

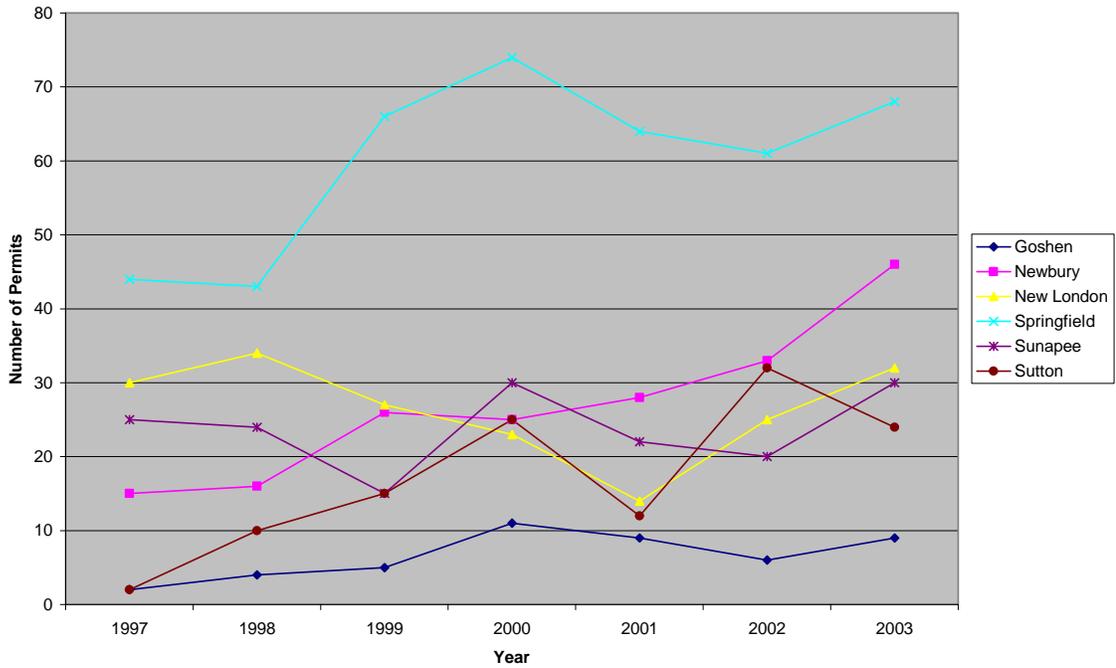
**Date Completed:** April 2004

**Investigator:** Tamsen B Bolte

### New Homes and the Stock Market



### New Home Building Permits by Town



**Attribute 9:** Watershed Characteristics

**Category:** Susceptibility to Impairment

**Question J:** Rate of watershed development.

**Directions:** Consult town planning boards, town Master Plans, regional planning commissions, or the NH Office of State Planning to obtain an estimate of the rate of development within the most recent 10 year period and within the immediate watershed area. Note whether the estimate is based upon acre/year or building permits/year.

**Rationale:** Knowing the rate of development within the watershed can help prioritize planning goals and objectives. Establishing development guidance priorities is the most efficient use of limited resources and is beneficial in protecting the natural characteristics of the waterbody.

**Process Followed:** Two processes were followed in developing the final conclusions about the rate of development within the watershed, which included a windshield survey and a collection of new home building permits from each of the six towns. The windshield survey incorporated the use of a 1987 USGS Topographic map that displayed existing buildings and roads. The next step was to cover the entire watershed by vehicle and map new development and new roads on the 1987 map. After completing the windshield survey, the newly gathered information was digitized onto the original topographic map. This gave us a visual representation of where development is occurring, and with this information the number of new homes could be calculated and measured against the number of homes present 17 years ago. We used this data to look at the development in the entire watershed, and just in the shoreland using a 250' buffer.

The next step in assessing rate of development was to examine new home building permits issued by each of the towns in the watershed. We had hoped to gather this data back to 1987 to correlate to the windshield survey, but found that to be impossible because of the way individual towns keep track of their building permit records. For some towns, gathering information from the town halls concerning building permits was available as far back as 1987, however some towns only had information backed up to 1997. In order to be consistent, we examined the number of building permits from 1997 to 2003 for each of the towns. We were not able to determine in-the-watershed and out-of-the-watershed development. Instead the building permits were collected for the entire town in all six towns. One limitation to our data is that the town of Springfield does not keep their building permits separate for new construction and other types of building requiring permits, whereas all of the other towns represent permits issued for new homes. The reader should keep in mind then, that our numbers could be overstating the number of new homes in this town.

**Findings and Analysis:** The Lake Sunapee Watershed has experienced approximately a 24% increase in the number of homes, from 2,324 in 1987 to 2,865 in 2004. . The total number of new building permits issued from 1997 to 2003 was 1,126. This total number needs to be carefully taken into consideration, since this number represents the number of new homes in the six town's entire area, within and outside the watershed boundary. Although there is this variable, the overall growth can still display the increase in development for the land around the watershed. Below is a table of the number of building permits issued by town and the totals:

	<b>Goshen</b>	<b>Newbury</b>	<b>New London</b>	<b>Springfield</b>	<b>Sunapee</b>	<b>Sutton</b>	<b>Totals</b>
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There is an attached graph to display this growth by town.

2004 Total Homes	2,865
1987 Total Homes	2,324
<b>Difference</b>	<b>541</b>
<b>Percent Change in 17 years</b>	<b>24%</b>

Attached is a graph of that displays the total number of new homes for all the towns in conjunction with the Dow Jones Industrial. It is interesting to follow the peaks and dips in the stock market with the number of new homes being built. Overall there is a trend of the number of new homes being on the rise per year. This trend is what needs to be watched for future development, which also implies more degradation to the lake system.

What is useful to note for future planning, more so than the percent increase, is where the development is taking place. This can be examined by using the older topographic maps with the addition of the new homes. Highlighting them in a different color will enable for a visual assessment of where the development is taking place.

**Evaluation Criteria:**

- 1) >25%/year
- 2) 15-15%/ year
- 3) 7-15%/year
- 4) 0-7%/ year
- 5) None within the past 5 years

**Sources:**

Goshen Town Office, Building Permit Records  
Newbury Town Office, Building Permit Records  
New London Town Office, Building Permit Records  
Sunapee Town Office, Building Permit Records  
Sutton Town Office, Building Permit Records  
Springfield Town Office, Building Permit Records  
"Welcome to NH Granit." 10 Nov. 2003 <<http://www.granit.sr.unh.edu>>

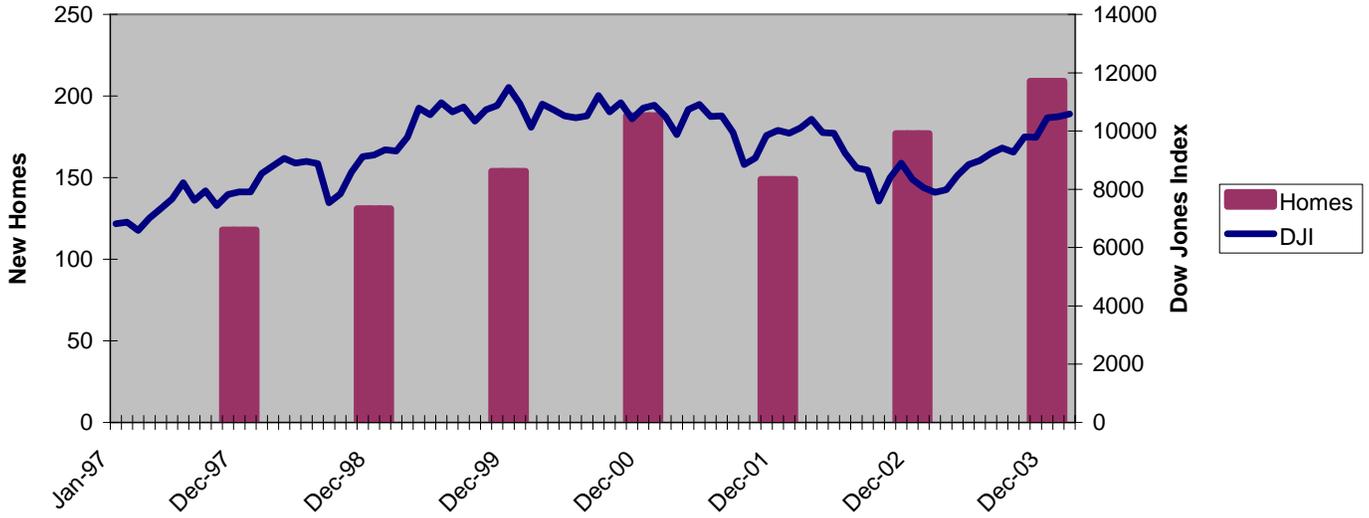
**Assessment of Question:** This question requires more complex research and evaluation than the directions offer. There are inconsistencies among town offices and the other resources offered, which make it difficult to obtain accurate results. One of the major issues found was that most town offices did not give a percentage; rather they responded with, "high," "medium," or "low," which can not be measured. To avoid any misleading results, the process followed was the best attempt at obtaining the most accurate results.

Another difficulty encountered involves the evaluation criteria because it only asks for the percent increase per year. This was unattainable information; therefore, the criterion was not used. A different measurement needs to be instituted to make this question more valuable.

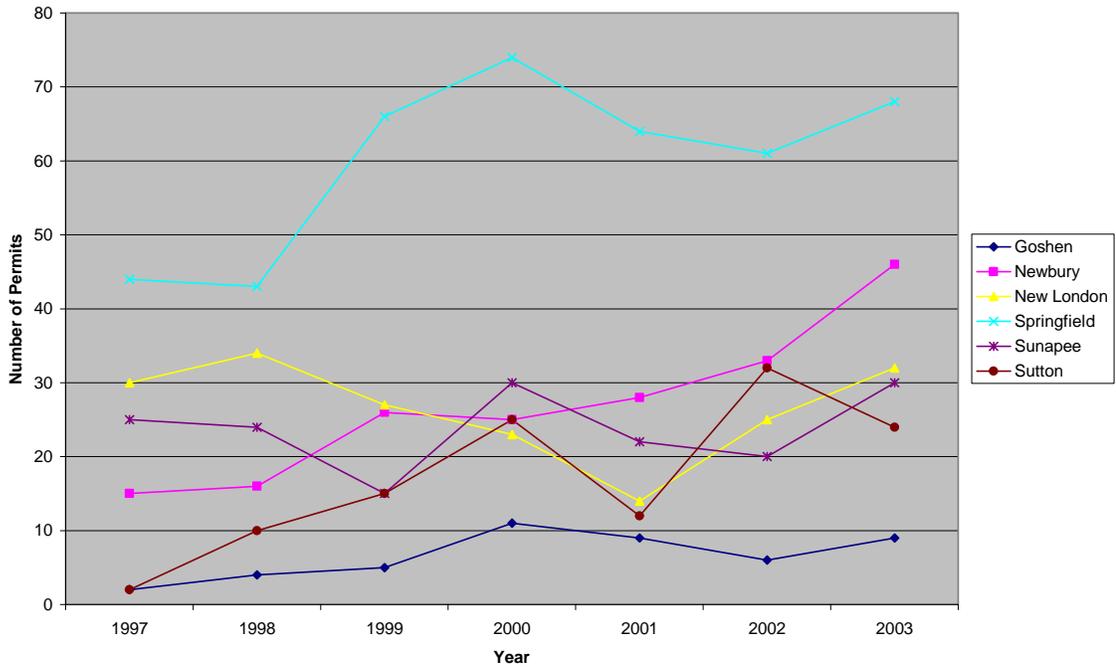
**Date Completed:** April 2004

**Investigator:** Tamsen B Bolte

### New Homes and the Stock Market



### New Home Building Permits by Town



**Attribute 10:** Visual/Aesthetic Characteristics

**Category:** Recreation

**Question A:** Scenic or natural features of interest visible from waterbody.

**Directions:** Record the name(s) and locations (s) of any significant scenic or natural features of interest that can be viewed from the waterbody.

**Rationale:** The presence of significant scenic or natural features of interest that can be viewed from the waterbody.

**Process Followed:** Took tour of the waterbody on a personal boat, marking visible natural features of interest on a map. Used ArcView to construct a map with names and locations of each. (See attachment). Contacted Aimee Ayers of the LSPA and the Lake Sunapee Yacht Club in reference to points of interest known to both organizations.

**Findings and Analysis:**

Mountains: Mount Kearsarge, Mount Sunapee, Black Mountain, Ragged Mountain, Blueberry Mountain, Bald Sunapee,

Points: Tilson's Point, Seminole Point,

Lighthouse: Burke Haven Lighthouse, Loon Island Lighthouse, Herrick Cove Lighthouse

Hills visible: Davis Hill, Oak Hill, Royal Arch Hill, Burpee Hill, Carver Hill, Garnett Hill, King Hill, Sunset Hill, Burkehaven Hill, Keyser Hill, Baker Hill, Grace Hill

Beaches: Soo Nipi Beach, State Park Beach

Islands: Twin Island, Star Island, Great Island, Little Island, Isle of Pines

Other: Pine Cliff, The Fells (John Hay Estate), Eagles Nest, Split Rock

**Evaluation Criteria:**

**Score:**

1) None	1
2) At least 1	2
3) At least 2	3
4) At least 3	4
5) >3	5

**Sources:**

Ayers, Amy. Personal Interview. 10 Nov 2003.

"Lake Sunapee Yacht Club." 15 Nov. 2003 <<http://www.lsync.net/pages/local.html>>

"GRANIT." Complex Systems Research Center. University of New Hampshire. 22 Oct. 2003 <<http://www.granit.sr.unh.edu/>>

**Assessment of Question:** This is an important question because it deals with aesthetically pleasing points of interest from the waterbody. These places are mostly accessible via trails. These locations are important to identify and preserve because of the aesthetic features, as well as the natural habitat each provides. Increased use could pose a threat to the watershed, due to littering, higher tourist rates, and other threats

tourists/hikers pose to their surroundings when in the woods. Not developing these points of interest, or not further developing these points will preserve the aesthetic and habitual qualities each possess, respectively.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings, Stacey Philbrook, Matthew Cummings

**Attribute 10:** Visual/Aesthetic Characteristics

**Category:** Unique or Outstanding Value

**Question A:** Scenic or natural features of interest visible from waterbody

**Directions:** Record the name(s) and locations (s) of any significant scenic or natural features of interest that can be viewed from the waterbody.

**Rationale:** The presence of significant scenic or natural features of interest that can be viewed from the waterbody.

**Process Followed:** Took tour of the waterbody on a personal boat, marking visible natural features of interest on a map. Used ArcView to construct a map with names and locations of each. (See attachment). Contacted Aimee Ayers of the LSPA and the Lake Sunapee Yacht Club in reference to points of interest known to both organizations.

**Findings and Analysis:**

Mountains: Mount Kearsarge, Mount Sunapee, Black Mountain, Ragged Mountain, Blueberry Mountain, Bald Sunapee,

Points: Tilson's Point, Seminole Point,

Lighthouse: Burke Haven Lighthouse, Loon Island Lighthouse, Herrick Cove Lighthouse

Hills visible: Davis Hill, Oak Hill, Royal Arch Hill, Burpee Hill, Carver Hill, Garnett Hill, King Hill, Sunset Hill, Burkehaven Hill, Keyser Hill, Baker Hill, Grace Hill

Beaches: Soo Nipi Beach, State Park Beach

Islands: Twin Island, Star Island, Great Island, Little Island, Isle of Pines

Other: Pine Cliff, The Fells (John Hay Estate), Eagles Nest, Split Rock

**Evaluation Criteria:**

**Score:**

5) None	1
6) At least 1	2
7) At least 2	3
8) At least 3	4
5) >3	5

**Sources:**

Ayers, Amy. Personal Interview. 10 Nov 2003.

"Lake Sunapee Yacht Club." 15 Nov. 2003 <<http://www.lsync.net/pages/local.html>>

"GRANIT." Complex Systems Research Center. University of New Hampshire. 22 Oct. 2003 <<http://www.granit.sr.unh.edu/>>

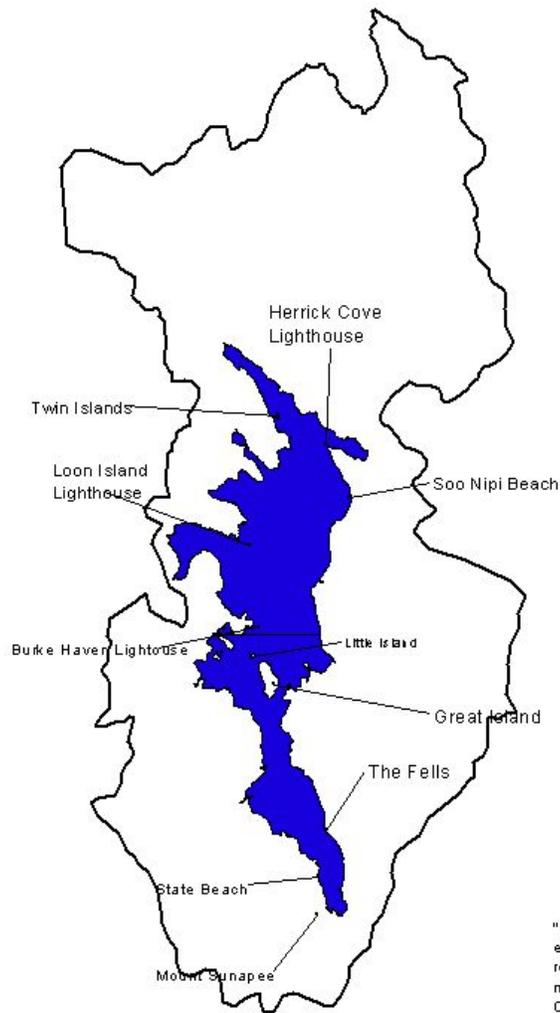
**Assessment of Question:** This is an important question because it deals with aesthetically pleasing points of interest from the waterbody. These places are mostly accessible via trails. These locations are important to identify and preserve because of the aesthetic features, as well as the natural habitat each provides. Great deals of use could pose a threat to the watershed, due to littering, higher tourist rates, and other threats

tourists/hikers pose to their surroundings when in the woods. Not developing these points of interest, or not further developing these points will preserve the aesthetic and habitual qualities each possess, respectively.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings, Stacey Philbrook, Matthew Cummings

# Selected Scenic Features Visible from Waterbody



"Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."

**Attribute 10:** Visual/Aesthetic Characteristics

**Category:**

**Question B:** Scenic viewing opportunities of the waterbody.

**Directions:** Using a map of your waterbody, mark the scenic locations from which the lake or pond can be viewed (ex. roadway pullovers, public parks, access sites, and public beaches) by the general public. Visit each location and on the same map shade in the area of the waterbody you are able to view from that spot. After visiting each location and shading in the area viewed, use the map to estimate the total percent of the lake viewed (percent of map that is shaded).

**Rationale:** Viewing areas allow the general public to gain an appreciation for the natural beauty of a lake or pond. Over time, these areas may also permit an evaluation of changes in land use along the visible shoreline.

**Process Followed:** Contacted Laura Alexander, adjunct instructor of Community and Environmental Studies at Colby-Sawyer College, and John Callewaert, Director of the Institute for Community and Environment at Colby-Sawyer College, to produce a list of locations for scenic viewing opportunities. Took photographs of the site's views, see attached pictures.

**Findings and Analysis:** There are no official public viewing opportunities in the Lake Sunapee Watershed though the lake can be seen from many locations. There were no viewing opportunities for the general public in the following towns: New London, Springfield, Sutton, and Goshen.

The scenic sites included:

- Mt. Sunapee (the entire lake can be viewed)
- The Fells
- Sunset Hill, Route 103A (across from the Fells)
- Newbury Harbor
- Sunapee State Beach
- Sunapee Harbor
- Dewey Beach
- Georges Mills Harbor

**Evaluation Criteria:**

- 1) No scenic viewing opportunities
- 2) Scenic viewing area(s) collectively allow <25% of waterbody to be observed
- 3) Scenic viewing area(s) collectively allow 25 – 50% of waterbody to be observed
- 4) Scenic viewing area(s) collectively allow 50 – 75% of waterbody to be observed
- 5) Scenic viewing area(s) collectively allow >75% of waterbody to be observed

**Sources:**

Alexander, Laura. Personal Interview. 24 Nov. 2003.

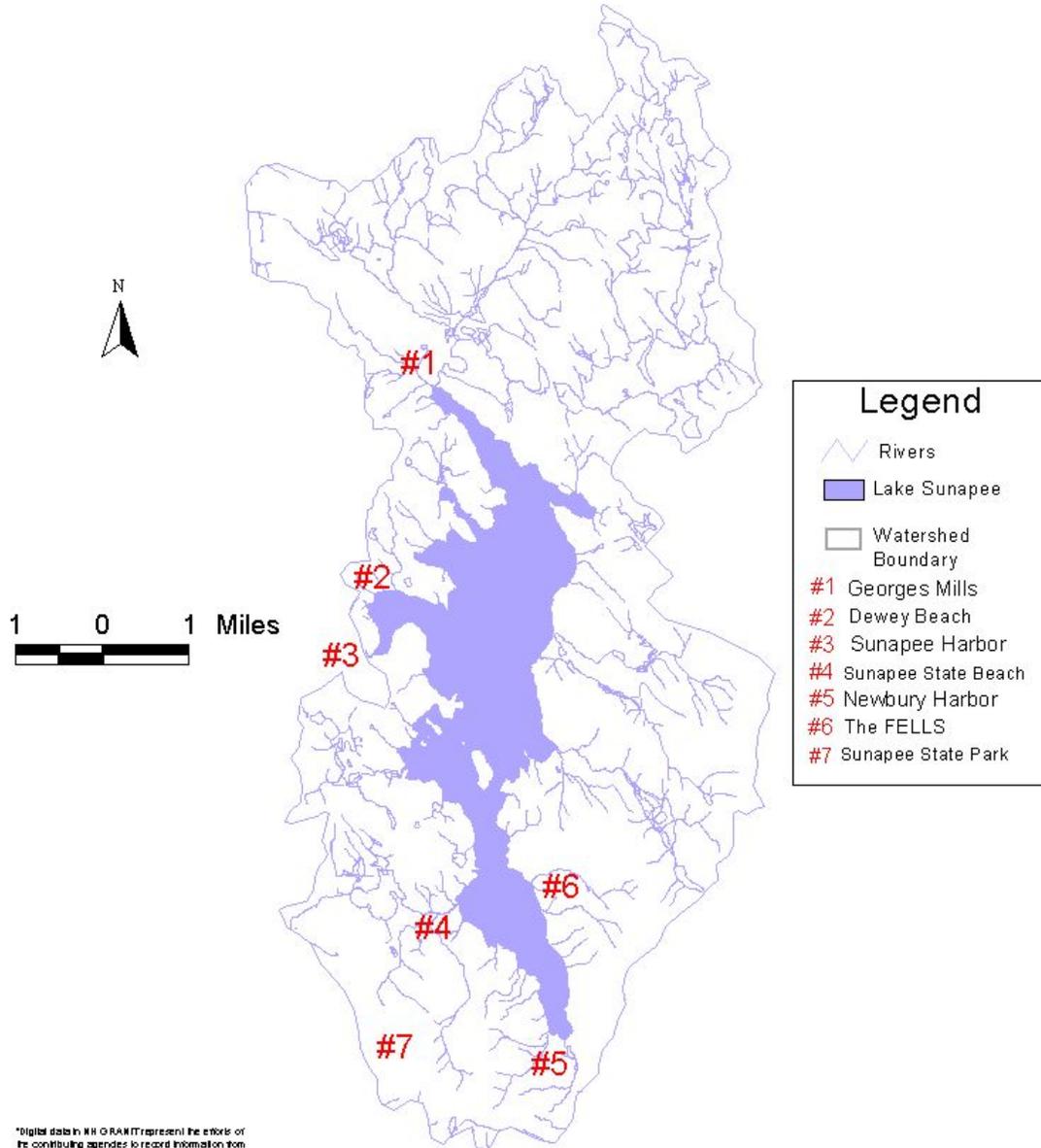
Callewaert, John. Personal Interview. 24 Nov. 2003.  
"GRANIT." Complex Systems Research Center. University of New Hampshire. 22 Oct.  
2003 <<http://www.granit.sr.unh.edu/>>

**Assessment of Question:** The question can easily be interpreted in different ways by different people. There could be a difference of opinion between someone who is accustomed with the area and someone who is not.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

# Scenic Viewing Areas



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Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory



Georges Mills Harbor  
#1



Dewey Beach  
#2



Sunapee Harbor  
#3



Sunapee State Beach  
#4



Newbury Harbor  
#5



The FELLS  
#6



Mt. Sunapee  
#7

**Attribute 10:** Visual/Aesthetic Characteristics

**Category:**

**Question C:** Noise level at scenic viewing areas.

**Directions:** Gauge the levels of natural and unnatural detectable sounds at each of the scenic viewing areas identified above.

**Rationale:** The level of desirable noise varies from person to person, however noisy viewing areas, such as those next to busy roadways, will be less aesthetically pleasing than areas set in more remote areas.

**Process Followed:** Contacted Laura Alexander, adjunct instructor of Community and Environmental Studies at Colby-Sawyer College, and John Callewaert, Director of the Institute for Community and Environment at Colby-Sawyer College, to produce a list of locations for scenic viewing opportunities. Visited all sites (in November) and determined where noise would generate from during the summer months.

**Findings and Analysis:** Roadways and boat traffic were among the top concerns for noise. Some locations for example, The Fells and Sunset Hill, experienced only natural sounds while sites including town harbors and beaches were noisy due to people and motors.

**Evaluation Criteria:**

- 1) High; unnatural sounds predominate (i.e. constant traffic, industrial, construction)
- 2) Moderate; some unnatural sounds audible (i.e. occasional nearby traffic, diffuse constant traffic noise, distant industrial noise)
- 3) Low; natural sounds predominate (i.e. birds, wildlife, winds)

**Sources:**

Alexander, Laura. Personal Interview. 24 Nov. 2003.  
Callewaert, John. Personal Interview. 24 Nov. 2003.

**Assessment of Question:** The question can easily be interpreted in different ways by different people. There could be a difference of opinion between someone who is accustomed with the area and someone who is not.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

**Attribute 10:** Visual/Aesthetic Characteristics

**Category:**

**Question D:** Dominant land use visible from waterbody

**Directions:** Estimate the percentage of visible undeveloped, agricultural, residential, and commercial land uses within the watershed from the waterbody. If you cannot view the entire watershed from one point, choose a variety of points on the waterbody. Using a map of the entire watershed, including the waterbody, mark your location. In different colors shade in the types of land uses you see (undeveloped, agricultural, residential, and commercial). In the end you should have a map of visible land uses within your watershed as seen from the waterbody. Looking at the outline of the total **viewable** area of the watershed and comparing it to the areas of land use types that were shaded in, estimate the percentage for each type of land use viewed.

**Rationale:** Lakes and ponds that have little visible development tend to be more aesthetically pleasing than waterbodies with a heavily developed visible landscape surrounding them.

**Process Followed:** Drove around waterbody, taking pictures and viewing the land use from nine locations around the waterbody. These locations were: Georges Mills, Dewey Beach, Sunapee Harbor, Fishers Bay, the State Beach, Newbury Harbor, The Hay Estate (Fells), Soo Nipi Beach, and the Ledges. Used ArcView to construct map and estimate the land usage area of each type of land use.

Note\*: See map included on following page.

**Findings and Analysis:** Found the majority of the land use visible from the waterbody to be forested- 21%. Found the residential usage to be 14% and the commercial land use to be 1%. No land visible from the waterbody is used as agricultural land. The amount of forested land shows the amount of undeveloped land visible within the watershed. Further development in these areas should be of some concern. The lack of agricultural land visible use in the watershed is a good thing, because there is not a large amount of fertilizers and pesticides flowing in to the waterbody.

Estimated percent:

- 1) % forested: 21%
- 2) % agricultural: N/A
- 3) % residential: 14%
- 4) % commercial: 1%

**Evaluation Criteria:**

- 1) Commercial or urban development dominates visible landscape
- 2) Densely clustered residential development and occasional commercial land uses dominates visible landscape
- 3) Residential and/or commercial development present and visible but interspersed with forested or other natural land use types

- 4) Low density residential development present without any commercial development, but visible landscape dominated by natural vegetation and undisturbed land
- 5) Entire visible landscape dominated by natural vegetation and undisturbed land.

**Sources:**

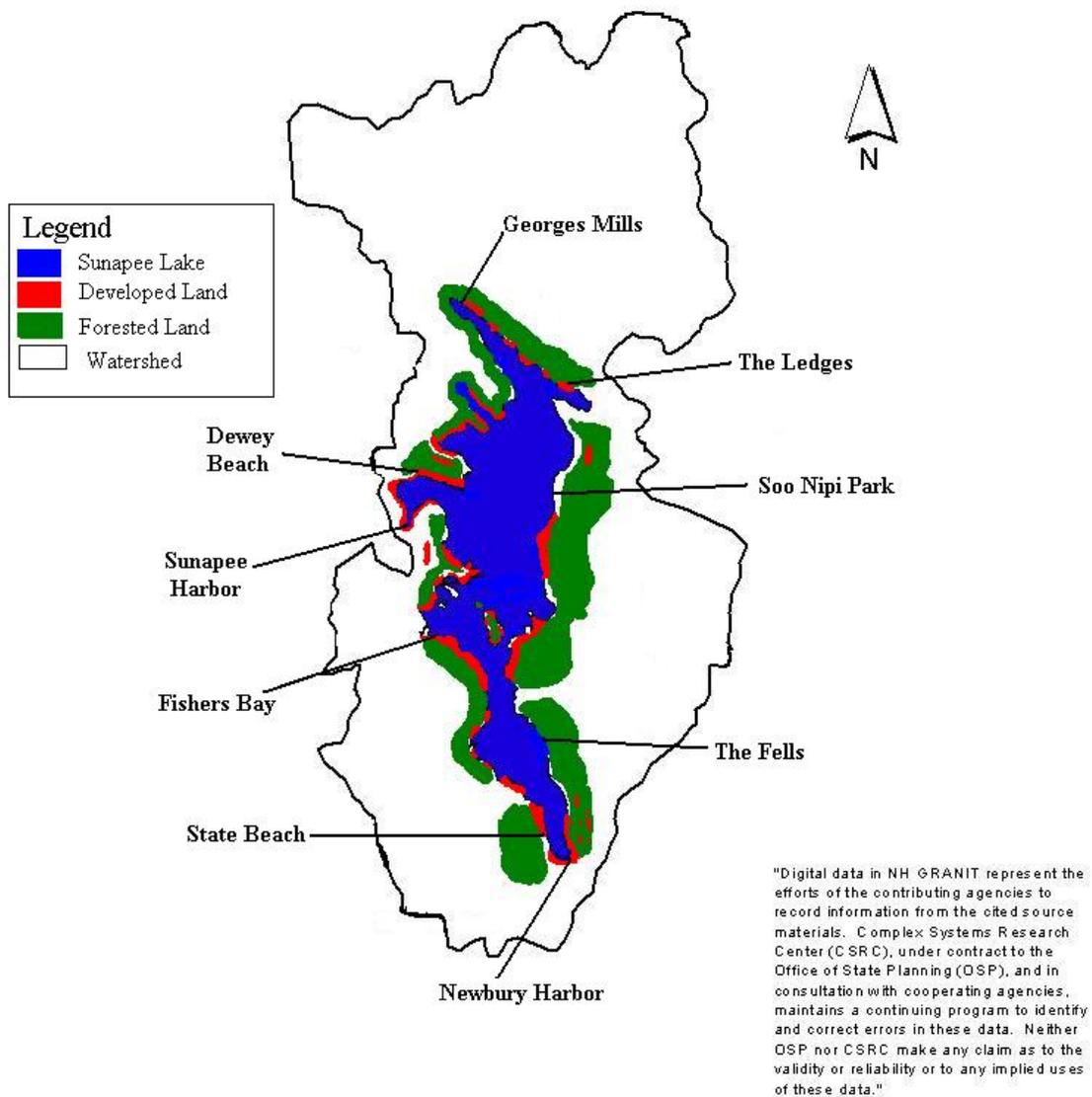
"GRANIT." Complex Systems Research Center, Institute for the Study of Earth, Oceans, and Space, and University of New Hampshire. 22 Oct 2003  
<<http://www.granit.sr.unh.edu/>>

**Assessment of Question:** This question is important to know, because of the threat of development to a waterbody/watershed. This question is difficult to answer because the entire watershed cannot be viewed from the waterbody, leading to a great deal of estimation.

**Date Completed:** November 2003

**Investigator:** Joseph J. Jennings

# Land Use Visible From Selected Points



**Attribute 10:** Visual/Aesthetic Characteristics

**Category:**

**Question E:** Odors present on a waterbody or at viewing locations.

**Directions:** Gauge the duration and intensity of natural and unnatural odors at various locations on the waterbody and at popular land-based viewing locations.

**Rationale:** The types and levels of detectable odors will affect the aesthetic value of the lake or pond being considered.

**Process Followed:** Contacted Laura Alexander, adjunct instructor of Community and Environmental Studies at Colby-Sawyer College, and John Callewaert, Director of the Institute for Community and Environment at Colby-Sawyer College, to produce a list of locations for scenic viewing opportunities. Visited all sites (in November) and determined where odor would generate from during the summer months.

**Findings and Analysis:** The only influences that could potentially produce odors at the scenic viewing sites were passing cars and boats. No other odors could be predicted.

**Evaluation Criteria:**

- 1) Unnatural odors distinct and continuously present at more than 1 location
- 2) Unnatural odors distinct and continuously present at only 1 location
- 3) Unnatural odors intermittent dependent on production source(s) and wind direction at more than 1 location
- 4) Unnatural odors intermittent dependent on production source(s) and wind direction at only 1 location
- 5) Only natural odors detectable at all location(s)

**Sources:**

Alexander, Laura. Personal Interview. 24 Nov. 2003.

Callewaert, John. Personal Interview. 24 Nov. 2003.

**Assessment of Question:** The question can easily be interpreted in different ways by different people. There could be a difference of opinion between someone who is accustomed with the area and someone who is not.

**Date Completed:** November 2003

**Investigator:** Matt Cummings & Stacey Philbrook

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

<b>RECREATIONAL VALUE</b> <b>Attribute and Associated Questions</b>	<i>Recorded Value</i>	<i>Rec. Value</i>
<b>ATTRIBUTE 1. GEOGRAPHICAL, SPACIAL, AND DEMOGRAPHIC INFORMATION</b>		
C. Proximity to major transportation corridors (miles to nearest major roadway)	5	5
D. Total resident population w/in 30 mile radius (# of people)	3	5
<b>ATTRIBUTE 2. PHYSICAL WATERBODY CHARACTERISTICS</b>		
A. Surface water area (acres)	5	5
E. Shoreline configuration (i.e. shape)	5	5
F. Island presence/absence (# of islands)	4	5
<b>ATTRIBUTE 3. WATER QUALITY CHARACTERISTICS</b>		
F. Secchi disc transparency (meters)	4	5
<b>ATTRIBUTE 4. BIOLOGICAL / ECOLOGICAL CHARACTERISTICS</b>		
A. Algal abundance ( ug/L of chl a)	5	5
H. Specialized habitats, breeding or rearing areas (# of areas, structures)	5	5
<b>ATTRIBUTE 5. RECREATIONAL CHARACTERISTICS</b>		
A. Average watercraft density on lake or pond (all types)	1	5
B. Type of watercraft use (% of total watercraft)	3	5
C. Private marine service / docking facilities (#)	2	5
E. Recreational fishing (i.e. types and # of game fish species pursued)	5	5
F. Occurrence of fishing tournaments / derbies (# / year)	2	5
G. Angler Usage (# anglers / acre)	1	5
K. Boat launches and access sites (#)	4	5
L. Other recreation and support facilities (#)	5	5
<b>ATTRIBUTE 6. RESTRICTIONS OR PROHIBITED USES</b>		
E. Power boat restrictions	4	5
F. Ski craft restrictions	3	5
<b>ATTRIBUTE 9. WATERSHED CHARACTERISTICS</b>		
A. Watershed development and land use (% developed, % undeveloped)	4	5
<b>ATTRIBUTE 10. VISUAL / AESTHETIC CHARACTERISTICS</b>		
A. Scenic or natural features of interest from waterbody (# of features)	5	5
<b>TOTAL</b>	75	100

**A high score in this category indicates that the waterbody has a high recreational value.**

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

<b>UNIQUE OR OUTSTANDING VALUE Attribute and Associated Questions</b>	<b>Recorded Value</b>	<b>Out. Value</b>
<b>ATTRIBUTE 1. GEOGRAPHICAL, SPATIAL, AND DEMOGRAPHIC INFORMATION</b>		
B. Waterbody elevation (feet)	3	5
<b>ATTRIBUTE 2. PHYSICAL WATERBODY CHARACTERISTICS</b>		
B. Maximum water depth (meters)	4	5
J. Basin morphometry (# basins)	3	5
K. Waterbody origin (natural / artificial)	3	5
<b>ATTRIBUTE 3. WATER QUALITY CHARACTERISTICS</b>		
F. Secchi disc transparency (meters)	4	5
<b>ATTRIBUTE 4. BIOLOGICAL / ECOLOGICAL CHARACTERISTICS</b>		
C. Fish species diversity (# of species)	5	5
D. Avian species diversity (# of species)	5	5
E. Mammal species diversity (# of species)	5	5
F. Reptile & amphibian species diversity (# of species)	5	5
H. Specialized habitats, breeding or rearing areas (# of areas, structures)	5	5
K. Threatened and endangered plant/animal species and exemplary natural communities	4	5
<b>ATTRIBUTE 7. UNIQUE CHARACTERISTICS</b>		
A. Public drinking water supply (# households served)	3	5
B. Historic features in or around waterbody (#)	2	5
C. Educational facilities or sites (# and type)	5	5
E. Participant in VLAP, LLMP, or an alternative volunteer monitoring program	5	5
<b>ATTRIBUTE 8. SHORELAND CHARACTERISTICS</b>		
C. Protected land or land not available for development within the shoreland (% shoreland frontage)	3	5
H. Local land use regulatory measures	5	5
<b>ATTRIBUTE 9. WATERSHED CHARACTERISTICS</b>		
C. Protected land or land not available for development within the watershed (% of watershed area)	4	5
H. Local land use regulatory measures	5	5
<b>ATTRIBUTE 10. VISUAL / AESTHETIC CHARACTERISTICS</b>		
A. Scenic or natural features of interest visible from the waterbody (# of features)	5	5
<b>TOTAL</b>	<b>83</b>	<b>100</b>

**A high score in this category indicates that the waterbody has many unique or outstanding values.**

Lake Sunapee Watershed Project Portfolio - Comprehensive Lake Inventory

<b>SUSCEPTIBILITY TO IMPAIRMENT Attribute and Associated Questions</b>	<i>Recorded Value</i>	<i>Sus. Value</i>
<b>ATTRIBUTE 1. GEOGRAPHICAL, SPATIAL, AND DEMOGRAPHIC INFORMATION</b>		
D. Total resident population w/in 30 mile radius (# of people)	3	5
<b>ATTRIBUTE 2. PHYSICAL WATERBODY CHARACTERISTICS</b>		
C. Mean water depth (feet)	2	5
D. Percent shoal area / littoral zone (% of waterbody <15')	1	5
I. Hydraulic flushing rate (time waterbody flushes / years)	4	5
<b>ATTRIBUTE 3. WATER QUALITY CHARACTERISTICS</b>		
D. pH	1	5
E. Total phosphorus concentration (mg/L)	2	5
F. Secchi disc transparency (meters)	2	5
I. Historic point source discharges	1	5
<b>ATTRIBUTE 4. BIOLOGICAL / ECOLOGICAL CHARACTERISTICS</b>		
A. Algal abundance ( µg/L of chl a)	1	5
B. Algal community composition (% blue greens)	2	5
I. Exotic aquatic plant species (presence / absence and proximity to waterbody with an exotic)	5	5
J. Exotic aquatic animal species (presence / absence and proximity to waterbody with an exotic)	2	5
<b>ATTRIBUTE 5. RECREATIONAL CHARACTERISTICS</b>		
A. Average watercraft density on lake or pond (all types)	5	5
B. Type of watercraft use (% of total watercraft)	3	5
<b>ATTRIBUTE 8. SHORELAND CHARACTERISTICS</b>		
A. Shoreland development and use (% developed, % undeveloped)	5	5
C. Protected land or land not available for development within the shoreland (% shoreland frontage)	3	5
H. Local land use regulatory measures	1	5
<b>ATTRIBUTE 9. WATERSHED CHARACTERISTICS</b>		
A. Watershed development and land use (% developed, % undeveloped)	2	5
C. Protected land or land not available for development within the watershed (% of watershed area)	2	5
H. Local land use regulatory measures	1	5
<b>TOTAL</b>	<b>48</b>	<b>100</b>

**A high score in this category indicates that the waterbody has a high susceptibility to impairment.**