New Hampshire
2008 Section 305(b) and 303(d)
Surface Water Quality Report

September 2008

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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NEW HAMPSHIRE
2008 SECTION 305(b) and 303(d)
SURFACE WATER QUALITY REPORT
and
RSA 485-A:4.XIV Report to
the Governor and General Court

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PART A. EXECUTIVE SUMMARY

A.1 INTRODUCTION

The primary purpose of this document is to report on the water quality status of New Hampshire's surface waters and groundwater in accordance with Section 305(b) and 303(d) of the Federal Water Pollution Control Act as last reauthorized by the Water Quality Act of 1987 [PL92-500, commonly called the Clean Water Act (CWA)], and New Hampshire Statutes Chapter 485-A:4.XIV.

Section 305(b) of the CWA requires submittal of a report (commonly called the "305(b) Report"), that describes the quality of its surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water. Section 303(d) requires submittal of a list of waters (i.e., the 303(d) List) that are:

- impaired or threatened by a pollutant or pollutant(s),
- not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices for nonpoint sources and,
- require development and implementation of a comprehensive water quality study (i.e., called a Total Maximum Daily Load or TMDL study) that is designed to meet water quality standards.

New Hampshire Statutes Chapter 485-A:4.XIV requires the Department of Environmental Services (DES) to biennially provide a report to the governor and council (and others) of its findings regarding analysis of water quality monitoring data and identification of any long term trends which may affect the purity of the surface and groundwaters of the state.

The methodology for assessing surface waters in New Hampshire is fully described in the State's Consolidated Assessment and Listing Methodology or CALM (DES 2008a). As described in the CALM, water quality data is compared to the State's surface water quality standards to determine which designated uses are supported, which are not, and which uses cannot be assessed due to insufficient information. Designated uses for New Hampshire surface waters include primary contact recreation, secondary contact recreation, aquatic life, fish consumption, drinking water after adequate treatment and wildlife. In addition, tidal waters include the shellfish consumption use. The facilitate management of water quality data, surface waters in New Hampshire have been divided into over 5200 individual segments or assessment units (AUs). The ultimate goal is to have all surface waters assessed and supporting their designated uses.

The ability to assess a surface water is dependent on having high quality surface water monitoring data. In 2005, the State prepared a Water Monitoring Strategy (DES, 2005) which includes a description of the State's many monitoring programs and objectives as well as an estimate of the additional resources needed to accomplish all monitoring objectives. This analysis concluded that monitoring programs are underfunded by approximately one million dollars. Recognizing that the State does not have the resources to individually monitor and

assess each of the over 5200 assessment units (i.e. referred to as site specific assessments) DES has embarked on a probabilistic –based monitoring and assessment approach for some waterbody types. The probabilistic assessment approach utilizes data from a random sampling of a portion of a waterbody type to make statistically valid assessments of the waterbody type as a whole. Therefore, probabilistic assessments allow an entire waterbody to be statistically assessed with much fewer samples as compared to the site specific assessment approach. Site specific assessments, however, are still required when one wishes to know the surface water quality of a particular assessment unit. The probabilistic assessment approach was used to evaluate aquatic life, primary contact recreation, and secondary contact recreation in wadeable rivers (approximately 94 percent of New Hampshire's river miles) and in New Hampshire's estuaries.

A.2 SURFACE WATER ASSESSMENT RESULTS

New Hampshire, like many of the other New England States, has a statewide freshwater fish consumption advisory due to mercury levels found in fish tissue; the primary source of which is believed to be atmospheric deposition from both in-state and out-of-state sources. When this advisory is included in the assessment, all fresh surface waters are, by definition, less than fully supporting of all uses. Because New Hampshire cannot unilaterally resolve the mercury issue as much of the mercury is not generated in-state, and to provide a more balanced or fair assessment of the state's surface waters, two assessments are provided; one which takes into account the mercury advisory and one which does not. The assessment which does not account for mercury is perhaps more meaningful as it conveys information that would otherwise be masked by the mercury advisory and, perhaps more importantly, it represents information on impairments for which corrective action can be taken at the state level. Unless otherwise noted, the summary statistics below are from census or site specific assessments rather than probabilistic assessments.

Like other states, New Hampshire has a statewide freshwater fish consumption advisory in effect due to mercury. Because this advisory masks the other water quality issues that DES can directly resolve, two assessments are provided for fresh surface waters; one which includes the mercury advisory and one which does not.

New this year is the addition of wetlands to the Assessment Database. In all, 23,626 wetland assessment units covering 286,906 acres were added. This does not include wetlands in open water to avoid overlap with existing AUs in other waterbody types. DES also developed GIS-based criteria using the characteristics of adjacent land uses and conducted Level 1, or screening level, assessments. Although none of the wetlands were assessed as fully supporting or not supporting, the Level 1 assessment represents a significant first step to ultimately being able to definitively assess and report on wetland water quality.

For the first time, wetland assessment units have been added to the Assessment Database. In addition a Level 1 screening level assessment was performed. This represents a significant first step to ultimately being able to assess and report on wetlands water quality in the future.

A.2.1 OVERALL QUALITY/ USE SUPPORT

The following tables and figures provide a summary of the overall support status for all designated uses for all waters within state jurisdiction. Results are presented with and without the statewide mercury fish consumption advisory to reveal the status masked by the mercury advisory. Definitions of terms used in the tables (i.e., meets water quality standards, impaired, impaired – marginal condition, etc.) may be found in the Consolidated Assessment and Listing Methodology (DES, 2008a) a copy of which is provided in Appendix 4. Table 1 presents overall support status for all designated uses for all waters. Information regarding the statewide mercury fish consumption advisory is in Section (D.6)).

Although New Hampshire has achieved over 50 percent of its goal to have all waters assessed and fully supportive of all uses, there is much work to be done to restore impaired waters and to monitor waters that could not be assessed due to insufficient information.

Figure 1 and Figure 2 graphically display the overall use support for both the Site Specific Assessments (SSA) and Probabilistic Assessments (PA). Site Specific Assessments were conducted for Aquatic Life, Primary and Secondary Contact Recreation, Fish Consumption, Shellfishing (tidal waters), Drinking Water, and Wildlife. Probabilistic Assessments were conducted for Aquatic Life, Primary Contact, and Secondary Contact Recreation. Probabilistic Assessments are discussed further in Section D.4. The graphs for freshwater lakes, impoundments and rivers are based on six designated uses, whereas the bar graphs for tidal water (i.e., estuaries and ocean) are based on seven designated uses. Consequently, each freshwater use represents 16.7% and each tidal use represents 14.3% of the total bar graph. The ultimate goal is to have all surface waters meet standards and be fully supportive of all uses. If this was accomplished, each of the bar graphs below would be entirely shaded in green to indicate that all uses were assessed and meeting water quality standards. As indicated in the figures and table below, even with the statewide mercury advisory excluded, this goal has not been accomplished for any waterbody type. In specific, the overall assessment results for each waterbody type show that approximately 52 to 67 percent of the State's surface waters are fully supporting one or more designated uses. Consequently, although we have achieved over 50 percent of our goal, there is still much work to be done to restore impaired waters and to monitor waters that could not be assessed due to insufficient information.

Figure 1: Overall Use Support Excluding the State-Wide Mercury Advisory

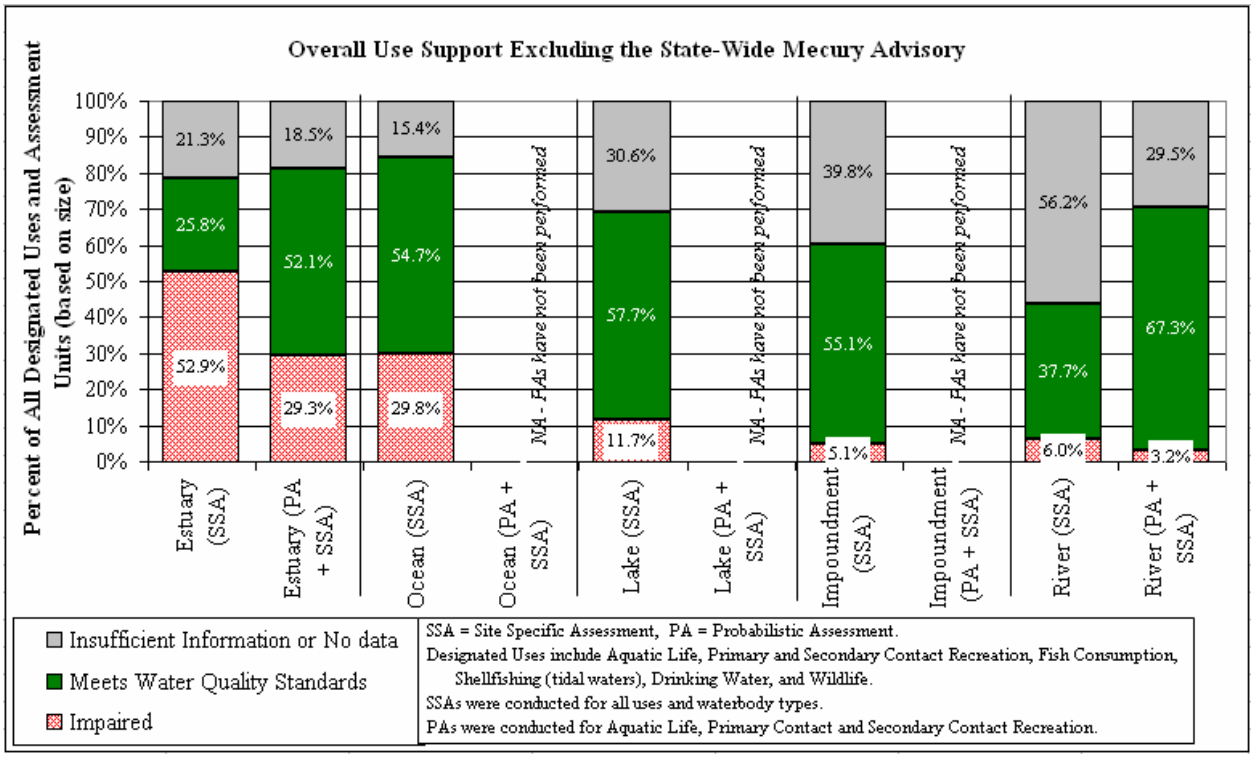


Figure 2: Overall Use Support Including the State-Wide Mercury Advisory

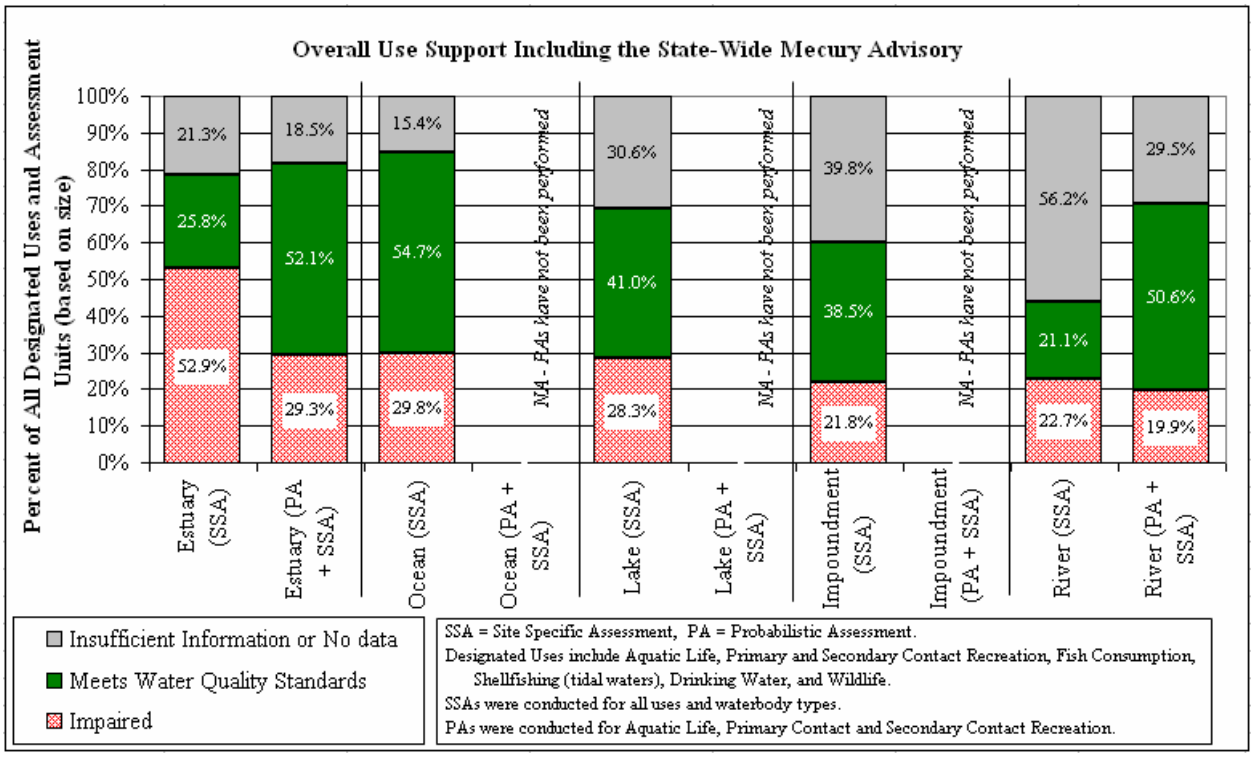


Table 1: Overall Use Support for All Surface Waters

Waterbody Type and Assessment Type	Overall Use Support (excluding mercury fish advisory) based on Site Specific Assessments				Overall Use Support (including mercury fish advisory) based on Site Specific Assessments			
	Fully Meets WQS	Insufficient Information or No Data	Impaired	Total Assessed	Fully Meets WQS	Insufficient Information or No Data	Impaired	Total Assessed
Rivers (SSA) Percent of Assessment Units and Designated Uses	37.7%	56.2%	6.0%	43.8%	21.1%	56.2%	22.7%	43.8%
River (PA + SSA) Percent of Assessment Units and Designated Uses	67.3%	29.5%	3.2%	70.5%	50.6%	29.5%	19.9%	70.5%
Impoundment (SSA) Percent of Assessment Units and Designated Uses	55.1%	39.8%	5.1%	60.2%	38.5%	39.8%	21.8%	60.2%
Lake (SSA) Percent of Assessment Units and Designated Uses	57.7%	30.6%	11.7%	69.4%	41.0%	30.6%	28.3%	69.4%
Estuary (SSA) Percent of Assessment Units and Designated Uses	25.8%	21.3%	52.9%	78.7%	25.8%	21.3%	52.9%	78.7%
Estuary (PA + SSA) Percent of Assessment Units and Designated Uses	51.2%	18.5%	29.3%	81.5%	51.2%	18.5%	29.3%	81.5%
Ocean (SSA) Percent of Assessment Units and Designated Uses	54.7%	15.4%	29.8%	84.6%	54.7%	15.4%	29.8%	84.6%

A.2.2 INDIVIDUAL USE SUPPORT

A.2.2.1 Primary Contact Recreation / Swimming

Primary contact recreation is defined as the suitability of a waterbody for full body contact and/or incidental ingestion or swimming use. Assessments are primarily based on bacteria data as an indicator of human health risk and chlorophyll as an indicator of aesthetic suitability.

In freshwater rivers and streams, approximately 8.6 percent of the mileage is fully supportive of swimming, 9.3 percent is not supportive and 82.1 percent could not be assessed due to insufficient information. A probabilistic assessment performed on wadeable streams for swimming found that 83.2 percent of the mileage is fully supportive, 6.1 percent is not supportive and 10.7 percent could not be assessed due to insufficient information.

In lakes and ponds, approximately 70.4 percent of the acreage is fully supportive of swimming, 7.3 percent is not supportive and 22.3 percent could not be assessed due to insufficient information.

In impoundments, approximately 48.4 percent of the acreage is fully supportive of swimming, 8.1 percent is not supportive and 43.4 percent could not be assessed due to insufficient information.

In estuarine waters, approximately 19.3 percent of the square mileage is fully supportive of swimming, 65.5 percent is not supportive, and 15.2 percent could not be assessed due to insufficient information. . Based on a probabilistic assessment , 86.7 percent of the square mileage is fully supportive, 1.6 percent is not supportive and 11.8 percent could not be assessed due to insufficient information.

In ocean waters, approximately 93.3 percent of the square mileage is fully supportive of swimming, 6.1 percent is not supportive and 0.6 percent could not be assessed due to insufficient information.

SWIMMING

Freshwaters

Based on site specific assessments, approximately 8.6% of rivers and streams support this use. Based on probabilistic assessments, 83.2% of rivers and streams fully support this use.

Approximately 70.4% of lakes and ponds support swimming.

Approximately 48.4% of impoundments and ponds support swimming.

Tidal Waters

Based on site specific assessments, 19.3% of the estuaries fully support the swimming use. Based on probabilistic assessments, approximately 86.7% of estuarine waters fully support this use.

Approximately 93.3% of open ocean waters support swimming

A summary of the primary contact recreation use support for each waterbody type is shown in Figure 3 and a map showing the state-wide distribution of the assessment results is provided in Figure 4.

Figure 3: Assessment Unit Use Support Status for Primary Contact (i.e. Swimming)

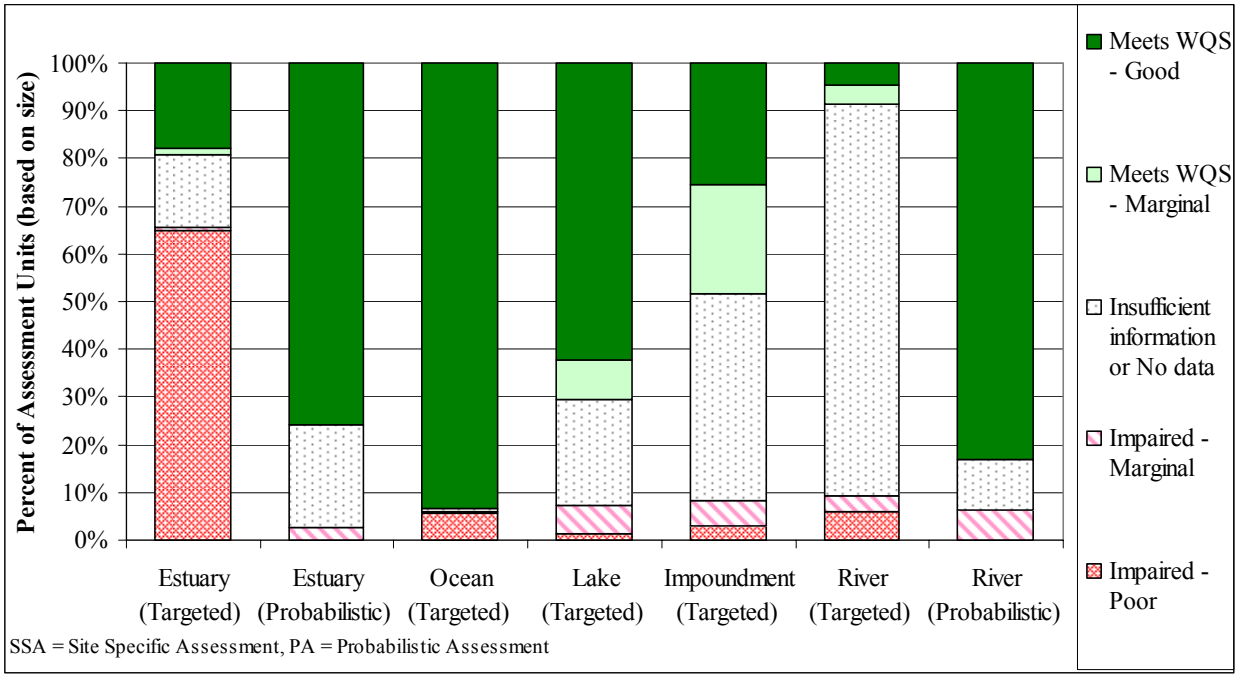
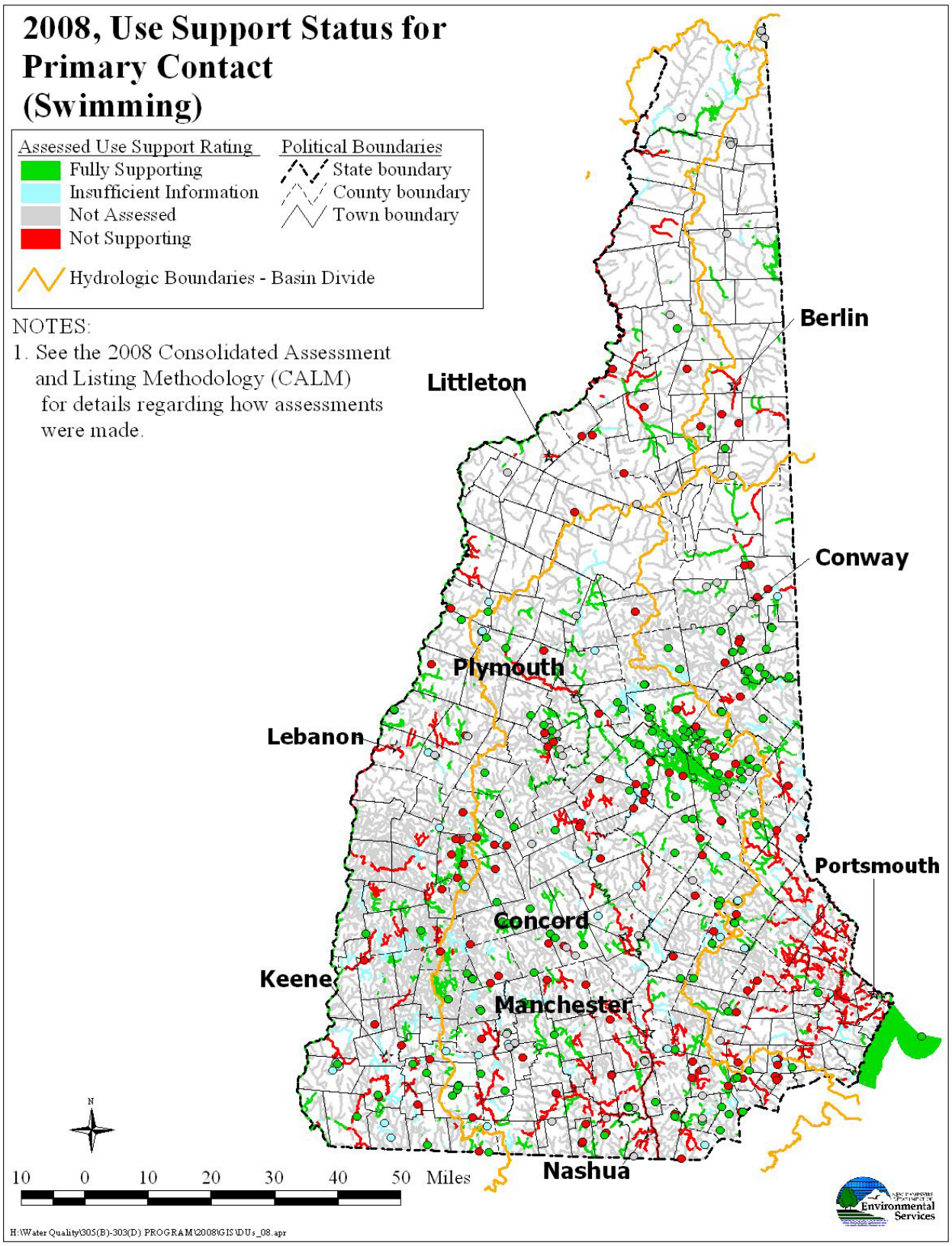


Figure 4: Statewide Use Support Status for Primary Contact (i.e. Swimming)



A.2.2.2 Secondary Contact Recreation / Boating

Secondary contact recreation is defined as activities that result in incidental water contact, aesthetic concerns, and obstacles to navigability.

In freshwater rivers and streams, approximately 16.6 percent of the mileage is fully supportive of secondary contact, 1.2 percent is not supportive and 82.2 percent could not be assessed due to insufficient information. A probabilistic assessment performed on wadeable streams for secondary contact found that 95.4 percent of the mileage is fully supportive, 0.0 percent is not supportive and 4.6 percent could not be assessed due to insufficient information.

In lakes and ponds, approximately 75.7 percent of the acreage is fully supportive of secondary contact, 1.3 percent is not supportive and 23.0 percent could not be assessed due to insufficient information.

In impoundments, approximately 51.2 percent of the acreage is fully supportive of secondary contact, 2.5 percent is not supportive and 46.3 percent could not be assessed due to insufficient information.

In estuarine waters, approximately 57.1 percent of the square mileage is fully supportive of secondary contact, 25.9 percent is not supportive and 17.0 percent could not be assessed due to insufficient information. A probabilistic assessment performed on estuarine waters for secondary contact found that 95.0 percent of the square mileage is fully supportive, 0.0 percent is not supportive and 5.0 percent could not be assessed due to insufficient information.

In ocean waters, approximately 98.9 percent of the square mileage is fully supportive of secondary contact, 0.6 percent is not supportive and 0.5 percent could not be assessed due to insufficient information.

SECONDARY CONTACT

Freshwaters

Based on site specific assessments, approximately 16.6% of rivers and streams support this use. Based on probabilistic assessments, 95.4% of rivers and streams fully support this use.

Approximately 75.7% of lakes and ponds support swimming.

Approximately 51.2% of impoundments and ponds support swimming.

Tidal Waters

Based on site specific assessments, 57.1% of the estuaries fully support the swimming use. Based on probabilistic assessments, approximately 95.0% of estuarine waters fully support this use.

Approximately 98.9% of open ocean waters support swimming

A summary of the secondary contact recreation use support status for each waterbody type is graphically shown in Figure 5 and a map showing the state-wide distribution of assessment results is provided in Figure 6.

Figure 5: Assessment Unit Use Support Status for Secondary Contact (i.e. Boating)

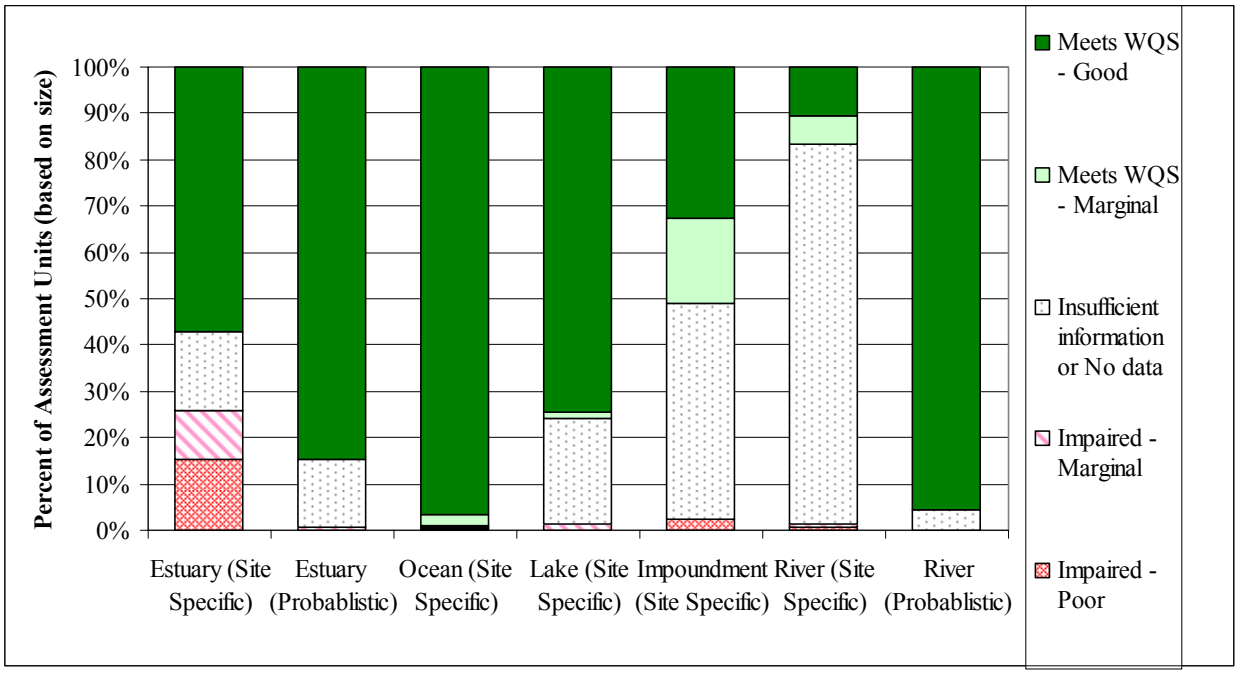
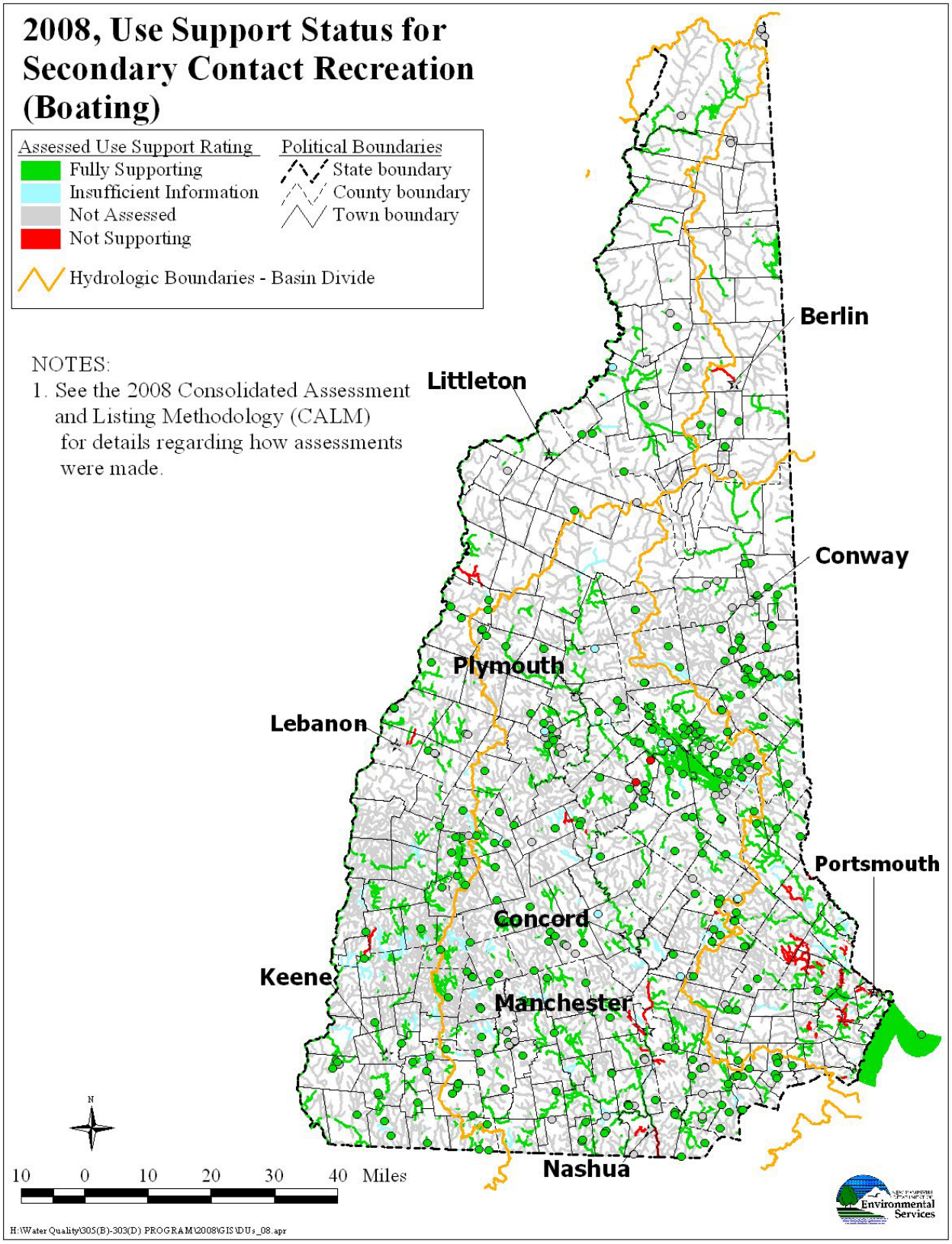


Figure 6: Statewide Use Support Status for Secondary Contact (i.e. Boating)



A.2.2.3 Aquatic Life Support

Aquatic life is defined as the suitability of a waterbody to sustain a balanced, integrated, and adaptive community of indigenous aquatic life. Use support is determined by physical, chemical, and biological criteria.

In freshwater rivers and streams, approximately 1.1 percent of the mileage is fully supportive of aquatic life, 25.7 percent is not supporting and 73.2 percent could not be assessed due to insufficient information. A probabilistic assessment performed on wadeable streams for aquatic life found that 37.9 percent of the mileage is fully supporting of aquatic life, 14.3 percent is not supporting and. 47.8 percent could not be assessed due to insufficient information.

In lakes and ponds, approximately 0.2 percent of the acreage is fully supportive of aquatic life, 61.5 percent is not supporting and 38.3 percent could not be assessed due to insufficient information.

In impoundments, approximately 31.1 percent of the acreage is fully supportive of aquatic life, 19.9 percent is not supporting and 49.0 percent could not be assessed due to insufficient information.

In estuarine waters, approximately 4.0 percent of the square mileage is fully supportive of aquatic life, 78.7 percent is not supportive and 17.2 percent could not be assessed due to insufficient information. A probabilistic assessment performed on estuarine waters for aquatic life found that 84.5 percent of the square mileage is fully supportive of aquatic life, 3.8 percent is not supporting and 11.8 percent could not be assessed due to insufficient information.

In ocean waters, approximately 90.9 percent of the square mileage is fully supportive of aquatic life, 2.1 percent is not supportive and 6.9 percent could not be assessed due to insufficient information.

AQUATIC LIFE

Freshwaters

Based on site specific assessments, approximately 1.1% of rivers and streams support this use. Based on probabilistic assessments, 37.9% of rivers and streams fully support this use.

Approximately 0.2% of lakes and ponds support aquatic life.

Approximately 31.1% of impoundments and ponds support aquatic life.

Tidal Waters

Based on site specific assessments, 4.0% of the estuaries fully support the aquatic life use. Based on probabilistic assessments, approximately 84.5% of estuarine waters fully support this use.

Approximately 90.9% of open ocean waters support aquatic life.

A summary of the aquatic life use support status for each waterbody type is graphically shown in Figure 7 and a map showing the state-wide distribution of assessment results is provided in Figure 8.

With regards to wetlands, a Level 1 (i.e., screening level) assessment was performed for the first time this year. The distribution of Level 1 wetlands assessment scores are shown in Figure 9. Since this is a screening level assessment, no wetlands were definitively assessed as fully supporting or not supporting. A total of 18,909 (80.0%) wetland assessment units were assessed as insufficient information - potentially supporting and 4,717 (20.0%) as insufficient

information - potentially not supporting of aquatic life use. Figure 12 shows a distribution of how the potentially supporting and potentially not supporting wetland assessment units are geographically distributed. Results of the Level 1 assessment including both the Level 1 assessment score and the relationship to the potential support threshold are discussed in Section D.3.9 and Appendix 36.

Figure 7: Assessment Unit Use Support Status for Aquatic Life.

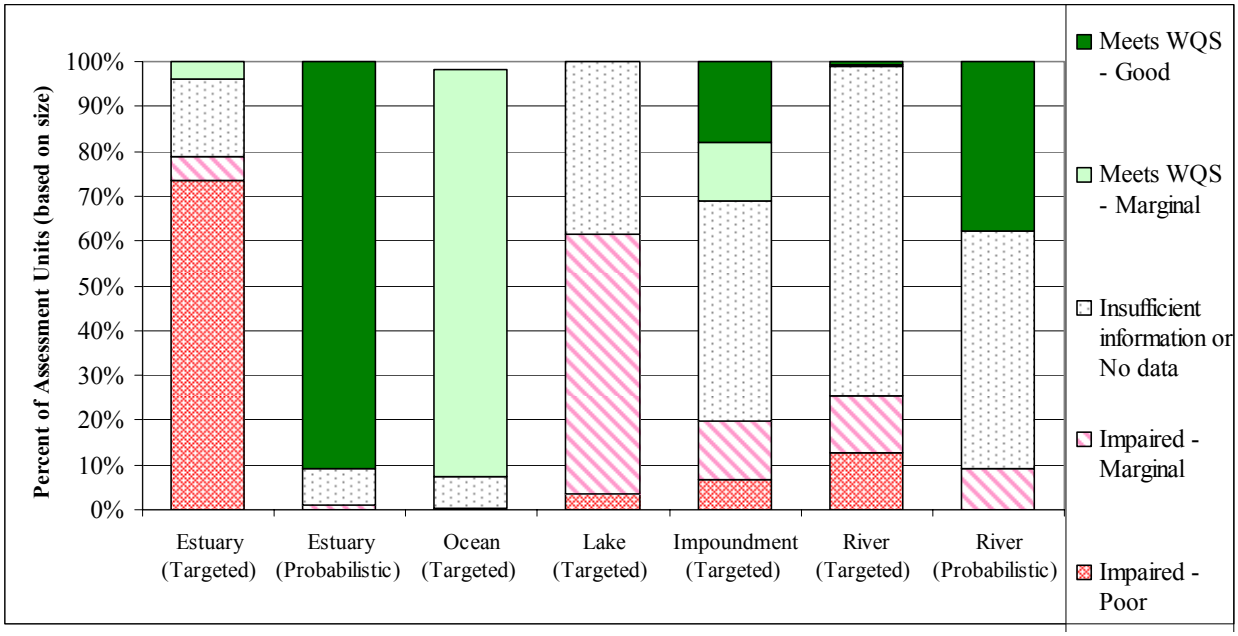


Figure 8: Statewide Use Support Status for Aquatic Life.

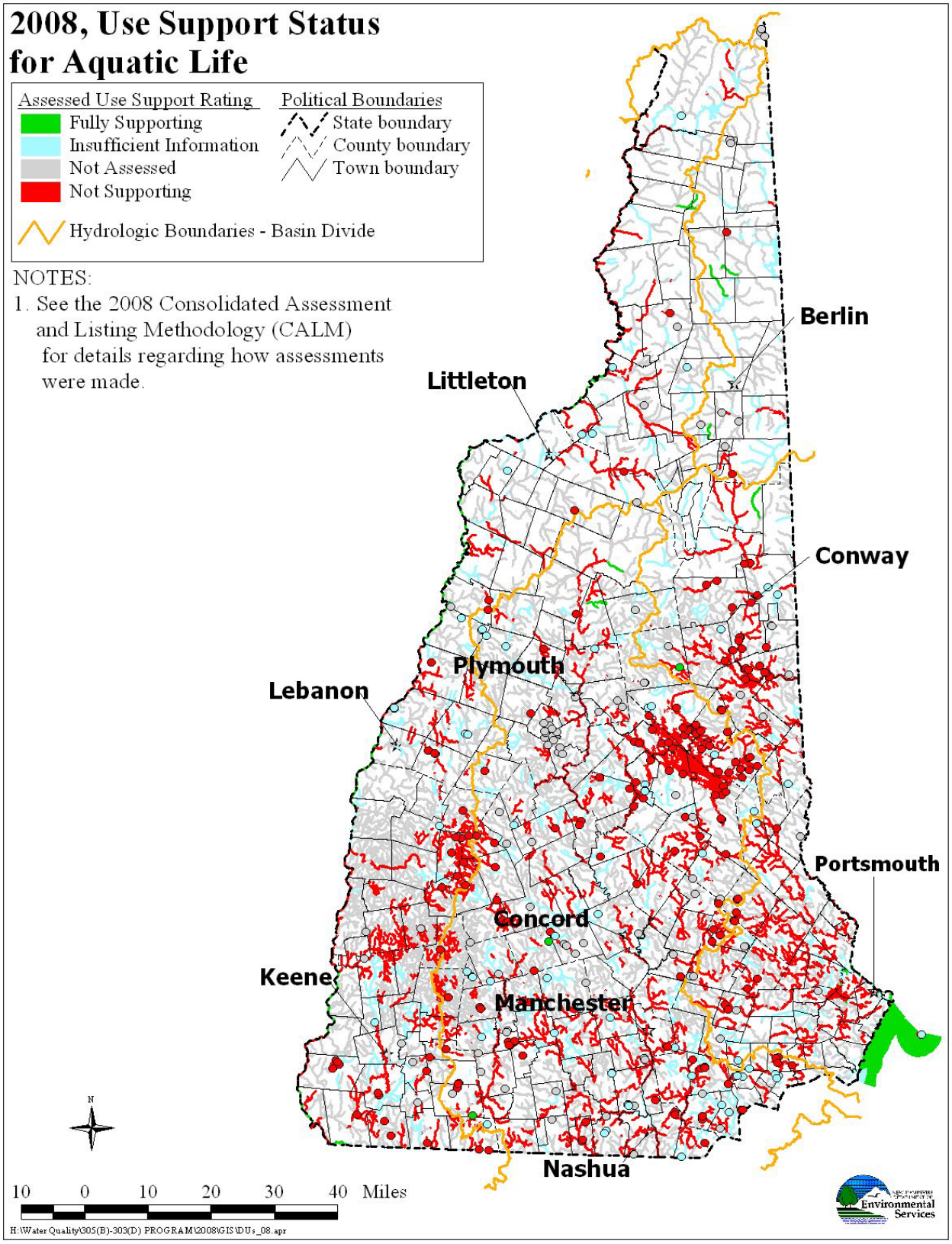


Figure 9: Distribution of Level 1 Wetland Assessment Scores.

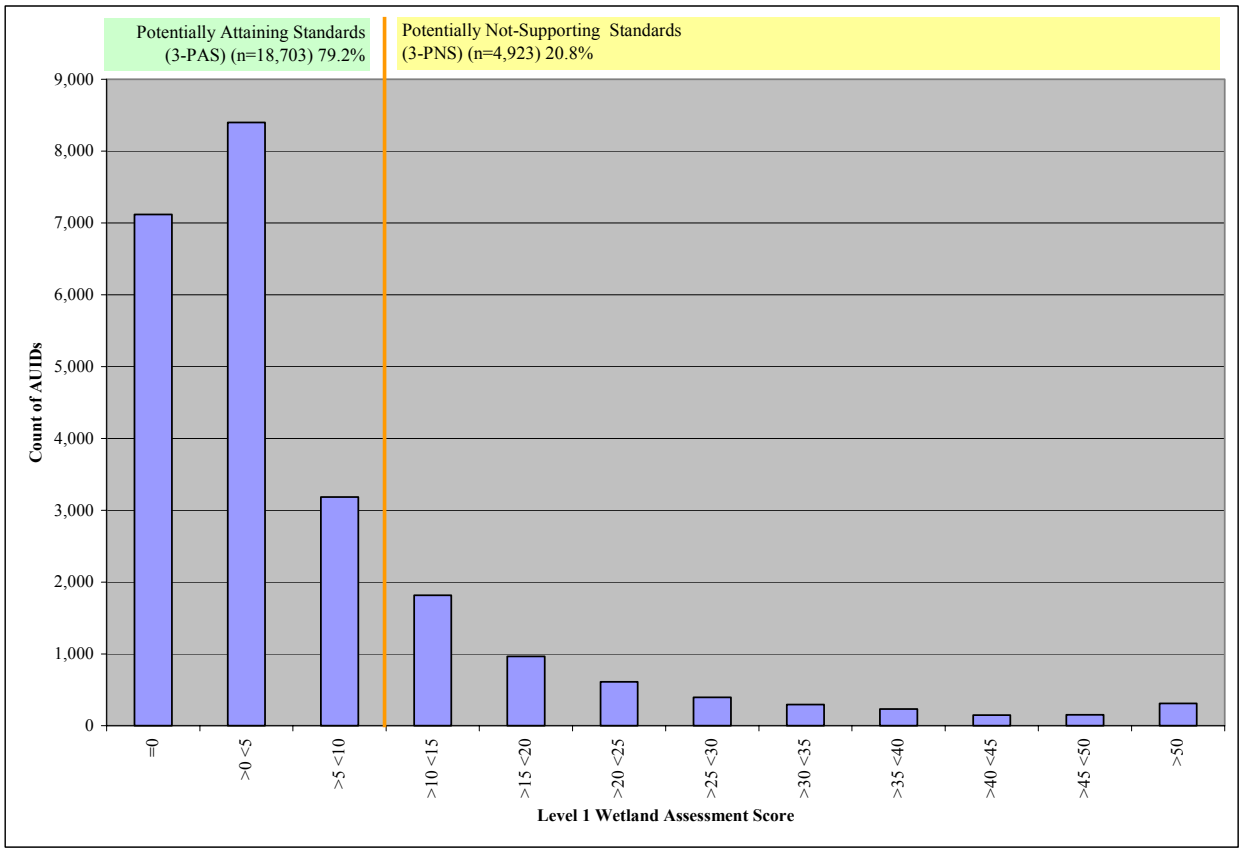
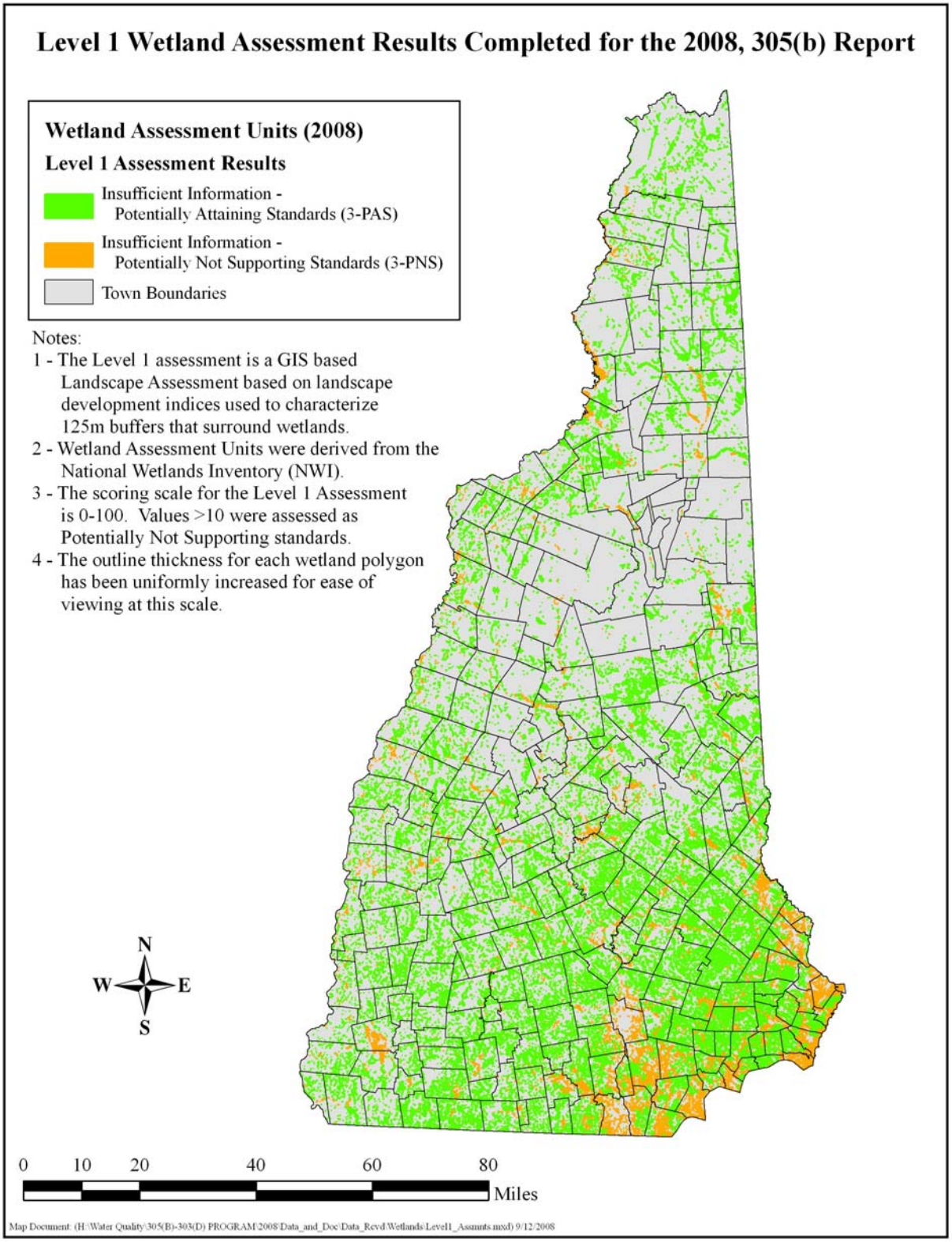


Figure 10: Statewide Distribution of Level 1 Wetland Assessment Scores.



A.2.2.4 Fish Consumption

Fish consumption is defined as the suitability of waters to support fish free from contamination at levels that pose a human health risk to consumers.

If the statewide fish consumption advisory due to mercury is accounted for in the assessment, none of the fresh surface waters are fully supportive of the fish consumption use.

Excluding the state-wide advisory:

- 100 percent of the total acreage of lakes and ponds fully supported and 0 percent did not support fish consumption;
- 98.2 percent of the total acreage of impoundments fully supported and 1.8 percent did not support fish consumption;
- 99.8 percent of the total miles of freshwater rivers and streams fully supported and 0.2 percent did not support fish consumption;
- 0.0 percent of the total square miles of estuaries and ocean waters fully supported and 100.0 percent did not support fish consumption.

In freshwaters, the only fish consumption advisory (other than mercury), is for dioxin on the Androscoggin River downstream of Berlin. The primary source of dioxin was removed in 1994. Although fish tissue sample results have shown a decrease in dioxin levels, they are not yet low enough to rescind the fish advisory

FISH CONSUMPTION
Excluding the state-wide mercury advisory, fish consumption is fully supported in,
- 100 percent of lakes
- 98.2 percent of impoundments
- 99.8 percent of rivers
- 0 percent of estuaries
- 0 percent of ocean water

Excluding mercury, none of the State's tidal waters fully support fish consumption due to a bluefish advisory that was issued in 1987 because of PCB levels in the fish tissue.

A.2.2.5 Shellfish Consumption

Shellfish consumption use is defined as the suitability of waters to support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers.

SHELLFISH CONSUMPTION
45% of estuarine waters are conditionally approved for shellfishing.

None of the state's 17.8 square miles of estuaries are fully supportive of this use due to PCBs and dioxins detected in lobster tomalley and mercury in shellfish. Based on fecal bacteria or the potential for fecal contamination, a number of estuaries are open to shellfish harvesting as determined by sanitary surveys conducted in accordance with national shellfish guidelines. The National Shellfish Sanitation Program (NSSP) classifies 8.0 square miles (44.7 percent) of estuary as conditionally approved and 9.92 square miles (54.3 percent) as closed. As of January 1st 2007, areas described as "conditionally approved" are open except when rainfall exceeds 1 to 2.5 inches depending upon the area in question. These areas may also be closed due to WWTF problems or discharge events at marinas. In the event of such a rainfall or discharge occurrences the resource is closed until sampling confirms safe conditions.

None of the state's 70.1 square miles of open ocean are fully supportive of this use due to PCBs and dioxins detected in lobster tomalley and mercury in shellfish. Based on fecal bacteria measurements or the potential for fecal contamination, a number ocean areas are open to shellfish harvesting as determined by sanitary surveys conducted in accordance with national

shellfish guidelines. The National Shellfish Sanitation Program (NSSP) classifies 63.47 square miles (90.4 percent) of ocean waters as open and 6.72 square miles (9.6 percent) as closed.

A.2.2.6 Drinking Water Supply After Adequate Treatment

Drinking water supply after adequate treatment is defined as the suitability of waters, that, after adequate treatment, will be suitable for human intake and meet state/federal drinking water regulations.

All surface waters were assessed for the use of drinking water supply. All are reported to be fully supportive of this use based on state law which requires all such waters to be suitable for drinking after adequate treatment.

DRINKING WATER SUPPLY AFTER ADEQUATE TREATMENT
All surface waters fully support the drinking water use.

A.2.2.7 Wildlife Uses

The wildlife use is defined as ability of waters to provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.

WILDLIFE
Use support criteria for wildlife assessments have not yet been developed.

Criteria for determining use support are under development. For this cycle, all surface waters were assessed as "Not Assessed" for this use.

A.2.3 CAUSES AND SOURCES OF IMPAIRMENT

Causes (i.e., pollutants) and probable sources of impairment for each major waterbody type were ranked according the total size of the waterbody it impaired and provided in the tables below.

A.2.3.1 Rivers

Rank	Impairment	Total Size (Miles)	Number of AUs
1	Mercury	9658.51	3219
2	pH	2098.08	528
3	Escherichia coli	868.25	223
4	Oxygen, Dissolved	380.10	91
5	Aluminum	281.48	61
6	Dissolved oxygen saturation	263.34	66
7	Benthic-Macroinvertebrate Bioassessments (Streams)	256.13	50
8	Habitat Assessment (Streams)	81.14	18
9	Lead	77.84	24
10	Chloride	63.07	24
11	Fishes Bioassessments (Streams)	60.48	11
12	Iron	47.71	15
13	Invasive Aquatic Algae	47.39	5
14	Chlorophyll-a	40.83	9
15	Other flow regime alterations	37.77	12
16	Non-Native Aquatic Plants	34.92	9
17	Copper	28.79	8
18	Phosphorus (Total)	28.78	10
19	Dioxin (including 2,3,7,8-TCDD)	18.19	10
20	Zinc	7.53	4
21	Physical substrate habitat alterations	6.58	1
22	Foam/Flocs/Scum/Oil Slicks	5.43	2
23	Creosote	3.53	1
24	Taste and Odor	3.05	1
25	Manganese	3.00	4
26	Low flow alterations	2.43	1
27	Arsenic	1.50	2
28	Ammonia (Un-ionized)	1.50	1
29	Cadmium	1.00	1
30	Chromium (total)	0.50	1
31	DDD	0.50	1
32	Sedimentation/Siltation	0.46	1
33	Turbidity	0.46	1
34	Benzo(a)pyrene (PAHs)	0.20	1

Rank	Source of Impairment	Total Size (Miles)	Number of AUs
1	Atmospheric Deposition - Toxics	9658.51	3219
2	Source Unknown	2599.65	658
3	Municipal Point Source Discharges	52.46	19
4	Municipal (Urbanized High Density Area)	49.38	17
5	Combined Sewer Overflows	49.14	17
6	Highway/Road/Bridge Runoff (Non-construction Related)	41.23	15
7	Commercial Districts (Shopping/Office Complexes)	40.90	14
8	Illicit Connections/Hook-ups to Storm Sewers	37.35	12
9	Industrial Point Source Discharge	32.77	19
10	Landfills	26.88	10
11	Freshettes or Major Flooding	25.45	4
12	Impervious Surface/Parking Lot Runoff	18.66	5
13	Unspecified Urban Stormwater	18.08	2
14	Streambank Modifications/destabilization	14.18	4
15	Contaminated Groundwater	11.57	2
16	Inappropriate Waste Disposal	8.04	1
17	Manure Runoff	7.27	3
18	Livestock (Grazing or Feeding Operations)	7.01	1
19	Impacts from Hydrostructure Flow Regulation/modification	6.86	5
20	Acid Mine Drainage	5.25	1
21	Airports	4.05	2
22	Industrial/Commercial Site Stormwater Discharge (Permitted)	4.05	2
23	Rcra Hazardous Waste Sites	3.53	1
24	Channelization	3.05	1
25	Unpermitted Discharge (Industrial/commercial Wastes)	2.73	2
26	Flow Alterations from Water Diversions	2.43	1
27	Unpermitted Discharge (Domestic Wastes)	2.38	1
28	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	2.01	2
29	Habitat Modification - other than Hydromodification	1.27	1
30	Salt Storage Sites	0.53	1
31	Highways, Roads, Bridges, Infrastructure (New Construction)	0.46	1
32	Animal Feeding Operations (NPS)	0.30	1
33	Petroleum/natural Gas Activities	0.20	1
34	Pollutants from Public Bathing Areas	0.01	1

A.2.3.2 Lakes

Rank	Impairment	Total Size (Acres)	Number of AUs
1	Mercury	164615.4	1153
2	pH	93717.1	406
3	Non-Native Aquatic Plants	67832.7	56
4	Dissolved oxygen saturation	16290.9	98
5	Cyanobacteria hepatotoxic microcystins	8454.1	51
6	Oxygen, Dissolved	8398.6	26
7	Turbidity	4249.8	2
8	Chlorophyll-a	3026.7	30
9	Escherichia coli	2851.7	100
10	Aluminum	647.2	22
11	Sedimentation/Siltation	210.6	2
12	Other flow regime alterations	86.0	1
13	Chloride	49.2	3
14	Excess Algal Growth	1.3	1

Rank	Source of Impairment	Total Size (Acres)	Number of AUs
1	Atmospheric Deposition - Toxics	164615.4	1153
2	Atmospheric Deposition - Acidity	89735.3	371
3	Source Unknown	83285.8	275
4	Highways, Roads, Bridges, Infrasturcture (New Construction)	4249.8	2
5	Municipal Point Source Discharges	482.9	1
6	Municipal (Urbanized High Density Area)	374.6	9
7	Waterfowl	230.0	7
8	Unpermitted Discharge (Domestic Wastes)	223.3	2
9	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)	222.0	1
10	Streambank Modifications/destabilization	210.0	1
11	Channel Erosion/Incision from Upstream Hydromodifications	210.0	1
12	Package Plant or Other Permitted Small Flows Discharges	142.2	1
13	Impacts from Hydrostructure Flow Regulation/modification	86.0	1
14	Residential Districts	62.2	2
15	Commercial Districts (Shopping/Office Complexes)	49.2	3
16	Highway/Road/Bridge Runoff (Non-construction Related)	49.2	3
17	Flow Alterations from Water Diversions	42.4	1
18	Industrial Point Source Discharge	22.4	2
19	Pollutants from Public Bathing Areas	16.0	17
20	Animal Feeding Operations (NPS)	14.8	1
21	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	6.8	5
22	Yard Maintenance	0.6	1

A.2.3.3 Impoundments

Rank	Impairment	Total Size (Acres)	Number of AUs
1	Mercury	21395.4	812
2	pH	3629.8	39
3	Escherichia coli	1426.5	39
4	Non-Native Aquatic Plants	1191.3	14
5	Dissolved oxygen saturation	757.7	13
6	Dioxin (including 2,3,7,8-TCDD)	384.1	8
7	Oxygen, Dissolved	331.2	20
8	Chlorophyll-a	239.1	8
9	Cyanobacteria hepatotoxic microcystins	213.8	1
10	Chloride	60.0	1
11	Phosphorus (Total)	43.1	3
12	2-Methylnaphthalene	10.0	1
13	Acenaphthene	10.0	1
14	Benzo(a)pyrene (PAHs)	10.0	1
15	Benzo[a]anthracene	10.0	1
16	Benzo[b]fluoranthene	10.0	1
17	Benzo[k]fluoranthene	10.0	1
18	Chrysene (C1-C4)	10.0	1
19	DDD	10.0	1
20	DDE	10.0	1
21	Dieldrin	10.0	1
22	Endrin	10.0	1
23	Heptachlor	10.0	1
24	Indeno[1,2,3-cd]pyrene	10.0	1
25	Lindane	10.0	1
26	Pyrene	10.0	1
27	Other flow regime alterations	5.0	1
28	Sedimentation/Siltation	3.5	1

Rank	Source of Impairment	Total Size (Acres)	Number of AUs
1	Atmospheric Deposition - Toxics	21395.4	812
2	Source Unknown	4854.5	64
3	Municipal Point Source Discharges	609.1	7
4	Combined Sewer Overflows	562.0	6
5	Impacts from Hydrostructure Flow Regulation/modification	500.0	1
6	Industrial Point Source Discharge	393.1	10
7	Illicit Connections/Hook-ups to Storm Sewers	239.1	9
8	Highway/Road/Bridge Runoff (Non-construction Related)	63.5	2
9	Commercial Districts (Shopping/Office Complexes)	60.0	1
10	Municipal (Urbanized High Density Area)	60.0	1
11	Atmospheric Deposition - Acidity	55.0	1
12	Freshettes or Major Flooding	5.0	1
13	Pollutants from Public Bathing Areas	4.1	3
14	Highways, Roads, Bridges, Infrastructure (New Construction)	3.5	1

A.2.3.4 Estuaries

Rank	Impairment	Total Size (Square Miles)	Number of AUs
1	Dioxin (including 2,3,7,8-TCDD)	17.842	64
2	Mercury	17.842	64
3	Polychlorinated biphenyls	17.842	64
4	Estuarine Bioassessments	13.368	27
5	Enterococcus	11.690	23
6	Fecal Coliform	9.316	35
7	pH	7.722	10
8	Oxygen, Dissolved	7.334	8
9	Chlorophyll-a	1.359	4
10	Nitrogen (Total)	1.359	4
11	Dissolved oxygen saturation	0.889	3
12	2-Methylnaphthalene	0.400	2
13	Anthracene	0.400	2
14	Benzo(a)pyrene (PAHs)	0.400	2
15	Benzo[a]anthracene	0.400	2
16	Chrysene (C1-C4)	0.400	2
17	DDD	0.400	2
18	DDE	0.400	2
19	DDT	0.400	2
20	Dibenz[a,h]anthracene	0.400	2
21	Fluoranthene	0.400	2
22	Fluorene	0.400	2
23	Naphthalene	0.400	2
24	Pyrene	0.400	2
25	Acenaphthene	0.240	1
26	Acenaphthylene	0.240	1
27	Benzo[g,h,i]perylene	0.240	1
28	Biphenyl	0.240	1
29	Dieldrin	0.240	1
30	Indeno[1,2,3-cd]pyrene	0.240	1
31	Phenanthrene	0.240	1

Rank	Source of Impairment	Total Size (Square Miles)	Number of AUs
1	Atmospheric Deposition - Toxics	17.842	64
2	Source Unknown	17.842	64
3	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	2.478	22
4	Combined Sewer Overflows	1.735	3
5	Animal Feeding Operations (NPS)	0.470	1
6	Sanitary Sewer Overflows (Collection System Failures)	0.393	4
7	Illicit Connections/Hook-ups to Storm Sewers	0.363	2
8	Petroleum/natural Gas Activities	0.160	1
9	Unpermitted Discharge (Domestic Wastes)	0.123	1
10	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)	0.110	1

A.2.3.5 Ocean

Rank	Impairment	Total Size (Square Miles)	Number of AUs
1	Dioxin (including 2,3,7,8-TCDD)	70.060	25
2	Mercury	70.060	25
3	Polychlorinated biphenyls	70.060	25
4	Enterococcus	4.249	13
5	Fecal Coliform	1.797	8
6	BOD, Biochemical oxygen demand	1.250	1

Rank	Source of Impairment	Total Size (Square Miles)	Number of AUs
1	Atmospheric Deposition - Toxics	70.060	25
2	Source Unknown	70.060	25
3	Forced Drainage Pumping	1.619	2
4	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	1.500	1
5	Municipal Point Source Discharges	1.250	1
6	Waterfowl	0.059	2
7	Unpermitted Discharge (Domestic Wastes)	0.050	1
8	Sewage Discharges in Unsewered Areas	0.030	1

A.2.4 LAKE TROPHIC AND ACIDITY STATUS

Approximately 4.5 percent of the surface area of all surveyed lakes are eutrophic and have relatively high levels of nutrients and plant growth.

Trophic surveys were conducted on 663 of the 667 "significant lakes" representing 155,601 acres or 83.7 percent of all of the lakes in the state. Approximately 28 percent of the significant lakes that were surveyed were classified as oligotrophic (relatively low levels of nutrients and plant productivity). Approximately 49.3 percent of the lakes, representing approximately 21.5 percent of the total surface area were mesotrophic (moderate levels of nutrients and plant productivity) and the remaining 22 percent of the surveyed lake were classified as eutrophic (relatively high levels of nutrients and plant productivity). Eutrophic lakes, however, accounted for only 4.5 percent of the total surface area.

Less than 5% of the surface area of all surveyed lakes are highly acidic.

Of the 771 lakes and ponds with pH data, approximately 38 percent experience non-natural slightly acidic conditions (pH 5.5 to 6.4) and 4.4 percent experience non-natural highly acidic conditions (pH less than 5.5). An additional 34 lakes experience natural acidic conditions based on color measurements. According to the U.S. EPA, waters that have an acid neutralizing capacity (ANC) of zero or less (which corresponds to a pH of about 5.2), are considered to be acidified. A 2005 evaluation of lake data revealed that 3 percent of all lakes and 17 percent of remote, mostly high elevation ponds are acidic based on this definition

A.2.5 WATER QUALITY TRENDS

Four parameters were investigated in 81-85 lakes where at least 10 years of data existed. For chlorophyll a, 10 (12 percent) of the 83 lakes showed an improvement in water quality, 37 (44 percent) showed stable water quality, 4 (5 percent) showed a decline in water quality, and 32 (39 percent) showed fluctuating water quality. For Secchi transparency, 10 (12 percent) of the 85 lakes showed an improvement in water quality, 56 (66 percent) showed stable water quality, 8 (9 percent) showed declining water quality, and 11 (13 percent) showed fluctuating water quality. For epilimnetic total phosphorus, 14 (17 percent) of the 83 lakes showed an improvement in water quality, 36 (43 percent) showed stable water quality, 2 (2 percent) showed declining water quality, and 31 (37 percent) showed fluctuating water quality. For hypolimnetic total phosphorus, 7 (9 percent) of the 81 lakes showed an improvement in water quality, 20 (25 percent) showed stable water quality, 5 (6 percent) showed declining water quality, and 49 (60 percent) showed fluctuating water quality. A general assessment of the above trends suggests that most lakes show no trend (are either stable or fluctuating), and of those showing a trend, more are improving than are degrading.

Trends were analyzed in the data from the NHDES Acid Lake Outlet Monitoring Program. Trends were analyzed on the 20 year datasets for 20 lakes identified as having significant trends for a suite of parameters. For pH, two lakes had decreasing trends, four lakes had increasing trends and the remaining 14 lakes had no significant trends. For alkalinity, 12 of the 20 lakes had increasing trends (improvement in water quality) and only one lake had

decreasing trends. For conductivity, 10 of the 20 lakes had increasing trends (declining water quality) and six lakes had decreasing trends. The increasing trends at Echo Lake, Granite Lake, Loon Pond, Millen Pond, and Pleasant Lake were an order of magnitude higher than for the other lakes. For calcium, six lakes had increasing trends while only two lakes had decreasing trends. For sulfate, only one lake had an increasing trend (Granite Lake) while nine lakes had decreasing trends (improvement in water quality). In terms of the effects of acid rain, Granite Lake has the most troubling trends. Not only is pH decreasing but alkalinity is also decreasing and sulfate is increasing.

For rivers, trends were evaluated for a station on the Saco River at the New Hampshire / Maine border. The only trends that were apparent in the 14 year dataset (1990-2003) were increasing dissolved oxygen saturation, and decreasing turbidity and zinc which are indicative of improved water quality and increases in specific conductivity, and temperature, which can be indicative of declining water quality. The trends were apparent in both the raw and flow-adjusted concentrations.

Comparisons to historical data show that dissolved inorganic nitrogen concentrations have increased in Great Bay by 59 percent in the past 25 years. During the same period, suspended solids concentrations increased by 81 percent, although there are some questions about the appropriateness of the comparison. Trends over the past 15 years since the current monitoring program began are difficult to interpret, with increasing trends evident at only a few stations for a few parameters. Any increase in nitrogen concentrations has apparently not resulted in increased phytoplankton blooms. The only increasing trend for chlorophyll-a was observed at a station with very low concentrations already. Moreover, a probabilistic survey of the estuary in 2002-2003 found only 1.6 percent of the estuary to have chlorophyll-a concentrations greater than 20 ug/L.

Eelgrass coverage in the Great Bay has been declining since 1996 except for one good year in 2001. The cause of the decline in uncertain. Water clarity, disease, and nuisance macroalgae are all possible factors. More research is needed to understand the reasons for the decline.

A.2.6 WETLANDS

In New Hampshire there are an estimated 5,554 acres of tidal wetlands and 400,000 to 600,000 acres of non-tidal wetlands. The net change in wetlands due to permitted projects and violations versus restoration projects over the past two years have resulted in the loss of 0.022 percent of the state's tidal wetlands, and 0.037 of non-tidal wetlands. Permitting conditions on major projects (more than 20,000 square feet of freshwater wetlands or any amount of tidal wetlands) are designed to assure that there has been no significant net loss of wetlands function.

Over the past two years, less than 0.04 percent of all wetlands were impacted. Monitoring and enforcement of permit requirements have been expanded to assure compliance with permitting conditions, including the mitigation of unavoidable impacts.

In 1992, New Hampshire became the first state to be issued an inclusive statewide programmatic general permit by the U.S. Army Corps of Engineers that eliminates federal

reliance on Nationwide general permits. The New Hampshire state Programmatic General Permit (NHSPGP) was reissued in June 2002, and continues to serve as a model that other states strive to match. The NHSPGP will be up for renewal in 2007, and DES continues to work with federal agencies to improve the process even further.

As previously reported, New Hampshire has, for the first time, added wetlands to the Assessment Database. In all, 23,626 wetland assessment units covering 286,906 acres were added. Though no wetlands were assessed this cycle, this represents a significant first step to ultimately being able to assess and report on wetland water quality.

A.3 GROUNDWATER ASSESSMENT

New Hampshire is highly dependent on groundwater for drinking water. Groundwater is found in both overburden and fractured bedrock aquifers. Highly productive stratified drift aquifers are found scattered throughout the state. Natural groundwater quality from stratified drift aquifers is generally good, however, this water can be impacted by such aesthetic concerns as iron, manganese, corrosiveness, taste and odor. Bedrock well water quality is also generally good although this water can be impacted by naturally occurring contaminants including fluoride, arsenic, mineral radioactivity, and radon gas. Elevated concentrations of radon gas occur frequently in bedrock wells.

In addition to naturally occurring contaminants, there are many areas of localized contamination due primarily to releases of petroleum and volatile organic compounds from petroleum facilities, commercial and industrial operations and landfills. Of particular concern recently are detections of MTBE, a gasoline additive, in public and private wells. Many of these detections appear to be associated with usage of small amounts of gasoline by homeowners rather than leaking underground storage tanks or commercial operations. In May 2005, Governor John Lynch signed legislation prohibiting the use of MtBE in gasoline in New Hampshire after January 1, 2007. Due to widespread winter application of road salt, sodium is also a contaminant of concern in New Hampshire groundwater. Although localized contamination continues to be discovered in New Hampshire, particularly from leaking underground storage tank sites, the state has made steady progress in remediating sites with contaminated groundwater.

Groundwater quality in New Hampshire is generally good although there are localized areas of degraded groundwater from human activity and natural sources.

Recently, groundwater availability issues are of increasing concern, particularly in southern and southeastern New Hampshire. This concern has led to the passage of legislation that requires that any adverse impact to surrounding water resources from a large groundwater withdrawal be identified and mitigated.

New Hampshire continues to involve all stakeholders in identifying and addressing groundwater protection issues. The second five-year workplan to improve groundwater protection in partnership with stakeholders has been completed and a third five-year workplan is in the development phase.

A.4 SPECIAL STATE CONCERNS

Although tremendous progress has been made in the past 35 years to clean up surface waters in the New Hampshire, there is much more to be done. The following is a list of the major water quality concerns and issues in the state that DES and others will be directing their attention to in upcoming years.

Special State concerns include:

Sustainability of Water Resources
Climate Change
Funding of Water Programs
Drinking Water Quality/Quantity
Upgrading Wastewater Facilities & CSO Abatement
Nonpoint Source Pollution
Nuisance Aquatic Species
Opening Shellfish Beds for Harvesting
Estuarine Eutrophication
Mercury Reduction
Acid Deposition
Chloride (Road Salt)
Cyanobacteria Blooms

SUSTAINABILITY OF WATER RESOURCES

Increasing growth and development is stressing the quality, quantity and natural aquatic biota of many of the State's water resources. Although much has been accomplished, there is concern and evidence that existing water management programs may not be adequate to protect water quality and quantity. To help restore and protect its water resources for future generations, the Commissioner of DES authorized the Lakes Management Advisory Committee (LMAC) and the Rivers Management Advisory Committee (RMAC) on January 3, 2007 to undertake a Sustainability Initiative. These committees are legislatively charged with advising the DES on maintaining water quality and quantity.

For the purposes of their report, the LMAC and the RMAC developed the following functional definition of sustainability to achieve their goals:

> *"to institute anti-degradation measures to preserve and protect water quality and quantity, to maintain intact ecological linkages between surface waters and their surrounding watersheds, to achieve the appropriate balance between different human uses while protecting the biological integrity of the resource, and to restore and improve existing degraded systems."*

To date, eight issues have been identified that need to be addressed to achieve Sustainability. Next steps include cataloging ongoing efforts, describing roadblocks to success, prioritizing the issues, proposing concrete options to consider for each of the eight issues, and proposing environmental and programmatic indicators to measure how well success is achieved.

CLIMATE CHANGE

The world's leading scientists concluded in 2007 that it is "unequivocal" that Earth's climate is warming, and that it is "very likely" (a greater than 90 percent certainty) that the heat-trapping emissions(i.e., carbon dioxide and other greenhouse gases) from the burning of fossil fuels and other human activities have caused "most of the observed increase in globally averaged temperatures since the mid-twentieth century" (NIECIA, 2007 and IPPC, 2007).

To address climate change, Governor John Lynch established a Climate Change Task Force through Executive Order in 2007 with the charge of developing a Climate Change Action Plan for the State of New Hampshire. Goals of the Task Force include reducing greenhouse gas emissions and recommending steps New Hampshire can take to meet those goals. Recommendations by the Task Force will also help New Hampshire achieve the Governor's goal of ensuring 25 percent of our energy comes from renewable sources by 2025.

INSUFFICIENT FUNDING TO MANAGE WATER RESOURCES

Management of New Hampshire's surface waters requires adequate funding to support essential core programs. These programs are needed to 1) help prevent the degradation of surface waters in the state and the potential loss of revenue and 2) to protect the hundreds of millions of dollars which have already been invested to restore and maintain water quality in New Hampshire. For the past several years federal funding for many programs have remained flat or decreased. If this trend is not reversed soon, or if other sources of funding are not found, important water quality programs will need to be cut back in scope and staff or eliminated. This would be extremely detrimental to New Hampshire's water resources since many programs are already under-funded and understaffed. Further, if water quality is allowed to decline, recent studies have shown that it could have a significant negative impact on the State's economy.

DRINKING WATER ISSUES

Existing data demonstrates that most of the state has very high quality drinking water. However, as population increases and landscapes are altered by human activities, it is critical that New Hampshire implements land conservation practices, best management practices, education and outreach and regulatory enforcement where appropriate to protect water resources. Additionally, as water treatment systems continue to be installed throughout New Hampshire to remove naturally occurring contaminants, regulations and policies will need to continue to be enforced to ensure that these concentrated contaminants or the substances utilized to regenerate treatment devices are not discharged to the surface waters of the state.

WASTEWATER TREATMENT FACILITY ISSUES

In accordance with the technology limits of state and federal law, the vast majority of municipal wastewater facilities receive at least secondary treatment. Many of these facilities, however, are beyond their design life and will soon need upgrades, equipment replacement, and the like. In addition, water quality studies have shown that some wastewater facilities will need to be upgraded to provide advanced treatment for pollutants such as biochemical oxygen demand, phosphorus, and/or nitrogen. Six New Hampshire communities are also dealing with abatement of combined sewer overflows. To expedite implementation of plant upgrades and CSO abatement plans, federal funding assistance is needed.

NONPOINT SOURCES

The major contributors to nonpoint source (NPS) pollution are people at home, work and play. To address such NPS issues it is necessary to 1) convince people that a problem exists, 2) develop reasonable solutions and 3) fund the solutions. Stormwater runoff is a major contributor

of nonpoint source pollution in many areas. Education and funding are the major obstacles which must be overcome to resolve NPS water quality concerns. Education and outreach are essential since many water quality impairments are the result of the cumulative impacts of individual actions. Integration of land use planning, land protection, and best management practices (BMP) implementation remains a challenge in preventing and controlling NPS pollution. Permanent protection of critical lands, including riparian buffers and headwater streams, is essential to maintaining water quality, particularly in urbanizing areas. Assisting communities with complying with Phase II of the federal NPDES stormwater permitting requirements will also help to abate urban stormwater pollution.

INTRODUCTION OF NON-NATIVE NUISANCE AQUATIC SPECIES

Preventing the spread of new exotic aquatic plants and animals into state waters is a major concern in New Hampshire. In 1997, legislation was passed to prohibit the sale, transport and introduction of exotic aquatic weeds in the state. In 1999, rules were adopted pursuant to this legislation, further restricting activities that would result in new introductions of non-native species. These rules were revised and expanded in 2007. The Exotic Species Program must continue to prevent the introduction and spread of non-native nuisance aquatic species in New Hampshire's surface waters so as to protect the ecological, recreational, aesthetic, and economic values of our waterbodies. Unfortunately, during the summer of 2007, an invasive alga (*Didymosphenia geminata*) became a new problem to the waters of New Hampshire. Now, in addition to battling infestations of exotic aquatic plants in over 70 waterbodies, we have the added problem of a microscopic alga that is posing a problem as well. With limited resources for control, DES continues to work strongly towards prevention and early detection of new infestations, while trying to manage existing infestations as best as possible with limited funds.

COASTAL ISSUES- SHELLFISHING AND EUTROPHICATION

Opening more shellfish beds for harvesting continues to be a priority in New Hampshire. Since 1993, the State has been actively working on reopening shellfish harvesting areas. Efforts to identify sources of bacteria pollution and classify shellfish growing areas have resulted in the reopening of over 850 acres of estuarine waters for harvest. In addition to the work in estuarine areas, the DES Shellfish Program reopened nearly all of the Atlantic Coast for harvesting in late 2000. To date, approximately 47 percent of the estuarine waters are conditionally approved and 93 percent of the coastal waters are approved for shellfishing.

Estuarine eutrophication is becoming more of a concern in New Hampshire with nitrogen concentrations in Great Bay increasing by 59 percent in the past 25 years. Negative effects of excessive nitrogen, such as algae blooms and low dissolved oxygen levels are beginning to show in some of the estuarine tributaries. Two ecosystem changes of particular concern are the loss of eelgrass and shellfish. The causes of eelgrass declines are uncertain but loss of water clarity, disease, excess nitrogen, and nuisance macroalgae are all contributing factors. Oyster and clam populations are at or approaching the lowest levels ever recorded and trends suggest that oyster populations appear to be experiencing a slow decline. In 2005, DES initiated a process to develop numeric nutrient criteria for NH's estuaries. DES will continue to work on this issue in the coming years to identify an appropriate threshold for nitrogen loading to the estuaries.

MERCURY IN FISH

Similar to other states in the northeast, New Hampshire has statewide fish consumption advisory due elevated levels of mercury levels in fish tissue. The advisory recommends limiting the amount of fish eaten per month. Symptoms of mercury poisoning can include loss of sensation in the extremities (paresthesia), loss of coordination in walking, slurred speech, diminution of vision and/or loss of hearing. Human related sources that may emit mercury into the atmosphere include coal combustion, smelting, and waste incineration with the majority originating from outside of the northeast region.

Much work has been done to reduce mercury emissions in New Hampshire including development and implementation of a state level mercury reduction strategy, passage of legislation to impose stringent mercury emission limits on the State's largest municipal waste combustor, medical waster incinerators and coal-fired utilities as well as legislation banning the sale of many types of mercury-added products in the State. In addition the State continues to actively participate an effort led by the Conference of the New England Governors and the Eastern Canadian Premiers to implement the Regional Mercury Action Plan and participated in the development of a mercury TMDL for the northeast region prepared by the New England Interstate Water Pollution Control Commission with assistance from the northeast states. Although significant progress has been made, more work remains to further reduce mercury down to levels that will ultimately allow the fish consumption advisory to be rescinded.

ACID DEPOSITION (ACID RAIN)

The passage of the Clean Air Act Amendments in 1990 has resulted in a decrease in sulfur dioxide emissions from in-state and out-of-state sources. Unfortunately, this has resulted in little if any improvement in the acidity or acid neutralizing capacity status of New Hampshire surface waters. As a result, hundreds of waterbodies in the state do not meet state water quality standards for the protection of aquatic life due to low pH (i.e. acidic conditions). Additional reductions in nitrogen and sulfur emissions are necessary to expedite recovery from acid deposition in the Northeast.

CHLORIDES AND ROAD SALT

Monitoring data have shown increasing levels of sodium, chloride, and conductivity in surface waters, presumably from deicing (i.e., road salt) runoff. The most impacted surface waters are those that drain salted roads, highways, and urban areas. Total Maximum Daily Load (TMDL) studies were recently drafted for four brooks in the I-93 expansion corridor that fail to meet the water quality criteria for chloride. Efforts are underway to work with New Hampshire Department of Transportation and stakeholders to decrease salt loadings in the region and to educate the public on the issue.

CYANOBACTERIA BLOOMS

DES considers Cyanobacteria (formerly referred to as blue-green algae) a significant public health risk to people who recreate in infected waters and increases the likelihood of animal mortality if infected waters are ingested. Nutrient enriched waterbodies increase the

potential for nuisance blue-green scums that are potentially toxic to the aquatic ecology. Cyanobacteria scums can be fatal to all animals that consume the water and can cause severe illness or skin rashes if ingested or contacted by humans. To protect the public and environmental health, DES has taken a proactive approach by issuing advisories for designated public bathing beaches impacted by cyanobacteria and issuing press releases to warn shoreland owners that cyanobacteria scums are present around the waterbody

PART B. INTRODUCTION

B.1 PURPOSE

The primary purpose of this document is to report on the water quality status of New Hampshire's surface waters and groundwater in accordance with Section 305(b) and 303(d) of the federal Clean Water Act and New Hampshire Statutes Chapter 485-A:4.XIV. Further information about these requirements is provided below. This report also provides an overview of water pollution abatement efforts in New Hampshire.

The Federal Water Pollution Control Act [PL92-500, commonly called the Clean Water Act (CWA)], as last reauthorized by the Water Quality Act of 1987, requires each state to submit two surface water quality documents to the U.S. Environmental Protection Agency (EPA) every two years. Section 305(b) of the CWA requires submittal of a report (commonly called the "305(b) Report"), that describes the quality of its surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water.

The second document is typically called the "303(d) List " and is so named because it is a requirement of Section 303(d) of the CWA. The 303(d) List includes surface waters that are:

1. impaired or threatened by a pollutant or pollutant(s),
2. not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices for nonpoint sources and,
3. require development and implementation of a comprehensive water quality study (i.e., called a Total Maximum Daily Load or TMDL study) that is designed to meet water quality standards.

In addition to satisfying federal reporting requirements, this document is also intended to satisfy New Hampshire Statutes Chapter 485-A:4.XIV which requires the Department to biennially provide a report to the governor and council (and others) of its findings regarding analysis of water quality monitoring data and identification of any long term trends which may affect the purity of the surface and groundwaters of the state.

B.2 REPORT FORMAT

This report is organized in a manner consistent with national guidance and is similar to past 305(b) reports. This facilitates comparison with previous New Hampshire reports and with 305(b) reports from other states that followed the national guidance

Part A includes the Executive Summary. Part B (Introduction) discusses the purpose of the report, an overview of the report format as well as the DES surface water quality website.

The Background section (Part C) begins with New Hampshire surface water statistics such as the number and acres of lakes, total river miles and square miles of estuaries and oceans.

This section also includes a description of the many water pollution control programs in New Hampshire including contact information. Examples include the water quality standards, non-point source control and the coastal programs to name but a few. A cost/benefit analysis discusses the social and economic impacts of clean water. Finally, the state special concerns section provides a list of the major water quality concerns and issues in the state that DES and others will be directing their attention to in upcoming years.

Part D includes a discussion of New Hampshire's numerous water resource monitoring programs and "Water Monitoring Strategy". A brief review of how the monitoring data was assessed to determine water quality status is then provided. This is followed by details of the assessment results including a statewide overview and detailed assessments for each waterbody type. The lakes assessment section includes all of the CWA Section 314 reporting requirements. Results from New probabilistic assessment efforts in estuaries and wadeable streams as well as results of trend analyses for estuaries, lakes and rivers are also presented. Finally, Part D includes a section on public health issues such as drinking water restrictions, bathing beach advisories and fish consumption advisories.

Part E discusses groundwater resources in New Hampshire. This discussion starts with groundwater protection programs followed by a summary of groundwater quality.

Part F of the report provides details of the public participation process that occurred throughout the assessment process. Public input was requested for water quality data, as well as comments on the Consolidated Assessment and Listing Methodology (NHDES, 2008) and the draft 2008 Section 303(d) list.

B.3 DES SURFACE WATER QUALITY ASSESSMENT WEBSITE

Readers are encouraged to visit the DES Surface Water Quality Assessment website at http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm for a downloadable copy of this document as well as additional assessment information, lists and maps. The website also includes instructions to help find assessment information for any waterbody of interest. Included is a list sorted in alphabetical order by waterbody type and then waterbody name and another sorted by town/city, then waterbody type and then waterbody name. Using these lists the assessment unit identification number (or AUID) for any waterbody can be obtained. Knowing the AUID, the various lists can be consulted to find water quality assessment results for any surface water of interest.

PART C. BACKGROUND

C.1 TOTAL WATERS

While New Hampshire is not a large state in terms of land area or population, it is fortunate to have numerous lakes, ponds, rivers, streams, and estuaries. Though its coastline is limited, its tidal embayments are extensive. With an average of 40 inches of rainfall fairly evenly distributed throughout the year, New Hampshire's surficial aquifers are regularly replenished.

Table 1 provides a general overview of surface and groundwater statistics for New Hampshire. The estimated number and acres of lakes, ponds and reservoirs shown on Table 1 are based upon New Hampshire's Assessment Units which are based on the 1:100,000 scale, National Hydrography Database (see Appendix 1 for details on how Assessment Units were created). The number and size of significant publicly owned lakes, reservoirs and ponds is from the DES, Watershed Management Bureau, Biology Section's database.

The estimated miles of rivers and streams are less than that reported in the 2000 305(b) Report but are approximately the same as reported in 2002, 2004, and 2006. The apparent reduction in the number of stream miles is a function of counting format. The previous value reported in 2000 of 10,881 miles included all of the "transport reaches" through lakes, impoundments, and estuaries. The number presented here represents free-flowing miles from the 1:100,000 National Hydrography Database. The slight decrease from 2002 (15 miles) reflects corrections to the Assessment Units such as removal of 1:100,000 scale line work that does not reflect the route of any river or stream and adjustments to the start and end points of riverine impoundments.

The category called Impoundment was new in 2002 and generally represents riverine impoundments or larger lake-like waters that exist because of the presence of a dam. In Table 2 impoundments have been broken out as greater than, or less than 10 acres to help reconcile differences between the 2008 and pre-2002 lake areas and counts.

With regard to the estuaries, a value of 17.8 square miles is reported this year versus 17.7 square miles in 2002, 2004, and 2006, 21.24 square miles in 2002 and 28.2 square miles in 2000. The 21.24 square mile estimate in 2002 was computer generated by the New Hampshire Office of state Planning (NHOSP) and was based on 1:24,000 mapping. The apparent reduction in the square miles of estuaries from 2002 is a function of border position. The previous value stating 21.24 square miles includes all of the estuarine waters in New Hampshire as well as those that lie within Maine's jurisdiction on the Salmon Falls and Piscataqua Rivers. The value reported this year was corrected to include only those estuaries that are in New Hampshire. The 0.1 square miles increase from 2006 to 2008 reflects more detailed mapping of tidal creeks by the shellfishing program.

The Department's estimate of total waters is based on a scale of 1:100,000. Work involving the University of New Hampshire Complex Systems, United States Geological Survey, and the National Mapping Division (and others) to develop a centerline coverage for all waters in

New Hampshire consistent with the National Hydrography Dataset (NHD) at a scale of 1:24,000 was completed in October 2005. DES expects to use the 1:24,000 scale NHD to develop more accurate Assessment Units and estimates of total river / stream miles in the state for the 2010 reporting cycle.

Table 2: Surface Water Atlas

Topic	Value
State Population as reported in July 2007	1,315,000
Square miles of surface area	9,304
Number of major water basin	6
Total miles of rivers and streams[3,5]	9658
Miles of perennial rivers/streams[4]	NC
Miles of intermittent streams[4]	NC
Miles of ditches and canals[4]	NC
Border miles of shared rivers/streams[6]	310
Number of lakes/reservoirs/ponds[5]	867
Number of impoundments <10 Acres[7]	660
Number of impoundments >10 Acres[7]	152
Number of significant publicly owned lakes/reservoirs/ponds[8]	712
Number of significant publicly owned impoundments <10 Acres[7,8]	0
Number of significant publicly owned impoundments >10 Acres[7,8]	8
Acres of lakes/reservoirs/ponds[5]	164,615
Acres/Miles of impoundments <10 Acres[7]	1385 / 74
Acres/Miles of impoundments >10 Acres[7]	20,011 / 169
Acres of significant publicly owned lakes/reservoirs/ponds[7,8]	155,599
Acres/Miles of significant publicly owned impoundments <10 Acres[7,8]	0 / 0
Acres/Miles of significant publicly owned impoundments >10 Acres[7,8]	396 / 5.18
Square miles of estuaries[1,10]	17.8
Miles of ocean coast[2]	18
Acres of freshwater wetlands[9]	400,000 - 600,000
Acres of tidal wetlands[9]	7,500

Footnotes

1. NH Office of state Planning estimate based on 1:24,000 scale U.S. Geological Survey maps.
2. DES estimate based on 1:24,000 scale U.S. Geological Survey maps.
3. The apparent reduction in the number of stream miles is a function of counting format. The value of 10,881 miles reported in the 2000 305(b) Report included all of the "transport reaches" through lakes, impoundments, and estuaries. The number

presented here represents free-flowing miles from the 1:100,000 National Hydrography Database.

4. NC means the value was not calculated.
5. Based upon New Hampshire's Assessment Units which are based on the 1:100,000 scale, National Hydrography Database.
6. DES estimate of river miles for the Connecticut River, Halls Stream, the Salmon Falls River and the Piscataqua River.
7. For the 2002 305(b)/303(d) Assessments, the New Hampshire Department of Environmental Services began mapping and evaluating impoundments.
8. From the DES, Watershed Management Bureau, Biology Section, 2004.
9. 9.N.H. Department of Environmental Services, Wetland Bureau, ANNUAL REPORT, FY 2002 http://www.des.state.nh.us/pdf/Wetlands02.pdf
10. The 2002 305(b)/303(d) Assessment reported a value of 21.24 square miles of estuaries. This however included all estuarine waters in New Hampshire as well on the Maine side of the Salmon Falls and Piscataqua Rivers (3.73 square miles). The lower value reported this year was corrected to only include estuarine waters that lie in New Hampshire.

C.2 WATER POLLUTION CONTROL PROGRAM

New Hampshire has numerous water pollution control programs in place to help protect, restore and sustain the quality of its water resources. The following sections include a brief description of many of these programs including who to contact for more information.

C.2.1 WATER QUALITY STANDARDS

Contact: Bob Estabrook, DES Watershed Management Bureau
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C.2.1.1 Overview

Surface water quality standards establish the baseline quality that all surface waters of the state must meet in order to protect their intended uses. They are the "yardstick" for identifying where surface water quality is good or poor and for determining the effectiveness of regulatory pollution control and prevention programs. The Water Quality Standards Program is in charge of ensuring that the States surface water quality standards are up-to-date and protective of the designated uses assigned to each surface water.

Water quality standards in New Hampshire are included in the state's surface water quality regulations (Env-Wq 1700) (DES, 2008b) and in New Hampshire state statute RSA 485-A:8. A downloadable copy of the regulations may be obtained from http://des.nh.gov/organization/divisions/water/wmb/index.htm and a copy of the state statute may be obtained from http://www.gencourt.state.nh.us/rsa/html/l/485-a/485-a-mrg.htm.

The standards are composed of three parts: designated uses, water quality criteria, and antidegradation. Each of these components is briefly discussed below.

C.2.1.2 Designated Uses

Surface waters of the state are classified as either Class A or B, with the majority of waters being Class B. DES maintains a list that includes a narrative description of all the legislative classified waters. Designated uses are the desirable uses that surface waters should support such as swimming (i.e., primary contact recreation) and fishing (i.e., aquatic life). As indicated below, state statute RSA 485-A:8 is quite general with regards to designated uses for New Hampshire surface waters.

Classification	Designated Uses as described in RSA 485-A:8
Class A -	These are generally of the highest quality and are considered potentially usable for water supply after adequate treatment. Discharge of sewage or wastes is prohibited to waters of this classification.
Class B -	Of the second highest quality, these waters are considered acceptable for fishing, swimming and other recreational purposes, and, after adequate treatment, for use as water supplies.

Further review and interpretation of the regulations (Env-Wq 1700), however, reveals that the general uses can be expanded and refined to include the seven specific designated uses shown in Table 3. Each of these designated uses, with the exception of wildlife, were assessed for this reporting cycle. An assessment methodology for wildlife has not yet been developed but will be included in future assessments.

Table 3: Designated Uses for New Hampshire Surface Waters

Designated Use	DES Definition	Applicable Surface Waters
Aquatic Life	Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.	All surface waters
Fish Consumption	Waters that support fish free from contamination at levels that pose a human health risk to consumers.	All surface waters
Shellfish Consumption	Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers	All tidal surface waters
Drinking Water Supply After Adequate Treatment	Waters that with adequate treatment will be suitable for human intake and meet state/federal drinking water regulations.	All surface waters

Primary Contact Recreation (i.e. swimming)	Waters suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water	All surface waters
Secondary Contact Recreation	Waters that support recreational uses that involve minor contact with the water.	All surface waters
Wildlife	Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.	All surface waters

C.2.1.3 Water Quality Criteria

The second major component of the water quality standards is the "criteria". Criteria are designed to protect the designated uses of all surface waters and may be expressed in either numeric or narrative form. A waterbody that meets the criteria for its assigned classification is considered to meet its intended use. Water quality criteria for each classification may be found in RSA 485-A:8, I-V and in the state's surface water quality regulations (DES, 2008b).

C.2.1.4 Antidegradation

The third component of water quality standards is antidegradation which are provisions designed to preserve and protect the existing beneficial uses and to minimize degradation of the state's surface waters. Antidegradation regulations are included in Part Env-Wq 1708 of the state's surface water quality regulations (DES, 2008b). According to Env-Wq 1708.03, antidegradation applies to the following:

- Any proposed new or increased activity, including point and nonpoint source discharges of pollutants that would lower water quality or affect the existing or designated uses;
- a proposed increase in loadings to a waterbody when the proposal is associated with existing activities;
- an increase in flow alteration over an existing alteration; and
- all hydrologic modifications, such as dam construction and water withdrawals.

C.2.1.5 Revisions to Water Quality Standards

In accordance with the Clean Water Act (CWA), water quality standards are reviewed and revised, as necessary, at least every three years. Statutory authority to create (or revise) the water quality standards is provided under RSA 485-A:6 and RSA 485-A:8. Any new rules or changes to rules must be adopted in accordance with RSA 541-A, which first requires a public hearing.

The New Hampshire Surface Water Quality Regulations Env-Ws 1700 were re-adopted without change as interim rules for a period of six months, effective December 10, 2007. The rules with minor revisions updating and clarifying the existing rules, and now referred to as Env-Wq 1700, were formally adopted on May 21, 2008. In 2000, DES formed a Water Quality Standards Advisory Committee (WQSAC). The Committee is comprised of approximately 30

representatives from a variety of interests and organizations. The purpose of the Committee is to provide input to DES on water quality standards issues, including any proposed rule changes. Over the past few years and much discussion, proposed rule revisions have been drafted for numerous topics. It is expected that in the next year or two, formal rule-making will begin to adopt several proposed changes into Env-Wq 1700.

Important water quality standard issues that are currently under discussion include the following:

Antidegradation

As stated above, the purpose of antidegradation is to prevent the degradation of high quality surface waters unless lowering of water quality is necessary to accommodate important economic or social development in the area in which the surface waters are located. In no case, however, may water quality be allowed to be degraded below that necessary to support all existing uses of the surface water. The State has had antidegradation regulations for many years (see section C.2.1.4), however implementation has been slow due to lack of a clearly defined process. For instance, how does one quantify "important economic or social development"? This is especially true with regards to applying antidegradation to stormwater discharges from projects involving landscape change. Development of a process to implement antidegradation regulations is a high priority of DES and the Water Quality Standards Advisory Committee.

Numeric Nutrient Criteria

Nutrients in appropriate amounts are essential to the health of aquatic systems. However, excessive nutrients can result in excessive growth of aquatic macrophytes, phytoplankton and periphyton, which can, in turn, cause oxygen depletion, imbalances of aquatic species and a general decline in the aquatic resource.

In the mid 1990s water quality reports submitted by states to EPA indicated that nutrients were the leading cause of impairment in lakes and coastal waters and the second leading cause of impairment to rivers and streams. In addition, nutrient over enrichment was strongly linked to the large hypoxic zone in the Gulf of Mexico.

In February of 1998, President Clinton and Vice President Gore released a comprehensive Clean Water Action Plan the purpose of which is to provide a guide for Federal agencies to work with States in restoring and protecting the Nation's water resources. A key part of the Action Plan calls for expanded efforts to reduce nutrient over enrichment of waters and for EPA to work with States and Tribes to adopt criteria (i.e. numeric concentration levels) for nutrients, including nitrogen and phosphorus, as part of enforceable State water quality standards.

New Hampshire, like many states, has had narrative (but not numeric) nutrient water quality standards for many years (see Env-Wq 1703.14 of New Hampshire surface water quality regulations at http://des.nh.gov/organization/commissioner/legal/rules/index.htm). In accordance with EPA guidance in 2001, DES has prepared a numeric nutrient criteria implementation plan and has developed numeric criteria for phytoplankton chlorophyll a (a response variable of

excessive nutrients) as a quantitative interpretation of state narrative standards and has used the chlorophyll criteria for determining impairment of surface waters. DES has also convened advisory committees to help develop numeric criteria for lakes and estuaries. DES remains committed to this effort and over the next few years will continue to work with stakeholders to develop appropriate numeric nutrient criteria.

Establishing Biomonitoring Criteria

Surface water assessments in New Hampshire are based on chemical, physical, and biological data. Bioassessments reveal the integrated effects of multiple pollutant stressors over long periods of time and thus provide a holistic measure of their aggregate impact (USEPA, 1991). Baseline biomonitoring information is needed to develop and establish numeric biologic criteria for assessing the quality of surface waters.

Since 1997 DES has operated a comprehensive biomonitoring program for the ultimate purpose of assessing the biological integrity and ecological health of the state's surface waters. The primary focus of the program has been on the collection of data and establishment of numeric indices to evaluate the condition of wadeable streams. Initially, EPA grant funds supported two full time employees dedicated to the biological assessment program. To date, current program accomplishments include draft biological indices for benthic and cold water fish communities and the ongoing development of a refined wadeable stream classification system. However, 2004 staffing cuts at DES reduced the program to a single program manager. In turn, the reduction in dedicated staff has severely limited field activities, finalization of biological indices, and expansion to other waterbody types (i.e. lakes, large rivers, wetlands). Without additional funding future progress on the development and implementation of bioassessment tools will continue to be hampered.

Quantifying Allowable Water Level Fluctuations in Impoundments

Impoundments are surface waters under RSA 485-A:2.XIV and Env-Wq 1702.46 and are subject to surface water quality standards relative to the protection of designated uses such as aquatic life use support. Under 1703.01(c), all surface waters shall provide, wherever attainable, for the protection and propagation of fish, shellfish and wildlife, and for recreation in and on the surface waters. Under Env-Wq 1703.19, the state's surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

Although impoundments are subject to water quality standards, impoundments are used as storage reservoirs for human uses such as public recreation, drinking water supply, and hydroelectric power. Water use typically causes water level fluctuations (drawdown and refill) of impoundments and stream flow fluctuations downstream from the impoundment dam. These fluctuations can affect biological integrity in the impoundment and in the river reach(es) downstream from the impoundment dam. Water level fluctuations dewater the shoreline (littoral) areas of lakes and ponds, and the shorelines of upstream and downstream river reaches. This reduces physical aquatic habitats and refuge areas for fish, amphibians, aquatic insects, and plants.

Meeting surface water quality standards requires the establishment of management goals for impoundments and downstream reaches. Management goals are to be established consistent with Env-Wq 1703.19. Therefore, DES is developing guidance relative to water level management to effectively balance the competing interests of water use and water quality standards attainment. The guidance will address water level fluctuations in the impoundment and water releases to downstream river reaches. The water level fluctuations will likely be defined as functions of the magnitude, timing, frequency, and duration of changes in water levels.

C.2.2 POINT SOURCE CONTROL PROGRAM

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The Clean Water Act of 1972 provided much of the impetus for the water pollution abatement effort of the last three decades. With associated federal, state and local funding, involving the earlier Construction Grants Program, the current state Revolving Loan Program, as well as the state Aid Grant Program, significant progress in abating pollution from point sources was made and concomitant improvements in New Hampshire surface water quality was noted. The construction of industrial and municipal wastewater treatment facilities (WWTF) initially focused on technology-based controls and on conventional pollutants. With the completion of the upgrade of the primary plants to secondary treatment and with the elimination of most dry weather raw municipal discharges, New Hampshire has shifted emphasis to water quality-based controls and to the control of toxic pollutants.

The following is an overview of the major components comprising New Hampshire's point source control program. First discussed in Section C.2.2.1 is the discharge permit process which is the primary vehicle used to control and prevent point source discharges from violating water quality standards. In Section C.2.2.2, EPA's Combined Sewer Overflow Policy for abating pollution from combined sewer overflows (CSOs) is discussed. Another important component is the industrial pretreatment program, the purpose of which is to control the pollutants that industries discharge to municipal WWTFs so that the pollutants do not pass through or interfere with the treatment processes at the WWTF or contaminate the sewage sludge; this is discussed in Section C.2.2.3. The methods used to ensure compliance of point sources with water quality standards is covered in Section C.2.2.4.

C.2.2.1 Discharge Permits

Contact: Jeff Andrews, P.E., DES Wastewater Engineering Bureau,
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The primary means of regulating point sources in New Hampshire is through the discharge permit process. Since the state is not "delegated," EPA is responsible for

implementing the NPDES (National Pollutant Discharge Elimination System) permit process in accordance with Section 402 of the Clean Water Act (CWA). As a rule, the state works closely with EPA to establish appropriate discharge limits. Prior to issuance of the NPDES permit, the state must certify that the permit meets state water quality laws and regulations.

In accordance with RSA 485-A:13, dischargers are also required to obtain a state discharge permit. In almost all cases, the NPDES permit serves as the state discharge permit. In such cases, and after the NPDES permit is issued, DES sends a letter to the discharger informing them that their NPDES permit is also their state discharge permit. In this manner, the permittee only has one set of permit conditions to comply with.

Permits are generally issued for five years. In New Hampshire there are presently a total of 147 NPDES permits that have been adopted as state discharge permits. Of these 147 permits, 98 are individual permits and 49 are general permits (general cooling water permits, water treatment plant general permits, remediation general permits, and POTW general permits). Of the 147 permits 57 are categorized as major permits and 90 are categorized as minor permits.

RSA 485-A:8, I-IV and the Surface Water Quality Regulations (Env-Wq 1700) are the primary references used to develop permit effluent limits. Where toxics are a concern, specific permit limits, based on the chemical specific criteria in the Surface Water Quality Regulations, are set for those toxics in the permittee's effluent which may cause water quality violations. To further prevent toxic discharges, most permits also include a requirement to perform whole effluent toxicity (WET) tests to determine if the combined effect of all substances in the discharge are potentially toxic to aquatic organisms in the receiving water.

C.2.2.2 Combined Sewer Overflow (CSO) Strategy

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Combined sewer overflows (CSOs) are point source discharges regulated under the NPDES and state discharge permit system. By 2007, 38 CSOs remain located in the communities of Berlin, Exeter, Lebanon, Manchester, Nashua, and Portsmouth.

In 1994, EPA issued a national strategy to address CSOs by requiring communities to implement nine minimum technology-based controls and develop CSO long-term control plans (LTCP). The LTCP addresses a range of CSO control options that would ultimately lead to achieving appropriate water quality objectives and compliance with the CWA. LTCPs are required for Lebanon, Manchester, Nashua and Portsmouth. All of these communities have a LTCP for their CSOs.

Berlin completed a project to separate their combined sewers; however, they have one CSO remaining that during storm events occasionally discharges to the Androscoggin River. This CSO acts as an emergency relief point to prevent flooding of the main pumping station which pumps wastewater across the Androscoggin River to the wastewater treatment facility. The City continues to monitor the frequency, volume, and duration of overflows and intends to

eliminate this CSO by reducing infiltration/inflow (I/I) in the sewers upstream of the pump station. In 1995, an I/I study was completed which included televising the sewers, and smoke and dye testing in order to identify major sources of I/I. Based on the recommendations of this study, the City has spent close to $1 million to remove I/I.

Exeter has eliminated all of its CSOs, except one, through a separation program. The remaining CSO overflows during storm events to Clemson Pond, which outlets to the Squamscott River. As of 2007, Exeter is working with EPA to develop a plan to reduce the CSO overflow events, and possibly eliminate all CSO overflows.

Lebanon has seven remaining CSOs that occasionally discharge during storm events to Great Brook, and the Mascoma and Connecticut Rivers. In the spring of 1996, EPA issued an Administrative Order (AO) to the City to complete a CSO Facility Plan, the purpose of which is to identify the least cost alternative to abate CSOs to meet current water quality standards. EPA reviewed and approved the CSO Facility Plan and issued an AO on June 6, 2000 requiring the City to eliminate their seven CSO outfalls by December 31, 2012. In 2007, the City requested that the date to eliminate their CSOs be extended to December 31, 2020.

In the cities of Manchester and Nashua, CSOs remain a significant concern. As of 2007, there are 17 CSOs remaining in Manchester. Fifteen of the CSOs discharge to the Merrimack River and 2 CSOs discharge to the Piscataquog River. Manchester is preparing a plan to eliminate or separate the remaining CSOs. Nashua has eight CSOs remaining; four of the CSOs discharge to the Nashua River and four discharges to the Merrimack River. Studies have been conducted by both communities to quantify the impacts of the CSOs on the receiving waters. It appears that bacteria and floatables are the major pollutants which must be abated. Both communities are under enforceable orders to implement the agreed upon CSO abatement plan.

Although Portsmouth has eliminated seven CSOs, it still has four remaining that either discharge to a tidal pond which outlets to the Piscataqua River or directly to the Piscataqua River. In 2007, EPA issued an AO which includes a schedule for separating remaining portions of the CSO system.

C.2.2.3 Industrial Pretreatment Program

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In accordance with the CWA, some municipal NPDES permits also include requirements to develop (or update) and implement an Industrial Pretreatment Program (IPP). "Pretreatment" refers to measures industry must take to prevent the discharge into municipal sewers of toxic pollutants from industry that are incompatible or will interfere with the municipal wastewater treatment process that will pass through the treatment plant and cause problems in the receiving waterbody, cause a problem with sludge disposal or poses a health threat to WWTF workers. Dischargers regulated by the IPP are referred to as "indirect" dischargers because their flow does not discharge directly to the receiving water before being treated at the municipal WWTF.

The requirements to implement a federal IPP are generally limited to municipalities with industry that have wastewater treatment plants designed for 5 million gallons per day (MGD) or more. However, small communities may also be required to implement a federal IPP if nondomestic wastes have caused upsets, sludge contamination or violations of the municipal wastewater treatment plant's NPDES permit conditions. There are currently 13 municipalities in New Hampshire with EPA approved IPPs. Though the state does not have delegation for either the NPDES program or the federal IPP, DES assists EPA by providing program coordination, Pretreatment Compliance Inspections, Audits, and reviews of Annual Reports, Sewer Use Ordinances and Local Limits.

New Hampshire also has an IPP which supplements the federal program. Statutory authority for the state IPP is included in RSA 485-A:5. Regulations (Env-Ws 904) regarding standards for pretreatment of industrial wastes were recently revised and became effective on April 21, 2005.

In general, the state IPP requires municipal wastewater treatment plants with industrial contributors to:

- Develop Local Limits and minimum pretreatment standards which are included in its DES approved Sewer Use Ordinance.

- Implement a system to permit all significant industrial dischargers, including sampling, monitoring and reporting requirements.

- Apply to DES for approval of an Industrial Discharge Request (IDR) for the industrial discharge. This is submitted by the municipality using information provided by the industry. IDR approval is required to allow any new industry or any existing industry which is proposing to increase its flow or change its wastewater characteristics, to discharge to the municipal wastewater treatment plant.

The state IPP applies equally to all municipal wastewater treatment plants with or without federally approved IPPs. To date, several municipalities have implemented or are working on their own local pretreatment programs.

The economic cost to the communities of the pretreatment programs has generally been transferred to the industrial users by means of fees. In addition to municipal program administration costs, industrial users bear the cost of monitoring and pretreatment.

At this time it does not appear that interference of treatment processes or sludge recycling due to industrial discharges or the "pass-through" of industrial wastewater at municipal WWTFs is a significant concern. Continued oversight of industrial pretreatment programs by the state and federal government is necessary, however, to support local pursuit of program goals and to create incentives for pollution prevention.

C.2.2.4 Permit Compliance and Enforcement Program

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DES regularly inspects NPDES facilities and reviews discharge monitoring reports submitted by permittees for compliance with their permit limitations. When a violation is discovered, and assuming it does not pose an imminent threat to human health or the environment, DES will first do all it can to bring a violator into compliance through technical assistance, pollution prevention techniques, and/or Letters of Deficiency (LODs). This process allows the violator to voluntarily attain compliance, and in many cases it is very effective.

In more serious cases, or where compliance efforts have not been effective, formal enforcement actions may be necessary. These may include Administrative Orders (AO), Administrative Fines, Consent Agreements or Consent Decrees. In cases where court orders such as Consent Agreements or Consent Decrees are to be issued, a referral is made to the New Hampshire Department of Justice. Depending on the availability of resources, and the specifics of a case, enforcement actions may be turned over to the EPA or performed in conjunction with the EPA.

New Hampshire remains very concerned that all WWTFs maintain compliance with the requirements of their NPDES permits. Also of continuing concern is the maintenance of physical plants. To insure that local, state and federal investments are secure and that permit limits are being complied with, DES inspectors regularly conduct either compliance sampling inspections (CSIs) or compliance evaluation inspections (CEIs). Emphasis is placed on the major NPDES permits which are usually inspected on an annual basis. Inspections of the minor permittees are normally conducted on a biannual basis. At the time of plant inspections, inspectors prepare and issue comprehensive inspection reports to the facility citing deficiencies or recommending corrective action relative to such things as permit requirements, correct and timely filing of Discharge Monitoring Reports (DMRs), laboratory quality assurance programs, and correct laboratory procedures for all required testing.

C.2.2.5 Wastewater Treatment Facility Technical Assistance Program

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For many years, DES has had an active Technical Assistance program for publicly-owned wastewater treatment facilities (WWTFs). Frequent on-site inspections are performed each year, to assist WWTFs in maintaining compliance. Particular attention is paid to minor facilities that are not currently subjected to routine compliance inspections. Occasionally, assistance is also requested from industrial discharges.

In addition to offering highly technical advice, DES also conducts an extensive training program both in classroom environments as well as on-site over-the shoulder teaching and assistance. This is partially subsidized by EPA's 104(g)1 Operator Outreach Grant program.

Finally, DES administers a comprehensive Operator Certification program. The purpose of this program is to assure that properly trained and responsible personnel oversee the cost-effective operation and maintenance of treatment facilities, thereby protecting the over $1 billion government dollars, invested on such installations in New Hampshire.

C.2.3 SECTION 319 NONPOINT SOURCE CONTROL PROGRAM

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DES Website: http://des.nh.gov/organization/divisions/water/wmb/was/index.htm

Nonpoint source (NPS) pollution, unlike pollution for industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.

DES's nonpoint source program is administered by the DES Watershed Management Bureau, Watershed Assistance Section (http://des.nh.gov/organization/divisions/water/wmb/was/index.htm) Funds for Watershed Assistance Grants are appropriated through the DES Watershed Assistance Section from the U.S. Environmental Protection Agency under Section 319 of the Clean Water Act. Grant funds are available to develop and implement watershed based plans addressing nonpoint pollution problems in high quality watersheds or in impaired watersheds. A database of funded projects can be found at http://www2.des.state.nh.us/OneStop/watershed_npsgrants_query.aspx .

Half of the Section 319 funds are earmarked by federal guidance for restoration of impaired watersheds. Beginning in 2004, watershed restoration projects using 319 funds were required to address all of the elements of a watershed-based plan specified in EPA guidance. In general, plans must identify an impairment, determine pollutant load reductions needed to meet water quality standards, determine best management practices required to meet the targeted load reductions, and measure progress toward water quality goals.

Bog Brook in North Stratford is the first watershed to be restored under the new criteria. The Brook was impaired by hydrologic modification decades earlier that resulted in stream channel instability. Using techniques outlined in the DES Generic QAPP for stream morphology projects, the Town of Stratford, through its consultant and contractor, designed and built a restored, stable stream channel. Several other stream morphology projects are under development, including project on the Pemigewasset River, Baker River, Nash Stream, Black Brook in Manchester, Suncook River, and the Upper Connecticut River.

Restoration projects were completed in Middle Brook Canal, Moultonborough, and Crystal Lake, Manchester, and are likely to result in impairments being removed from the 303(d) list.

Over a dozen watershed based plans were recently completed in accordance with EPA guidance for impaired waters. For a list of watershed based plans, see http://des.nh.gov/organization/divisions/water/wmb/was/index.htm.

Each year, the Watershed Assistance Section prepares annual reports, which provide an overview of activities funded by the Section 319 program for the previous year as well as other activities within the within DES that address nonpoint source pollution. The annual reports provide a sense of the scope of work and costs that are necessary to abate various types of impairment caused by nonpoint sources as well as an indication of where future nonpoint source control efforts will be focused. Copies of the nonpoint source management annual reports for 2006 and 2007 are provided in Appendix 2.

C.2.4 MONITORING PROGRAMS

Please see section D.1 for a description of water monitoring programs in New Hampshire.

C.2.5 401 WATER QUALITY CERTIFICATION PROGRAM

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Section 401 of the federal Clean Water Act (CWA) (33 U.S.C. §1341) states, in part: "Any applicant for a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the state in which the discharge originates or will originate…that any such discharge will comply with the applicable provisions of sections 301, 302, 303, 306, and 307 of this title….". In general this means that any applicant for a federal license or permit to construct or operate a facility which may result in a discharge to navigable waters, must first obtain a certification from the state (i.e., 401 Certification) that the proposed activity will comply with state surface water quality standards.

In New Hampshire, the DES Watershed Management Bureau administers the Section 401 Water Quality Certification (401 Certification) Program. DES will issue a 401 Certification only if the activity is shown to comply with water quality standards. DES will deny a 401 Certification if the activity fails to demonstrate compliance with water quality standards. 401 Certifications can include conditions necessary to ensure compliance with water quality standards.

Examples of federal permits or licenses that require 401 Certification reviews include:

- CWA Section 404 (wetlands dredge and fill), through the U.S. Army Corps of Engineers (ACE). The extent of DES's review is based on the magnitude of the activity and the

type of permit to be issued by ACE [i.e., individual or state programmatic general permit (see section C.2.16)].
- CWA Section 402 (National Pollutant Discharge Elimination System-NPDES), through the U.S. Environmental Protection Agency (EPA). The extent of DES's review is based on the type of permit to be issued by EPA (i.e., individual or general permit).
- Federal Power Act (FPA) (hydropower and energy), through the Federal Energy Regulatory Commission. DES reviews each individual activity.

Since most developments impact wetlands and therefore need a federal Section 404 permit, and since all WWTFs discharging to surface waters require a federal NPDES permit, the 401 Certification program is very far-reaching and is consequently considered to be an extremely important tool for protecting the New Hampshire's surface waters.

In 2006, DES processed five complete applications and issued individual 401 Certifications for each of the five activities. In 2007, DES processed seven complete applications and issued individual 401 Certifications for each of the seven activities.

DES is currently developing procedural rules for the 401 Certification program. The rules will describe the 401 Certification application requirements and process, the public participation process, and the appeals process.

C.2.6 TMDLS AND LAKE DIAGNOSTIC FEASIBILITY STUDIES

C.2.6.1 Total Maximum Daily Load Studies (TMDLs)

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As mentioned in section B.1, Section 303(d) of the Clean Water Act requires Total Maximum Daily Load studies (TMDLs) to be conducted on all surface waters included on the Section 303(d) list of impaired waters. The term "total maximum daily load" (TMDL) refers to the calculation of the maximum amount of a pollutant that a waterbody can receive, and attain or maintain water quality standards for its designated use.

The TMDL calculation allows for the determination of a carefully identified allowable pollutant load equivalent to the sum of the waste load allocations (WLA) for point sources, load allocations (LA) for nonpoint sources and naturally occurring background sources, and an allocation of that load among the pollutant's sources. The TMDL is required to account for seasonal variations and must also include a margin of safety (MOS) that accounts for uncertainty and any lack of knowledge concerning the relationship between effluent limitations and water quality. In equation form, the TMDL may be expressed as:

$$\mathbf{TMDL = WLA + LA + MOS}$$

Once calculated, the TMDL is then allocated between all sources of the pollutant causing impairment. As a minimum TMDLs must be expressed in terms of a mass (i.e., load) per day, but

also be expressed in other ways (i.e., concentration, toxicity, etc.) to facilitate implementation and determination of compliance. All TMDLs are subject to public review and comment and must be submitted to the United States Environmental Protection Agency (EPA) for review and approval.

In the broader sense, a TMDL refers to a detailed plan that identifies the pollutant reductions a waterbody needs to meet state surface water quality standards and develops a strategy to implement those reductions is order to restore the water quality. The general process for developing TMDLs includes identifying the problem pollutant, establishing the water quality goals or target values needed to achieve water quality standards, identifying the specific sources contributing the pollutant of concern, and then assigning a specific load allocation to each of the sources. Follow-up monitoring is usually needed to ensure that the implemented TMDL results in the attainment of the targeted water quality standard.

Since 2006, the NHDES TMDL Program has received EPA approval for many TMDL projects across the state including 272 TMDLs for lakes impaired by low pH (i.e., acid impaired lakes), two TMDLs for bacteria impaired freshwater public beaches, two bacteria TMDLs in the Little Harbor estuary and, as part of the Northeast Regional Mercury TMDL, credit for 5,124 TMDLs for the mercury impaired surface waters in New Hampshire. Like many other New England States, all surface waters in New Hampshire are impaired for the fish consumption use due to high levels of mercury in fish tissue (see section D.6.3) Anthropogenic sources of mercury include coal-fired power plants, municipal waste combustors, sewage sludge incinerators, and residential heating which emit mercury into the atmosphere that is later deposited onto the land and into surface waters. The Northeast Regional Mercury TMDL was developed to address all mercury impaired waters in the Northeast where atmospheric deposition is the primary source and was prepared by the states of Connecticut, Maine, Massachusetts, New Hampshire, New York and Rhode Island in cooperation with the New England Interstate Water Pollution Control Commission (NEIWPCC). For more information on the TMDL program including a list of completed TMDLs and TMDLs scheduled to be completed in the near future, visit the DES TMDL website at
http://des.nh.gov/organization/divisions/water/wmb/tmdl/index.htm

C.2.6.2 Diagnostic Feasibility Studies (Lakes)

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The Clean Lakes Program at the Department of Environmental Services (DES) involves the diagnostic evaluation of water quality within a given watershed. Lakes and ponds in New Hampshire are recommended for the Clean Lakes Program if data from other monitoring programs, like the DES Lake Survey Program or the Volunteer Lake Assessment Program (VLAP) show signs of declining water quality over time.

Diagnostic Feasibility studies are typically conducted over the course of a 16-month period, and hydrologic and nutrient inputs to lakes and ponds from their watersheds are monitored for a range of chemical, biological, physical and ecological parameters. Land use

patterns and characteristics are also evaluated through the course of this study. These data are used to develop hydrologic and nutrient budgets for the lake, and are ultimately used to pinpoint elevated sources of nutrients or other inputs to the waterbody from its watershed.

Once sources of pollution are identified, DES makes recommendations for remediation and lake rehabilitation. The program focuses on addressing watershed sources of nutrients *(e.g., erosion, septic systems, fertilizers, development, etc.)* before addressing in-lake symptoms of degradation *(e.g., decreased clarity, algal blooms, low oxygen levels, odors, etc.).*

Volunteers from the lake or pond are encouraged to assist in collecting samples, much like their role in the VLAP program. A strong relationship with the lake association and local town(s) is integral in formulating a long-term management strategy for the lake and its watershed.

A list of lakes with completed Diagnostic Feasibility studies as well as those that have studies underway, is provided in Section D.3.6.3.

C.2.7 EXOTIC SPECIES CONTROL PROGRAM

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The primary purpose of New Hampshire's Exotic Aquatic Plant Program is to "prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state" (RSA 487:17, II). The program focuses on submerged exotic aquatic plants, including variable milfoil (*Myriophyllum heterophyllum*), Eurasian milfoil (*Myriophyllum spicatum*), fanwort (*Cabomba caroliniana*), Brazilian elodea (*Egeria densa*), Hydrilla (*Hydrilla verticillata*) and water chestnut (*Trapa natans*), among other species. Other exotic aquatic plants such as common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*), are also of concern and, while not a focus of the program, are prohibited by the program for sale and distribution.

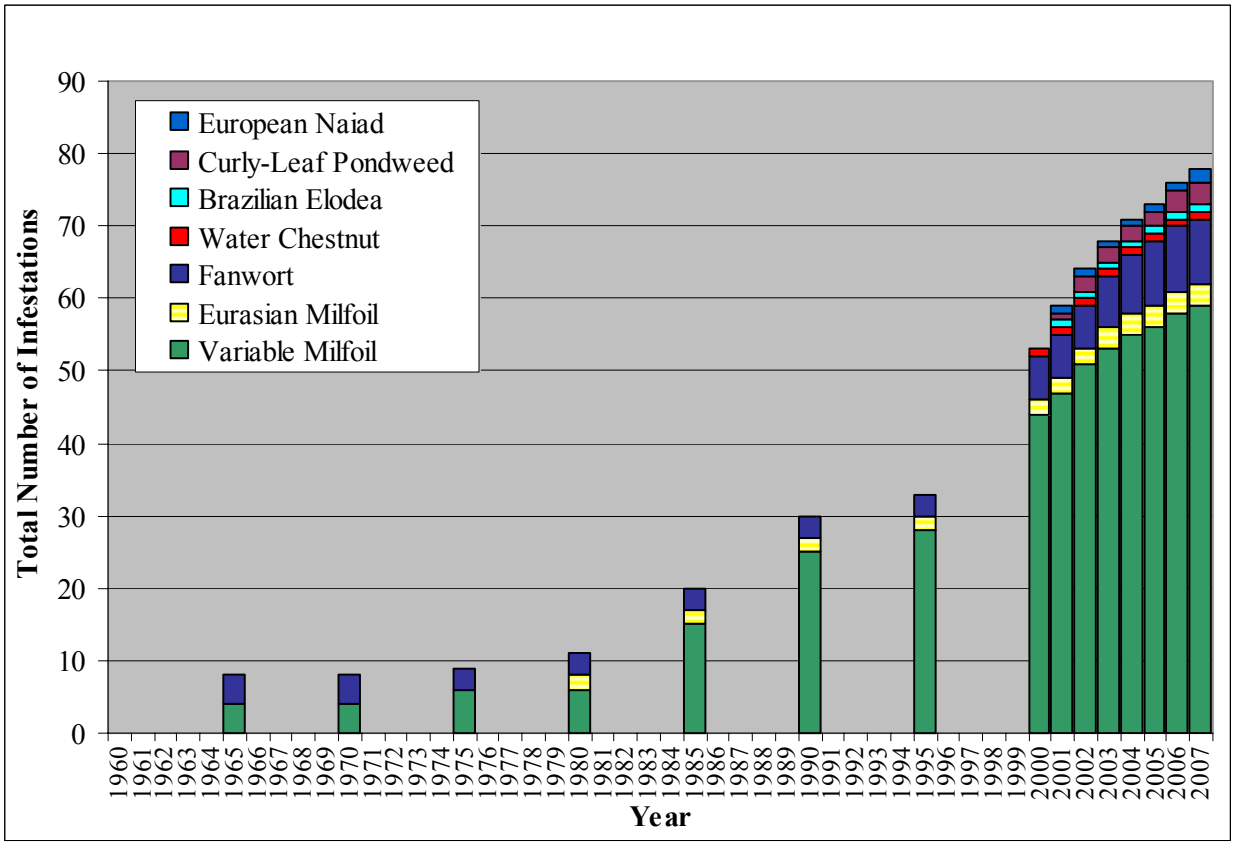
"Exotic aquatic plants" are plants living in lakes, rivers, or other waterbodies that are not part of New Hampshire's native aquatic flora. These plants, sometimes called 'nuisance' or 'invasive' species, or 'weeds,' can grow and reproduce rapidly, taking over large portions of waterbodies and impairing boating, recreation, and aesthetics, threatening native plant species and causing habitat loss. A study by the University of New Hampshire documented that there may be up to a 20 percent decline in lakefront property values attributable to the presence of exotic aquatic plants (Halstead et al., 2003).

Exotic aquatic plants propagate primarily by fragmentation, a process by which a piece broken from a mature plant can grow roots, settle in a new location, and begin growth of a new plant. Plant fragments, most often generated by human activity, can easily become entangled on boats, trailers, fishing equipment, or diving gear, thus spreading from waterbody to waterbody. Recreational boat registrations in New Hampshire have grown over 20 percent since 1997, to include more than 103,000 boats registered in 2007. With the increase in boating activities, there

is increased potential for the spread of exotic aquatic plants to new locations and waterbodies by boats and other water-related recreational equipment.

The first exotic aquatic plant infestation in New Hampshire was discovered in 1965 in Lake Winnipesaukee. Since then, infestations have increased to a total of 78 infestations on 69 waterbodies in 2007 (Figure 11).

Figure 11: Exotic Aquatic Plant Infestations 1960 to 2007



Four fanwort infestations were documented in the 1960s, but a dredge of Millville Lake during the early 1980s led to its eradication in this lake, leaving only three infestations (Phillips Pond, Sandown; Big Island Pond, Derry and Arlington Mill Reservoir, Salem). Other fanwort populations were documented in the Nashua River and Mine Falls Pond, Nashua, and in Robinson Pond, Hudson, in the late 1990s, and in Lake Massabesic in 2003. Fanwort infestations were also documented in 2004 in Otternic Pond, Hudson, and in Wilson Lake, Salem in 2005, bringing the total in 2007 to nine infestations.

Water chestnut, first found in New Hampshire in 1998, is currently documented only in the Nashua River. The presence of a water chestnut seed in a new waterbody in the fall of 2007 suggests that there may be another waterbody plagued by this species. A 2008 field inspection is planned for that waterbody. During the summer of 2001, the first New Hampshire infestation of Brazilian elodea (*Egeria densa*) was identified in Nutts Pond, Manchester. Seven waterbodies now have more than one species of exotic aquatic plants: Mine Falls Pond, Nashua (milfoil and fanwort), Robinson Pond and Otternic Pond, Hudson (milfoil and fanwort), Lake Massabesic,

Auburn (milfoil and fanwort), the Nashua River, Nashua (milfoil, fanwort, curly-leaf pondweed and water chestnut), the Connecticut River south of Hanover (Eurasian water milfoil, two exotic water naiads, and curly-leaf pondweed), and Glen Lake, Goffstown (variable milfoil and invasive water naiad).

A new problem in 2007 was the identification of the invasive alga *Didymosphenia geminata* in the Connecticut River. The infestation stretches from just north of Lake Francis, down through Northumberland to date. DES will continue monitoring the spread of Didymo within the Connecticut River, and any new sites, annually.

This program, initiated in 1981, has five focus areas: 1) Prevention of new infestations, 2) Monitoring for early detection of new infestations to facilitate rapid control activities, 3) Control of new and established infestations, 4) Research towards new control methods with the goal of reducing or eliminating infested areas, and 5) Regional cooperation.

The program is funded through a $5 fee derived from New Hampshire boat registrations. Of that $5 fee, a total of $4.50 is dedicated to tasks and projects associated with exotic aquatic plants.

C.2.8 DAM REMOVAL PROGRAM

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There are more than 4,800 active and inactive dams in the state of New Hampshire. Many of these dams were built during the Industrial Revolution in the 19th and early 20th centuries, and played a central role in New Hampshire's economic and societal growth during that period. But as technological and societal needs changed over the years, so too has the need for dams. Although many dams continue to serve valuable purposes, others are no longer being used for their intended purpose and pose safety, environmental, and other problems. Addressing these concerns can be costly and controversial, however, in New Hampshire, owners are given the option of dam removal. Selective dam removal can eliminate a public safety hazard, relieve a dam owner's financial and legal burdens and restore a river to a healthier, free-flowing condition.

In early 2000, two events occurred that were monumental in enabling the state of New Hampshire to assist owners with the option of dam removal. In 2000, the New Hampshire River Restoration Task Force was formed with the common goal of exploring opportunities to selectively remove dams for a variety of reasons, including for the purposes of restoring rivers and eliminating public safety hazards. The Task Force is a diverse group that provides technical and/or financial assistance, and is comprised of state and federal agencies, conservation organizations, local interest groups and others. In 2001, the New Hampshire Department of Environmental Service created a staff position entitled "River Restoration Coordinator". This individual helps to facilitate the processes involved with the dam removal option from conception to completion; working hand-in-hand with the owner and other interested parties. This individual is also the chairperson of the New Hampshire River Restoration Task Force and

coordinates bi-monthly meetings. These meetings provide the Task Force members with the most up to date information on current and future projects, and current issues associated with dam removal and river restoration.

As shown in Table 4 eight (8) dams have been removed in New Hampshire since 2000. Currently there are more than twenty-five (25) dams under consideration for removal. These projects are in various stages of the process. As a result of the increase in the Annual Dam Registration Fee (ADRF) in New Hampshire, this Program has seen an increase in requests from dam owners who wish to explore the option of dam removal. It is anticipated that additional inquiries will be received in the future as well.

Table 4: Dams Removed in New Hampshire 2000 - 2007

Dam Name	Municipality	Waterbody	Year Removed
McGolderick Dam	Hinsdale	Ashuelot River	2001
Winchester Dam	Winchester	Ashuelot River	2002
Bearcamp River Dam	Tamworth	Bearcamp River	2003
Bellamy River Dam #5	Dover	Bellamy River	2004
West Henniker Dam	Henniker	Contoocook River	2004
Badger Pond Dam	Belmont	Tioga River	2004
Champlin Pond Dam	Rochester	Clark Brook	2005
Champlin Farm Pond Dam	Rochester	Farm Pond	2005

Although there have been no dams removed since 2005 under the auspices of the Program, 2008 has the makings of a banner year. There are six (6) dams that have either completed final design or are in the final design stage; all of which are currently scheduled for deconstruction during the 2008 construction season.

Dam removal is an option, as is dam repair, and should be considered on its own merits. When the costs associated with dam repair outweigh dam removal then removal may be a wise decision and can result in positive environmental, economic and social benefits.

C.2.9 INSTREAM FLOW PROGRAM

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The New Hampshire legislature created the River Management and Protection Program (RSA 483) in 1988. In 1990 instream flow protection provisions for Designated Rivers were added and the first five rivers were designated. These provisions require methods to define flows to protect the riverine resources of the river. The history of Instream Flow Protection in NH has been long and at times contentious. In 2002 a compromise (Chapter 278) was reached where a pilot program would test proposed assessment and management methods on two rivers before applying them to the state's other Designated Rivers. With this compromise, instream flow rules were promulgated in 2003 applying a pilot process to the Lamprey and Souhegan Rivers. The

Souhegan River pilot is being conducted under a contract with the University of New Hampshire. The Lamprey River pilot is contracted to Normandeau Associates, Inc.

There are two major steps in the pilot process. The first step is a study to determine the protected instream flows. The Lamprey protected instream flow study phase began in 2006. The study collected data during 2006 and 2007 to determine protected flows for the Designated River. The results of this study will be analyzed and presented in 2008. The Souhegan study phase was completed and its findings presented before the public in March 2007.

The two pilots are using similar methods to identify flow needs for the Designated Rivers. A reconnaissance of the river was conducted to identify flow-dependent resources. Several methods are being applied to identify the flow needs of these resources. Whitewater boaters' flow needs are identified by interviewing them on their boating preferences. The timing and magnitude of flows for supporting wetlands and riparian vegetation life cycles are assessed by elevation transects that are translated to flows. Fish species are evaluated using a habitat simulation model that determines the changes in habitat with changes in flow. Estimates of available habitat are made at different flows. Specific flow needs for life cycle needs like spawning and rearing and growth of juveniles are assessed by determining the specific needs for stream depth, flow velocity, substrate, and canopy.

The protective flows are determined within the context of the natural flow regime. This concept, called the Natural Flow Paradigm, says that the natural riverine community has developed, and is adapted to, the natural variations during the year and at shorter and longer intervals. This includes floods in the spring from meltwater and low flows in the summer. The natural regime benefits and restricts riverine species at different times, which keeps their populations in balance. By using this framework to constrain protected flows, natural droughts can be expected and accepted without concern because the riverine community is adapted to these conditions. The protected flows quantify the times, locations, durations, and frequency of flow changes that place the riverine community at risk because the balance is thrown off by the additional burdens of water use.

The second step in the pilot process is developing a water management plan to implement the protected flows. Water Management Plans apply to larger water users and dam owners. The water management plans will describe the conservation, water use, and impoundment management activities that will maintain the protected flows. Larger water users will help define conservation plans to reduce the impact of their use. They will also establish the conditions for a water use plan that may include additional storage or management of the timing and volumes of their use. Larger dams will be assessed for their ability to support protected flow needs by storing and releasing water to offset withdrawals. This is a process of coordination and discussion with water users and dam owners to define their priorities and needs and identify management alternatives that best suit their needs and the management needs under the Instream Flow Program. Each plan will be evaluated for cost impacts and an implementation schedule will be developed prior to adoption. The Souhegan Water Management Plan is under way and expected to be completed in late fall 2008. The Lamprey Plan will be started in the summer of 2008.

The NH legislature set a deadline of October 2007 (HB4, 2003) for completing the pilot studies and water management plans. A bill is in committee in the 2008 session to extend the program two years. A year after completion, a review is to be held with a public hearing to evaluate the pilot process and decide if changes are needed before applying the process to the other Designated Rivers. All of the protected flows and management plans are reviewed at a public hearing prior to adoption. During the pilot studies and water management plan development, two committees representing stakeholders and technical reviewers review the interim and final results that make up the protected flows and water management plans. Documentation of the pilot programs, including committee meetings and interim and final reports are available on the program's website
http://des.nh.gov/organization/divisions/water/wmb/rivers/instream/index.htm

C.2.10 LAKES AND RIVERS MANAGEMENT PROGRAMS

C.2.10.1 Rivers Management Program

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The New Hampshire River Management and Protection Program (RMPP) was established in 1988 with the passage of RSA 483 to protect certain rivers, called designated rivers, for their outstanding natural and cultural resources. The program is administered by the New Hampshire Department of Environmental Services (DES).

For a river to be designated for protection, an interested individual or organization must first develop a nomination outlining the river's values and characteristics. Support by local municipal officials and residents of the riverfront communities for the designation must also be sought and reported. Once completed, the nomination is submitted to the DES Commissioner and, if and when approved, forwarded to the General Court for consideration. If the Legislature approves the nomination, looking closely at the level of local support and presence of important river values, and if the Governor signs the bill, RSA 483 is amended to designate the river for protection under the program.

After designation, a management plan is developed so that the outstanding qualities of the river may be protected for future generations. The plan is developed and implemented by a volunteer local river advisory committee that also coordinates activities affecting the river on a regional basis. A typical plan identifies management goals and recommends actions that may be taken to protect the resources identified in the nomination. At the state level, the Department of Environmental Services assists with the development and implementation of the management plan and enforces regulations concerning the quality and quantity of flow in protected river segments.

Presently, the Ammonoosuc, Ashuelot, Cold, Connecticut, Contoocook, Exeter, Isinglass, Lamprey, Lower Merrimack, Upper Merrimack, Pemigewasset, Piscataquog, Saco, Souhegan and Swift Rivers are designated under RSA 483.

C.2.10.2 Lakes Management Program

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Recognizing the impacts of man's activities and the potential financial consequences if the quality of New Hampshire's lakes is allowed to deteriorate, the Legislature established the Lakes Management and Protection Program with the passage of RSA 483-A. The Program includes a Lakes Coordinator, and the Lakes Management Advisory Committee (LMAC) which advises the DES Commissioner and Lakes Coordinator in carrying out the purposes of the statute. The Advisory Committee is made up of 18 members, representing state agencies, municipalities, the conservation community, marine, tourism, real estate and business and industry interests and academia. The increased pressure we have placed on our lakes has resulted in the need for an active, multidisciplinary management approach to secure the wise management and preservation of our lakes. The numerous projects and products of the Lakes Program encompass the broad spectrum of lakes management.

Some of the more significant program goals include:

- To prepare state level management criteria for lakes that would form the basis for state agency decisions regarding lakes management and protection.
- To develop detailed guidelines for coordinated lake management and shoreland protection plans and develop recommendations for implementing the plans.
- To review the status and appropriateness of existing state statutes and proposed legislation addressing lakes and water quality management.
- To provide and exchange technical assistance among state and federal agencies and public and private sectors regarding lakes management and related issues.

C.2.11 SHORELAND PROTECTION PROGRAM

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In 1991, the General Court passed the Comprehensive Shoreland Protection Act (CSPA). The CSPA recognizes that the shorelands of the state of New Hampshire are among its most valuable and fragile natural resources and that the protection of these shorelands is essential to maintain the integrity and exceptional quality of the state's public waters. The Act establishes minimum standards for activities that impact the soils, vegetation, and topography within 250 feet of the state's public waters (the Protected Shoreland). The minimum standards create several individual setbacks and areas of restricted use within the Protected Shoreland depending on the nature of the project or activity. Setbacks are specified for primary structures, accessory structures, septic systems, fertilizer and pesticide use and a natural woodland buffer is established which places limitations on vegetation removal.

The CSPA became effective on July 1, 1994. In July of 2007, the Governor signed into law several significant changes to the CSPA. The changes are effective April 1, 2008 and include additional standards that establish impervious surface limitations; a waterfront buffer extending from the reference line to 50' landward in which herbicides and pesticides are prohibited, a grid and points system to manage trees and saplings within the waterfront buffer; a statewide 50' primary building setback, and a permit requirement for any construction, excavation, or filling activities within the protected shoreland.

C.2.12 ALTERATION OF TERRAIN PROGRAM (SITE SPECIFIC PERMITS)

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The Alteration of Terrain permit program was established in 1981 under the statutory authority of RSA 485-A:17 to regulate activities that significantly alter the characteristics of the existing ground surface. The purpose of the program is to review such projects to evaluate their potential adverse impacts on state surface waters, and require measures to mitigate the potential adverse impacts. The Alteration of Terrain permit program applies to any project with earth disturbances of greater than 100,000 square feet, or 50,000 square feet if located within Protected Shoreland. Typical projects requiring an Alteration of Terrain permit are commercial developments and large residential subdivisions.

As part of the review process for a project requiring an Alteration of Terrain permit, DES reviews submitted project plans and engineering analyses to evaluate that the project complies with requirements for: stormwater discharge controls; long-term treatment of stormwater runoff from impervious surfaces; and erosion and sediment best management practices during construction activities. Permit requirements are intended to protect existing stream banks by attenuating peak stormwater runoff resulting from changes in land use, and protect water quality by reducing the pollutant load in stormwater runoff. An average of 400 permits are issued by DES on an annual basis.

The Alteration of Terrain regulations are in the process of being revised. Adoption of the new rules is expected by early 2009.

C.2.13 MERCURY REDUCTION PROGRAM

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Mercury (Hg) is a naturally-occurring element that is released into the environment through human and natural activities, primarily in the form of air emissions. Mercury is classified as a persistent, bioaccumulative, toxic pollutant and, when it is deposited into surface waters via precipitation or runoff, it is changed into its more toxic, methyl form by bacteria and

passed up the food chain where it accumulates in fish tissue. Since the late 1800's mercury has been accumulating in the food chain in water bodies throughout New Hampshire and the region.

The impacts of mercury on fish-eating bird species such as the common loon, bald eagle and belted kingfisher have been well documented. Aquatic mammals such as otter and mink are also considered to be at risk from elevated mercury levels. Recent studies have shown that mercury is also present in land-based ecosystems and wildlife, including mountain songbirds such as the Bicknell's Thrush. Impacts on wildlife include changes in body chemistry, behavior and decreased reproductive success

Similarly, the primary means by which people are exposed to mercury is through the consumption of fish. Mercury exposure in humans can lead to a variety of negative health effects, including impacts on the central nervous system, gastrointestinal tract, kidneys and cardiovascular system. Fetuses and young children, whose central nervous systems are still developing, can be particularly susceptible to mercury toxicity.

Human related sources which may emit mercury into the atmosphere include fossil fuel combustion, waste incineration, and breakage of mercury-added products. Although New Hampshire sources emit some mercury, it is suspected that substantial quantities are emitted in states upwind and carried east by prevailing winds. Mercury is then deposited upon the lakes and soil of New Hampshire.

Efforts have been underway for several years at the federal, state and regional levels to address mercury contamination in the environment. In 1997, EPA released the "Mercury Study Report to Congress," to help states plan for mercury mitigation (USEPA, 1997). The report is a compilation of the best available information on the link between mercury emissions and fish contamination, the role of atmospheric transport in mercury contamination, the status of the nationwide inventory of mercury emissions, the costs and types of mercury control technologies and the health risks posed by mercury contamination.

In February of 1998 a report was issued by the Northeast States and Eastern Canadian Provinces, which took a regional look at the sources, transport and deposition, impacts, and ways to reduce mercury pollution (NEG/ECP, 1998). The study estimated that 47 percent of the mercury deposited in the Northeast United States originates in the Northeast, while 30 percent comes from sources outside of the region and the remaining 23 percent comes from the global atmospheric reservoir.

NESCAUM recently completed an updated regional mercury emissions inventory and there have been dramatic reductions in several in-region source categories. As the Northeast States continue to reduce their emissions of mercury, out-of-region sources will represent an even greater percentage of mercury deposited in the northeast. In order to obtain upwind reductions, New Hampshire joined several other states in a lawsuit to require the Environmental Protection Agency to place more stringent restrictions on these large mercury sources.

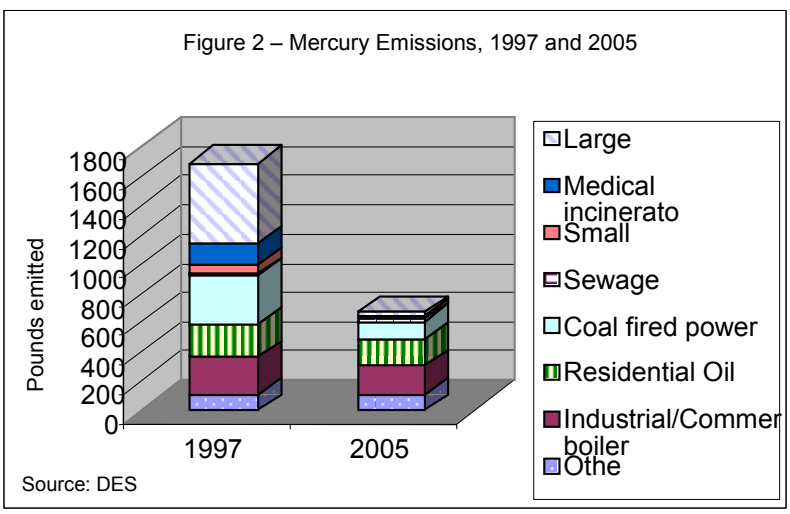
In New Hampshire, a state level mercury reduction strategy was drafted and released in October, 1998. The strategy contains 40 recommended actions to reduce mercury releases in New Hampshire, including those from medical and municipal waste incineration and power

generation. Implementation of the strategy has resulted in a 60 percent reduction in mercury releases to date (http://des.nh.gov/organization/commissioner/p2au/pps/ppp/index.htm. New Hampshire, along with the other New England States and Eastern Canadian Provinces has adopted an interim goal of 75 percent reduction by 2010 and the jurisdictions are working diligently to meet that goal. The long-term goal remains the virtual elimination of man-made mercury releases. The largest reductions in New Hampshire emissions have occurred in the municipal and medical waste incineration area. Due to legislative and regulatory efforts these sources have been reduced by 95 percent and 99 percent respectively (Figure 12). In 2006 the New Hampshire legislature passed a bill (HB 1463) to limit mercury emissions from coal-fired power plants which are the largest remaining single source of emissions in the state. Efforts are also underway to better characterize emissions from other fossil fuel sources such as burning of fuel oil and gasoline.

The strategy also emphasizes eliminating or reducing the use of non-essential mercury in common products and properly managing and recycling these products so that they are not incinerated or landfilled. Various legislative efforts have resulted in prohibiting the use of mercury and mercury compounds in schools, banning the sale of mercury fever thermometers and requiring manufacturers to report on mercury-added products sold in the state. Recent efforts to further regulate mercury-added products include the passage of two bills in 2007; HB 416 banned the disposal of all mercury-added products in landfills, incinerators and transfer stations, while HB 907 prohibited the sale of certain products including thermometers, other measuring devices, switches, relays and thermostats. In addition, New Hampshire was the first state to pass legislation that requires dentists to install amalgam separators with a minimum mercury removal efficiency of 95 percent. This requirement should result in a significant reduction in dental discharges of mercury to wastewater. Outreach efforts to hospitals, businesses, schools, auto salvage yards, municipalities and citizens on mercury reduction are also ongoing and are instrumental in the reduction of mercury in waste. Although significant progress has been made since the release of the mercury reduction strategy, more remains to be done.

New Hampshire is also an active participant in an effort led by the Conference of the New England Governors and the Eastern Canadian Premiers to implement the Regional Mercury Action Plan (MAP) (NEG/ECP 1998), adopted by the Governors and Premiers in June, 1998. To date, MAP activities have resulted in a 70 percent overall decrease in regional mercury emissions (see Figure 12).

Figure 12: Reduction in NH Mercury Emissions 1997-2005



C.2.14 ENVIRONMENTAL HEALTH PROGRAM - FISH ADVISORIES

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The responsibility for fish consumption advisories was transferred from the New Hampshire Department of Health and Human Services (DHHS) to the Environmental Health Program (EHP) of the New Hampshire Department of Environmental Services in July 2004. Most of the fish tissue analyses done to date were conducted as part of human health risk assessment studies. Fish tissue analyses are not routinely conducted in the state for state-wide risk assessment; rather they are usually performed when there is a perceived risk to public health associated with consumption of fish from a certain waterbody. Once a risk assessment is completed, EHP decides if a fish consumption advisory should be issued. Information regarding fish consumption advisories currently in effect in New Hampshire are presented in Section D.6.3

C.2.15 COASTAL PROGRAMS

C.2.15.1 New Hampshire Coastal Program (NHCP)

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Administered by the New Hampshire Department of Environmental Services, the New Hampshire Coastal Program (NHCP) was established in 1982 and is one of 34 federally approved coastal programs nationwide. Responding to the increasing demands on the nation's coast, Congress passed the Coastal Zone Management Act in 1972. This legislation authorized funding for state coastal programs through the National Oceanic and Atmospheric Administration.

New Hampshire's coastal zone is rich with natural, recreational and cultural resources that improve our quality of life and support and strengthen our economy. The coastal zone includes 17 towns, 18 miles of shoreline and 235 miles of tidally influenced land, including Great Bay, Little Bay, Hampton Harbor and many other coves and bays on the coast.

NHCP's mission is to balance the use and preservation of coastal resources. Through partnerships, funding and science, the program works to improve water quality and decision-making in 42 coastal watershed communities. The NHCP also supports maritime uses and restores coastal wetlands and rivers.

Under its federal mandate, NHCP conducts reviews to ensure consistency with state policy for coastal activities. Through funding, NHCP enables water quality protection, research, and environmental stewardship and education. Using its extensive partner network, the Coastal Program completes public access projects and coordinates the restoration of degraded coastal rivers and wetlands. In addition, NHCP initiates discussion of coastal-related issues, including ocean wind energy and tidal energy. The following is a summary of key NHCP accomplishments by Category.

Coordination and Public Involvement:

- Initiated and hosted a tidal energy workshop for over 50 state, federal, municipal and other partners to learn about and discuss tidal energy in February 2007.
- Continued involvement in the state legislated Tidal Energy and Great Bay Siltation Commissions, including vice chairing the Tidal Energy Commission and hosting a Web site for both commissions.
- Ongoing chair of the N.H. Dredge Management Task Force.
- Provided 24 trainings for about 600 coastal decision makers and over 350 educational and environmental stewardship opportunities for approximately 3,000 members of the public in 2006.

Coastal Water Quality Protection:

- Funded and coordinated the Coastal Volunteer Biological Assessment Program, enabling local watershed groups to collect locally important water quality data in the 2006 and 2007 seasons.
- Supported four volunteer water quality monitoring programs that collected data at approximately 75 coastal watershed sites in 2006.

Coastal Habitat Conservation and Restoration:

- Produced the Stream Barrier Removal Monitoring Guide, a framework of critical monitoring parameters for use by restoration professionals at dam and culvert removal sites in the Gulf of Maine watershed in fall 2007.
- Coordinated the New Hampshire Salt Marsh Monitoring program during the 2006 and 2007 seasons.
- Coordinated the federal Coastal and Estuarine Land Conservation Program (CELCP) to help fund local land protection efforts. New Hampshire's projects ranked 1st, 11th and 14th in the nation in 2007.
- Completed the Land Conservation Plan for New Hampshire's Coastal Watersheds in partnership in 2006. Began implementing the plan's recommendations.

Public Access:

- Updated and distributed public access guide of New Hampshire's coastal zone in summer 2007.
- Helped add 14 acres to an existing conservation preserve in 2007. An easement on the property allows passive recreation.

Coastal Hazards:

- Facilitated information exchange and partner discussion to work towards a methodology to assess stream crossings and culvert hazards.

Community Planning and Development:

- Provided technical assistance to coastal watershed towns on a comprehensive natural resources planning program focused on preserving coastal resources while accommodating growth.
- Local technical planning assistance through two regional planning commissions, including ordinance and regulation updates, subdivision and site plan reviews, and other planning assistance to local town boards in coastal communities.

Developed with feedback from partners and constituents, NHCP's strategic plan will guide work going forward for the next 2-3 years. Working with a network of partners, NHCP will focus on areas with the most demonstrated need that protect coastal resources while balancing the needs of people and ecosystems. The strategic plan has four main goals:

- Improve New Hampshire's management of ocean resources.
- Improve science-to-management in local communities.
- Protect and restore natural habitats in the coastal watershed.
- Build program capacity.

C.2.15.2 New Hampshire Estuaries Project (NHEP)

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The NHEP is part of the U.S. Environmental Protection Agency's (EPA's) National Estuary Program, which was established by Congress in 1987 to improve the quality of estuaries of national importance. The Clean Water Act Section 320 directs EPA to develop plans for attaining or maintaining water quality in an estuary. This includes protection of public water supplies and the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife, and allows recreational activities, in and on water, requires that control of point and nonpoint sources of pollution to supplement existing controls of pollution. The NHEP receives its funding from the EPA and is administered by the University of New Hampshire.

Beginning in 1995, the New Hampshire Estuaries Project (NHEP) embarked on a process to develop and systematically address the 98 Action Items outlined in the program's guiding document, the Comprehensive Conservation and Management Plan. The intent was to achieve the Plan's goals of improved water quality in New Hampshire's estuaries. The NHEP addresses Action Items by either completing them directly or funding other organizations to complete the work. In general the NHEP strives to:

- Improve the water quality and overall health of New Hampshire's estuaries;

- Support regional development patterns that protect water quality, maintain open spaces and important habitat, and preserve estuarine resources;
- Track environmental trends through the implementation of a long term monitoring program to assess indicators of estuarine health; and,
- Develop broad-based popular support for the implementation of the Management Plan by encouraging involvement of the public, local government, and other interested parties in its implementation.

The NHEP's Comprehensive Conservation and Management Plan for NH Estuaries was completed in 2000 and implementation has been ongoing (NHEP 2000). The Management Plan outlines key issues related to management of New Hampshire's estuaries and proposes strategies (Action Plans) that are expected to preserve, protect, and enhance the state's estuarine resources. The NHEP's priorities were established by local stakeholders and include water quality improvements, shellfish resources, land protection, and habitat restoration. Projects addressing these priorities are undertaken throughout NH's 830 square mile coastal watershed, which includes 42 communities. In addition, the NHEP developed and implements a monitoring program to track indicators of environmental health and assess management strategies.

Pollution Prevention Accomplishments

The NHEP funds various pollution prevention and water quality improvement projects each year. The following are a sampling of the most relevant projects that were funded in 2006 and 2007.

- Community grants for storm sewer mapping, illicit discharge detection and elimination (IDDE), and storm drain monitoring activities: IDDE projects were implemented in Rye, Somersworth, and Rochester; and storm sewer mapping projects were implemented in Seabrook, Rye, and Durham.

- Stormwater Management Manual and Training: The manual, *Guidelines and Standard Operating Procedures: Illicit Discharge Detection and Elimination and Pollution Prevention/Good Housekeeping for Stormwater Phase II Communities in NH*, was developed specifically for New Hampshire communities to assist their efforts in implementing IDDE programs and pollution prevention/good housekeeping for municipal activities. The manual was a key element of a training program delivered to over 240 DPW employees in 2007.

- Water Quality Pollution Reporting Guide and Campaign: the effort included production of a guide describing common sources and indications of water pollution, as well as information on where to report problems and how to prevent pollution. Guides were distributed to watershed organizations, conservation commissions, and public works departments. Bookmarks and posters supported the campaign as well.

- Pleasant Point Sewer Extension (Portsmouth): the city sewer was extended to the Pleasant Point area which is adjacent to the Back Channel area of the Piscataqua River. Seventeen homes in the area were using septic systems to treat wastewater.

Several of these septic systems were failing and several more were near failing and contributing to water quality problems.

Monitoring Accomplishments

Each year, the NHEP funds a variety of monitoring programs. The programs provide information on water quality, shellfish resources, aquatic habitat and land use in the coastal watershed. The NHEP monitoring programs were selected for funding because they complement existing monitoring programs of other agencies and fill critical data gaps. The major monitoring programs are:

- Tributary monitoring - monthly monitoring of water quality at the nine major tributaries to Great Bay and Little Harbor (conducted by DES through 2007);
- Eelgrass mapping – annual aerial surveys and mapping of the eelgrass distribution in the Great Bay estuary (conducted by UNH);
- Gulfwatch – annual monitoring of toxic contaminants in shellfish tissue (conducted by DES and UNH);
- Datasonde program – support for the maintenance and deployment of datasondes with in-situ dissolved oxygen probes to monitor daily trends in dissolved oxygen at key locations in the estuary (conducted by UNH);
- Oyster disease monitoring – annual monitoring of the prevalence of oyster parasites at the major oyster beds (conducted by NHF&G and Rutgers University);
- Nutrient monitoring – testing for particulate nitrogen and phosphorus species to complement the dissolved nitrogen and phosphorus monitoring conducted by other programs (conducted by UNH);
- Probabilistic surveys of water quality – water quality sampling at randomly located stations throughout the estuary, a continuation of the National Coastal Assessment program (conducted by UNH);
- Land use mapping - mapping impervious surfaces and conservation lands in the coastal watershed every five years (conducted by UNH);
- Oyster bed mapping – mapping the boundaries of the major oyster beds every three years (conducted by UNH).

In addition to the data collection, the NHEP Monitoring Program also contains a rigorous data analysis component. Data from the NHEP programs and data from other agencies are combined to calculate a suite of environmental indicators. The indicators are used to inform the NHEP Management Committee of the status and trends of environmental conditions in the estuary. The indicators are also used for the triennial State of the Estuaries report, which is the NHEP's main outreach vehicle. This report was released at the second State of the Estuaries conference which was held in Portsmouth, NH on October 27, 2006.

The NHEP Monitoring Program supports Clean Water Act core programs in many ways. First, the water quality data are imported to the DES Environmental Monitoring Database and used in Section 305(b)/303(d) assessments. The 305(b)/303(d) assessment process is the heart of the Clean Water Act. Second, one of the NHEP indicators tests for trends at tidal bathing beaches. The results from this indicator assist the DES Beach Program with management decisions. Third, the data collection and data analysis conducted by the NHEP are used by the

DES Oil Spill Program for contingency planning and, in the event of a spill, establishing baseline conditions. Fourth, the NHEP data has been used in two TMDLs (Hampton Harbor TMDL, Little Harbor TMDL). And, fifth, the NHEP has taken the lead role for establishing nutrient criteria for NH's estuaries. The recommendations from the NHEP will lead to the development of new water quality standards for the estuaries.

In future years, the NHEP will continue to implement water pollution prevention projects and long-term monitoring in NH's estuaries.

C.2.15.3 Shellfishing Program

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DES, under the authority granted by RSA 143:21 and 143:21-a, is responsible for classifying shellfish growing waters in the state of New Hampshire. The purpose of conducting shellfish water classifications is to determine if growing waters meet standards for human consumption of molluscan shellfish. DES uses a set of guidelines and standards known as the National Shellfish Sanitation Program (NSSP) for classifying shellfish growing waters.

The DES Shellfish Program conducts sanitary surveys to determine which shellfish growing areas are suitable for shellfish harvest/consumption. This work involves a shoreline survey for pollution sources, studies to determine each pollution source's impact to the receiving water, and intensive water monitoring under a variety of environmental conditions. Sanitary survey results are updated annually with new water quality data, and triennially with updated pollution source evaluations and other studies. A database of all properties inspected, and pollution sources identified, is maintained.

Routine monitoring provides updated water quality information, and consists of monthly water sampling of over 70 sites for fecal coliform bacteria and salinity. Each site is sampled 6 to 12 times per year. Additional water and/or shellfish tissue samples are examined for bacteria levels following rainfall, sewage discharges, or other pollution events. Red tide monitoring involves weekly sampling of blue mussel tissue (April through October) from Hampton/Seabrook Harbor and from Star Island, Isles of Shoals.

C.2.16 WETLANDS PROGRAM

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New Hampshire's Wetland Resources

New Hampshire has an estimated 400,000 to 600,000 acres of non-tidal wetlands and approximately 5,554 acres of tidal wetlands (6.7 percent to 10 percent of the state). The acreage

estimate for nontidal wetlands is based on: 1) LANDSAT telemetry data which is limited in resolution to wetlands that are greater than two acres in size. The NWI identified nearly 290,000 acres of wetlands, covering 5% of the state's land area (Table 3). Palustrine wetlands are the main type, totaling about 278,000 acres and representing 96% of the state's wetland area. Only 8,029 acres of estuarine wetlands occur, occupying nearly 3% of the wetland area. Emergent wetlands (salt and brackish marshes) were the most common estuarine wetlands, accounting for 70% of the estuarine wetlands. Riverine, lacustrine, and marine wetlands when combined account for 2,792 acres which is roughly 1% of the state's wetlands.

The U.S.D.A. National Resources Conservation Service has conducted soil surveys for New Hampshire during which soil scientists have identified wet soils that are now called "hydric soils." According to the latest soil survey statistics, over 576,000 acres of hydric soils have been mapped in New Hampshire. The conclusion is that the actual extent of wetlands probably lies somewhere between the two numbers. From the statewide perspective, then, the acreage of wetlands ranges between 290,000 acres (NWI) and 576,386 acres. Consequently wetlands may occupy anywhere between 5-10 percent of the state. (New Hampshire Wetlands and Waters: Results of the National Wetlands Inventory, Ralph W. Tiner, August 2007)

It is estimated that New Hampshire still has about 50 percent of its *tidal* and 90 percent of its *nontidal* wetlands present in the 18th century. A summary of wetlands loss over the past two years is shown in Table 5 below. The "Estimated Two-Year Impact" column of the table includes those impacts that have been permitted. The Department's database to track impacts and mitigation is limited to permitting activities.

The two-year creation/restoration numbers represent three types of activities; 1) creation and restoration that is conducted as compensatory mitigation for permitted wetland impacts, 2) restoration that is being conducted for that purpose (such as dam removal), or 3) restoration that is required for past unpermitted impacts as a requirement for the permit for another activity. In addition to the creation and restoration estimated in Table 5, easements were placed on approximately 3,773 acres as mitigation for impacts. Most of this is buffer to natural wetlands, or complexes of uplands and wetlands, and as such protects considerable functional value that would otherwise be vulnerable to development.

Table 5: Extent of Wetlands Type

Wetland Type	Estimated Total Size (acres)	Estimated Two Year Permanent Impacts (acres)	*Estimated Two Year Creation/ Restoration (acres)	Estimated Two Year Change (acres)	Percent Change
Tidal	5,553	(1)	35	34	+6%
Non-Tidal	400,000 - 600,000	(245)	113	(132)	(0.0264%)

Notes:

** Percent change is based on the 400,000 acre estimate of non-tidal wetlands.

In 2006, the Bureau issued permits for several large public transportation projects including 76 acres for the Route 93 improvements, 5.25 acres for the Lebanon Airport improvements, and 13.75 acres for the Laconia Airport improvements (see orange portion of the 2006 bar on the graph). In 2007, the Bureau issued permits for several large public works and

transportation projects including 16.72 acres for the construction of the Berlin Federal Prison, 12.8 acres for the Mt Carberry sanitary landfill and 5.2 acres for expansion of the Manchester Airport.

New Hampshire Wetlands Regulations

New Hampshire was one of the first states to regulate its nontidal wetlands, and remains one of only 14 states that do so today. New Hampshire first passed a statute regulating impacts to tidal wetlands in 1967, and the law was expanded to include non-tidal wetlands and surface waters in 1969. RSA 482-A is more inclusive than Section 404 of the Federal Clean Water Act in that it addresses both dredge and fill, requires permits for all projects regardless of size, and has no special exemptions for agriculture or other uses. New Hampshire statute RSA 482-A gives the New Hampshire Department of Environmental Services (DES) authority to promulgate rules and regulate activities involving dredge, fill, or construction in any wetland or upland areas adjacent to state designated prime wetlands, as well as any surface water body, sand dune or tidal buffer zone in the state. The Wetlands Bureau in the DES Water Division is responsible for application review, enforcement activities, and the issuance of permits, denials, orders, and other administrative documents. The Bureau maintains a web site at http://des.nh.gov/organization/divisions/water/wetlands/index.htm which includes weekly permit decisions, rules, law, fact sheets, application forms, and other useful information. The Bureau has offices in Concord and Portsmouth. Operation of the Portsmouth Office is partially funded through the New Hampshire Coastal Program using federal funds.

Appeals of wetlands permitting decisions go to the Wetlands Council whose membership includes the commissioners of the departments of Safety, Transportation and Resources and Economic Development; the directors of the Office Energy and Planning, and Fish and Game; and seven public members representing county conservation districts, local conservation commissions, elected municipal officials, the non-marine construction industry, the marine construction industry, a member of the NH Association of Natural Resource Scientists and general environmental protection and resource management interests. The public members are nominated by their respective interest groups and are appointed by the Governor and Council for three-year terms. The council reviews the record developed by DES, and can remand decisions to the Department if it finds the Department acted in an unreasonable or unlawful manner.

The DES 401 certification program is linked to wetlands regulation by a requirement that Wetlands Bureau approval is required prior to certification for any project involving dredge, fill, or construction of a structure in wetlands or surface waters. Surface waters and wetlands are included in the state's definition of "Waters of the state," but water quality criteria have not yet been defined for wetlands. The scope of New Hampshire wetlands regulation has evolved over the last 39 years, with several significant changes during the last 20 years. These changes reflect the response of the New Hampshire Legislature to an evolving understanding of both public and environmental needs in the state. In 1986 authorization was given to issue administrative fines. In 1989 the tidal buffer zone was expanded and boundaries clarified for easier determination in the field; a minimum impact notification process was added for forestry; authorization was given to issue administrative cease and desist orders and administrative removal/restoration orders; and the Superior Court was provided with significant civil and criminal penalties and a strengthened removal/restoration authority. In 1990 a graduated fee structure was developed that benefits both the applicant and the environment. The fees provide resources for a more timely review process, and the environment benefits from the financial incentive to minimize impacts. In 1993,

legislation enabled the former Wetlands Board to delegate minimum impact permitting to the Bureau, resulting in an expedited process. In 1995, a minimum impact notification process was added for recreational trail maintenance, and in 1996, legislation was passed which transferred the responsibilities of the Wetlands Board to the DES Wetlands Bureau and abolished the Wetlands Board. In 2003 the legislature increased the above referenced graduated fee structure from $0.04 per square foot of requested impact (no refund for denials or partial approvals) to $0.10 per square foot requested impact. In 2007 the fee was increased again, to $0.20 per square foot of requested impact. All fees, as well as administrative fines, go to DES for support of the Wetlands regulatory program. In 2004, rules were adopted for compensatory mitigation of larger wetland impacts. In 2006 an in-lieu fee program was implemented as another form of compensation. Those fees go into a fund for each watershed to be pooled and later used for significant watershed improvement projects.

INTERACTION WITH FEDERAL REGULATIONS

On June 1, 1992, the U.S. Army Corps of Engineers issued a New Hampshire state Programmatic General Permit (NHSPGP), and at the same time revoked most Nationwide Permits for use in the state of New Hampshire. The NHSPGP has broken new ground for reasonable and efficient environmental regulation. New Hampshire was the first state to have an inclusive state-wide state programmatic permit, and the unmitigated success of the process provides an excellent example of benefits accrued by increased cooperation between federal and state agencies. Less than 1 percent of the projects approved by the Wetlands Bureau require an individual permit from the Army Corps. The NHSPGP was reissued for another five years in June 2002, and again in 2007. It will be up for renewal again in 2012.

The NHSPGP evolved from recognition by the Army Corps, the U.S. Fish and Wildlife Service, and the U.S. Environmental Protection Agency that the New Hampshire wetlands law, and the Wetlands Bureau's thorough review process, provided a sound basis for streamlining federal wetlands permitting. All projects are reviewed on an individual basis, and permitted projects are classified as one of three categories: minimum impact (e.g., less than 3,000 square feet impact), minor (e.g., less than 20,000 square feet of impact), and major impact (e.g., 20,000 or more square feet of impact). The NHSPGP handles each of these New Hampshire categories as follows:

Projects approved and classified as minimum impact by the Wetlands Bureau may fall under the NHSPGP, with no Corps action required. The Wetlands Bureau notifies applicants to this effect.

Minor impact projects approved by the Bureau are screened by the Army Corps and the other federal agencies for possible inclusion under the NHSPGP. The Army Corps notifies the applicant within 30 days if an individual permit is required. If the project meets the conditions of the NHSPGP, and the Army Corps does not intervene in 30 days, minor impact projects are automatically approved under the NHSPGP.

Major impact projects approved by the Bureau are screened by the federal agencies, and the permittee is notified within 30 days whether she/he can proceed

under the NHSPGP or whether she/he needs an individual Corps permit. This 30 day period is not an automatic approval for major projects; the permittee needs affirmative notification from the Corps before he/she can proceed.

The following categories of projects are excluded from the NHSPGP, and always need an individual federal permit:

- More than three acres of fill.
- New boating facilities including marinas, yacht clubs, boat clubs, public docks, etc.
- Projects within the limits of a Corps navigation project.
- Discharge of spoils in the ocean.
- Improvement dredging in the lower Merrimack River, the Connecticut River, Lake Umbagog, or tidal waters.
- Breakwaters extending more than 50 feet from the shoreline.
- Projects adversely affecting a National Park, National Forest, National Wildlife Refuge, endangered species, or National Wild and Scenic River.
- Projects of national concern (e.g. significant wetlands fills; work that could affect archeological sites).

The process benefits everyone. The applicant is relieved of a time-consuming parallel federal permitting process, and is assured that they have a federal permit (the applicant was previously at risk if they assumed coverage by a Nationwide Permit). The Corps has reduced its average turn-around time on general permit decisions to 12 days (for projects that are not minimum impact), from a pre-NHSPGP 45 to 60 days (minimum impact projects have automatic federal approval). Environmental protection is enhanced by the team effort because limited federal and state regulatory resources are freed to address the most significant problems.

DEVELOPMENT OF WETLAND WATER QUALITY STANDARDS

In accordance with RSA 485-A:2, XIV, Env-Wq 1702.46 and Env-Wq 1702.53, wetlands are considered surface waters of the state. As such, they are protected by the state's water quality standards. Current water quality standards include the following narrative criteria specific to wetlands

Env-Wq 1703.02 Wetlands Criteria.

(a) Subject to (b) below, wetlands shall be subject to the criteria listed in this part.

(b) Wherever the naturally occurring conditions of the wetlands differ from the criteria listed in these rules, the naturally occurring conditions shall be the applicable water quality criteria.

To help assess wetlands, DES developed GIS-based criteria using the characteristics of adjacent land uses. This information was used to conduct Level 1 or “screening level” assessments of wetlands. The screening level assessments will also be useful for identifying candidate wetlands for testing of wetlands specific numeric criteria to see if there are significant differences between potentially impaired and reference (i.e., pristine) wetlands. Level 1 assessment results are presented in Section D.3.9.

C.2.17 GROUNDWATER PROTECTION PROGRAMS

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New Hampshire was one of the first four States in the Nation to receive EPA's endorsement of its comprehensive approach to groundwater protection. This endorsement is an acknowledgment that the state has an array of local, state and federal groundwater protection programs in place which are sufficiently coordinated to effectively protect groundwater. The state routinely engages all stakeholders in a process to identify and jointly address groundwater issues of concern. A list of the various groundwater protection programs is provided in Section PART E of this report.

C.3 COST/BENEFIT ASSESSMENT

C.3.1 OVERVIEW

Sections 305(b)(1)(D)(ii) and (iii) of the CWA require an estimate of the economic and social impact to achieve the objectives of Section 305(b) and the economic and social benefits of such achievement. The following is presented in fulfillment of this requirement.

C.3.2 SOCIAL IMPACTS OF CLEAN WATER

Most people recognize the importance and benefits of clean water and place a high social value on it. Quantification of the social impacts of clean water, however, is difficult. Generally speaking though, there is a positive social impact when the designated uses of a surface water are being met (i.e., clean water) and a negative social impact when uses are not being attained. For example, there is a negative social impact (i.e., on public health) in surface waters where the use of fish consumption is impaired by the presence of toxins. Similarly, negative social impact can occur in waters where the general recreational/aesthetic enjoyment of the surface water is impaired by the presence of floating scums and excessive algal blooms. Thresholds for determining when designated uses are impaired (and therefore when positive and negative social impacts are likely to occur) are included in the state's surface water quality standards and Consolidated Assessment and Listing Methodology (NHDES, 2008).

C.3.3 ECONOMIC IMPACTS OF CLEAN WATER

Like social impacts, quantification of the economic impacts of clean water are also difficult to determine with complete certainty. There is no doubt that there is a cost associated with keeping our waters clean. However, there is also an economic benefit in terms of increase in property value, additional revenue brought in by visitors attracted to our clean waters, lower treatment costs, etc.

Section C.3.3.1 through C.3.3.3 includes information on costs to keep our waters clean. Because data is not readily available for privately funded projects, the discussion focuses on the readily available information which includes costs associated with past or ongoing public

pollution control projects that have received state and/or federal financial assistance. Other pollution abatement costs associated with federally funded Section 319 nonpoint source projects may be found in Appendix 2.

With regards to economic benefit, Section C.3.3.4 includes a review of a recently completed economic study to determine the economic value of New Hampshire's lakes, rivers, streams and ponds.

C.3.3.1 Federal Construction Grants Program

Since the passage of the Federal Water Pollution Control Act of 1972 (Public Law 92-500), EPA assistance to municipalities for the planning, design and construction of projects under the Construction Grants for Wastewater Treatment Works Program has totaled nearly $442 million in grants**.** Under the state Aid Grant Program, New Hampshire has awarded grants for these projects of over $337 million, with actual payments for these projects totaling nearly $326 million. Although it is difficult to determine the actual contribution by municipalities to these projects, it is estimated that local shares over this period are nearly $59 million. This would suggest a total commitment to wastewater treatment works projects in New Hampshire from all funding sources of $838 million during the era of the Construction Grants Program. The phase-out of the federal construction grants program in 1990 was completed in New Hampshire with the administrative completion of all grant projects in Fiscal Year 1997.

C.3.3.2 20 percent to 30 percent state Grant Program

In response to the phasing out federal grant funds, the Governor and Legislature stepped forward by enacting Chapter 277 of the Laws of 1992 to provide a new 20 to 30 percent state grant program for local water pollution control projects. This law directs DES to establish and maintain a priority list of projects eligible to receive grant funds, using the existing priority system developed under the federal construction grants program, and further directs that an annual public hearing be held to receive comments on the priority list. The New Hampshire Water Pollution Control Program has provided 362 grants to 81 municipalities totaling nearly $105 million under this program. The current priority list includes 161 projects with total costs of nearly $195 million in Fiscal Year 2008, and 38 projects with total costs of nearly $160 million in Fiscal Year 2009.

C.3.3.3 State Revolving Fund (SRF) Program

Under the State Revolving Fund Program, New Hampshire has received $241,775,074 in Federal Fiscal Years (FFY) 1989 thru 2006 Title VI capitalization grant funds as of the end of FFY 2007. In addition, $3,966,030 in Title II funds have been transferred to the State Revolving Fund. These amounts along with the required twenty percent state matching funds of $49,148,221 have provided a total of $285,059,681 for the State Revolving Fund Program. SRF loans to municipalities using Federal funds totaled $265,549,413 through the end of FFY 2007. The repayment of loans by municipalities totaled $181,688,342 through the end of FFY 2007 and loans from the repayment account totaled $144,101,910 for the same period. The grand total of loans made from the SRF Program from all accounts totaled $409,651,323. Actual disbursements for construction projects in progress totaled $314,421,816 through the end of FFY 2007. A summary of SRF projects funded in 2007 and 2008 is provided in Table 6.

Table 6: State Revolving Fund Commitments for 2006 & 2007

Municipal Loan Recipient	Improvement Funded	Waterbody Benefited	Loan Amount
Concord	Hall St. Odor Control	Merrimack River	$1,210,000
Concord	Hall St. WWTP Headworks Improvements	Merrimack River	$1,275,000
Exeter	Langdon Ave. Pump Station	Squamscott River	$485,000
Hanover	WWTF Upgrade	Connecticut River	$5,100,000
Jaffrey	WWTF/PS Upgrade	Contoocook River	$13,371,000
Lebanon	WWTF Improvements Program	Connecticut River	$9,954,000
Manchester	WWTP Upgrade/Facility Plan	Merrimack River	$1,000,000
Manchester	Cemetery Bk. Conduit Rehabilitation	Merrimack River	$2,300,000
Newington	Belt Filter Press Replacement	Piscataqua River	$854,125
Newport	Guild Pumping Sta. Amendment	Sugar River	$145,000
Pittsfield	Septage Receiving Facility Amendment	Suncook River	$810,740
Portsmouth	Rye Line WW Pumping Station/Sewer	Piscataqua River	$1,500,000
Portsmouth	Lincoln Area Sewer Separation	Piscataqua River	$5,600,000
Portsmouth	Bartlett Area Sewer Separation	Piscataqua River	$3,000,000
Portsmouth	Pease Outfall and SBR	Piscataqua River	$2,932,611
Raymond	WWTF Construction/Sewer Interceptors	Groundwater	$11,998,500
Wolfeboro	WWTF Upgrade/Lehner St. Pump Station	Groundwater	$7,589,400
			$69,125,376

C.3.3.4 Economic Value of Lakes, Rivers, Streams and Ponds

In 2001, the New Hampshire Lakes Association commissioned a multi-phased study on behalf of the Lakes, Rivers, Streams and Ponds Partnership to provide estimates of the economic value from fishing, swimming, boating, public drinking water supplies and waterfront property ownership for lakes, rivers, streams and ponds in New Hampshire (Shapiro and Kroll, 2001, Shapiro and Kroll, 2003). Phase I of the study conducted in 2001 was the literature and methodological review; Phase II of the study was conducted in 2003 and is titled "Estimates of Select Economic Values of New Hampshire Lakes". A copy of this phase of the study is available at http://www.nhlakes.org/docs/EcoStudyPhaseII.pdf.
The Steering Committee for this economic study consisted of the following with contributions from numerous other organizations and agencies:

- NH Lakes Association
- NH Rivers Council
- NH Department of Environmental Services
- NH Department of Fish and Game
- Squam Lakes Association
- Lake Sunapee Protective Association
- Newfound Lake Region Association.

Results of Phase II of the study are summarized below (from Shapiro and Kroll, 2003).

- The total sales generated by recreational uses (i.e., boating, fishing, swimming) of New Hampshire's freshwaters, and by public drinking water supplies, range from $1.1 billion to as much as $1.5 billion annually.

- Annually, there are approximately 14.7 million visitor days spent by both residents and nonresidents in New Hampshire boating, fishing, and swimming. These visitor days represent roughly 65 percent of the state's summer visitor days and roughly 25 percent of the state's annual visitor days.

- Days spent boating, fishing and swimming collectively generate approximately:
    - $320 million to $340 million in annual household income;
    - 9,000 to 15,000 full- and part-time jobs; and,
    - $850 million to $1.2 billion in annual total sales, which represents 8 percent to 12 percent of the total impact of visitor spending on the state's economy.

- Nearly 200,000 households and businesses rely on public drinking water from surface water supplies. This generates approximately $75 million to $150 million in annual household income, 1,900 to 2,600 full-and part-time jobs, and $276 million to $300 million in annual total sales.

- A preliminary estimate suggests that waterfront property owners on lakes, rivers, streams and ponds pay an estimated $247 million per year in property taxes.

The study confirms that the economic value of our fresh surface waters is significant based on these five factors. In reality the value is much higher as the study did not include:

- Other recreational uses such as hunting waterfowl, shoreline picnics or bird watching;
- Commercial and industrial uses of surface waters;
- The economic benefit of business locating in NH due to access to surface waters;
- People's willingness to pay to keep surface waters clean for themselves as well as future generations.

In 2004, the Partnership commissioned a survey of New Hampshire residents as Phase III of the study. The purpose of Phase III of the study, conducted in 2004, was to ascertain public opinion about:

- The relative importance of different freshwater attributes, such as overall beauty of the area, water quality, pollution, and crowding, when NH residents decide to use the state's surface waters for recreational purposes, and
- How residents' attitudes and behavior would change if these freshwater attributes were altered.

Results of the survey are summarized below (from Shapiro and Kroll, 2004).

- The survey, conducted by the UNH Survey Center, found that 75 percent of in-state swimmers, boaters, anglers and other water users would decrease use if crowding got worse; 71 percent would decrease use if mercury got worse; and 70 percent would decrease use if algae blooms got worse. Sixty-seven percent would decrease their use if invasive plants got worse, and 59 percent would decrease use if water levels/flows got worse.
- The survey asked residents to rate the seriousness of a range of environmental and management issues, and invasive plants and crowding topped the list (68 percent rated these each as "very serious" or "serious"). These were followed by algae blooms (54 percent), water levels or water flows (52 percent), mercury (48 percent).

- The survey also asked if residents would change their behavior if these issues worsened, the respondents indicated that they would indeed do so. Of swimmers, boaters, anglers, and other users:

    - 58 percent would decrease use if water levels/flows worsened.
    - 67 percent would decrease use if invasive plants worsened.
    - 70 percent would decrease use if algal blooms worsened.
    - 71 percent would decrease use if mercury worsened.
    - 75 percent would decrease use if crowding worsened.

The survey confirmed that our lakes and rivers are a draw for residents and out-of-state visitors. New Hampshire residents are concerned about water quality and broad environmental factors, such as crowding and development along the shorelines. Maintaining the quality of our rivers and lakes, as well as the quality of the experience people have when they go out to recreate or sight-see is a real economic issue.

The final phase of the study conducted in 2006, consisted of a survey of individuals swimming, boating and fishing at 75 randomly selected access sites across the state ascertained their opinions about New Hampshire's surface water resources. This phase of the study determined if conditions worsen and these users change their behavior, meaning they would visit our waters less often, how this might financially impact New Hampshire. The results of this final phase of the study are summarized below (from Nordstrom, 2006).

- The total annual visitor days made by anglers, boaters and swimmers is 14.9 million; about 29% of the 51.4 million visitor days for the entire year in New Hampshire.

- The total sales generated by anglers, boaters and swimmers combined are nearly $400 million, or 26% of summer spending in New Hampshire.

- The total household income generated from these sales is about $134 million.

- Just under 6,000 jobs (full-time and part-time) are generated by fishing, boating, and swimming visits to New Hampshire.

- A range of 79% to 94% of recreationalists report high levels of satisfaction with the water quality, clarity and purity, natural views and scenery, crowding levels and water levels and flows.

- Half to two-thirds of visitors would decrease or cease their visiting days to a particular site if they perceived a decline in water clarity and purity, natural views and scenery, crowding levels and water levels and flows.

- Overall, perceived degradation to water clarity and purity will result in the greatest economic loss to New Hampshire. Perceived declines in water clarity and purity would result in about $51 million of lost sales, $18 million in lost income and more than 800 lost jobs statewide.

C.4 SPECIAL STATE CONCERNS AND RECOMMENDATIONS

C.4.1 INTRODUCTION

Although tremendous progress has been made in the past 35 years to clean up surface waters in the New Hampshire, there is much more to be done. The following is a list of the major water quality concerns and issues in the state that DES and others will be directing their attention to in upcoming years.

C.4.2 SUSTAINABILITY OF WATER RESOURCES

New Hampshire's water resources are essential elements of the State's unique natural beauty, tourist economy, quality of life and livelihood for many. However, increasing growth and development is stressing the quality, quantity and natural aquatic biota of many of the State's water resources. Although much has been accomplished, there is concern and evidence that existing water management programs may not be adequate to protect water quality and quantity. To help restore and protect its water resources for future generations, the Commissioner of DES authorized the Lakes Management Advisory Committee (LMAC) and the Rivers Management Advisory Committee (RMAC) on January 3, 2007 to undertake a Sustainability Initiative. These committees, which are comprised of representatives from numerous state agencies and public and private sector groups with water interests, are legislatively charged with advising the DES on maintaining water quality and quantity.

In January, 2008, the LMAC and RMAC published a report entitled, "The Sustainability of New Hampshire's Surface Waters"(LMAC/RMAC, 2008 and http://des.nh.gov/organization/divisions/water/wmb/rivers/index.htm). An excerpt from the report summarizing why a Sustainability Initiative is needed, is provided below:

> *"A combination of forces, including rapid population growth and urbanization are imposing new stresses on New Hampshire's surface waters and the State's ability to protect, maintain, and when necessary, restore surface water quality. This is the last major opportunity the State has to address critical water issues, before they either become extremely costly to manage or irreversible. To prevent the negative consequences that accompany our growing population we must develop new approaches that go beyond tasks forces and piecemeal*

strategies. If we adequately protect the ecological function of our terrestrial and aquatic resources, do not burden them with pollutants, nutrients, toxins, or sediment, or demand more than they can provide, they will be sustainable. To attain and continue to achieve excellent water quality, the State must take the lead by promoting a strong economy and maintaining environmental integrity. However, based on our performance to date we are not attaining these objectives. The LMAC and RMAC recommend that the State move forward with a Sustainability Initiative where the State undertakes an aggressive effort, including addressing landscape change and development and its impact upon water quality and quantity."

For the purposes of their report, the LMAC and the RMAC developed the following functional definition of sustainability to achieve their goals:

"to institute anti-degradation measures to preserve and protect water quality and quantity, to maintain intact ecological linkages between surface waters and their surrounding watersheds, to achieve the appropriate balance between different human uses while protecting the biological integrity of the resource, and to restore and improve existing degraded systems."

The report is a preliminary roadmap for the Initiative in that it provides an overview of the problem, what has been done in the past, and, most importantly, identifies eight key issues that need to be addressed to achieve Sustainability. These issues are summarized below:

#1 Lack of data to properly manage water resources (i.e., the need to increase the network of stream gages and to expand and improve the water quality monitoring network) and the need to improve data access and management by data users;

#2 Lack of a coordinated well-communicated strategy on a state-wide scale to effectively address landscape change and its impacts on water quality and quantity;

#3 The need to improve protection of shorelands and riparian buffers;

#4 The need to limit impacts to water quality and quantity from urbanization and watershed development (including stormwater impacts);

#5 The need to determine the biological, social and physical carrying capacity of State surface waters and to provide adequate public access;

#6 The need to control invasive species;

#7 The need to determine and properly manage consumptive uses of surface and groundwater (i.e., determine and implement Instream Flow Protection and Groundwater Withdrawal); and

#8 The need to address climate change impacts (i.e., rising sea levels, altered runoff patterns from reduced amounts of snowfall and more frequent extremes in precipitation from drought to floods, and increased water temperatures that could degrade cold water fisheries).

Having identified the issues, next steps include cataloging ongoing efforts, describing roadblocks to success, prioritizing the issues, proposing concrete options to consider for each of the eight issues, and proposing environmental and programmatic indicators to measure how well success is achieved. Development of a Sustainability Initiative is a high priority at DES and is a major undertaking that will take significant time, resources, coordination and cooperation to complete and implement.

C.4.3 CLIMATE CHANGE

The world's leading scientists concluded in 2007 that it is "unequivocal" that Earth's climate is warming, and that it is "very likely" (a greater than 90 percent certainty) that the heat-trapping emissions(i.e., carbon dioxide and other greenhouse gases) from the burning of fossil fuels and other human activities have caused "most of the observed increase in globally averaged temperatures since the mid-twentieth century" (NIECIA, 2007 and IPPC, 2007). According to a summary of the Northeast Climate Impacts Assessment (NEICIA, 2007) prepared by the Union of Concerned Scientists (USC, 2007), higher emissions of greenhouse gases could:

- cause average temperatures across New Hampshire to rise 9°F to 13°F above historic levels in winter and 6°F to 14°F in summer by late-century;
- result in an increase in winter precipitation on the order of 20 to 30 percent;
- increase the frequency and severity of major flooding river flooding events such as those that occurred in New Hampshire between 2005 and 2007;
- increase the frequency of short term (one to three month) droughts in New Hampshire; and
- cause global sea levels to rise between 10 inches and two feet by the end of this century which could increase the frequency of damaging coastal flooding and potentially inundate valuable coastal wetlands in New Hampshire.

To address climate change, Governor John Lynch established a Climate Change Task Force through Executive Order in 2007 with the charge of developing a Climate Change Action Plan for the State of New Hampshire. Members of the Task Force include business leaders, environmental leaders, state officials, legislators and community representatives with the chairman of the task force being the Commissioner of DES.

Goals of the Task Force include reducing greenhouse gas emissions and recommending steps New Hampshire can take to meet those goals. Recommendations by the Task Force will also help New Hampshire achieve the Governor's goal of ensuring 25 percent of our energy comes from renewable sources by 2025.

New Hampshire has joined other Northeast States in developing the Regional Greenhouse Gas Initiative, which is a regional effort to cap emissions from power plants. The Governor has called for passage this legislative session of a law implementing the Initiative. The Task Force will assist the state in its efforts as that Initiative continues to develop.

In accordance with the Executive Order, the Task Force is to report back to the Governor by Sept. 1, 2008. For more information on climate change visit the DES Air Resources Division website at http://des.nh.gov/organization/divisions/air/tsb/tps/climate/index.htm .

C.4.4 INSUFFICIENT FUNDING TO MANAGE WATER RESOURCES

Management of New Hampshire's surface waters requires adequate funding to support essential core programs such as those described in Section C.2. These programs are needed to 1) help prevent the degradation of surface waters in the state and the potential loss of revenue and 2) to protect the hundreds of millions of dollars which have already been invested to restore and maintain water quality in New Hampshire. For the past several years federal funding for many programs have remained flat or decreased. As a result, some programs, such as the biomonitoring program have already had to downsize (see section C.2.1.5). If this trend is not reversed soon, or if other sources of funding are not found, other important water quality programs will need to be cut back in scope and staff or eliminated. This would be extremely detrimental to New Hampshire's water resources since many programs are already under-funded and understaffed. For example, based on the New Hampshire Water Monitoring Strategy (DES, 2005), surface water monitoring programs in the State are currently under funded by approximately one million dollars (see section D.1). As a result, DES does not always have the data that it would prefer to make water management decisions. Further, if water quality is allowed to degrade, it could have a significant impact on the State's economy. As reported in section C.2.10.2, perceived declines in water clarity and purity are estimated to result in about $51 million of lost sales, $18 million in lost income and more than 800 lost jobs statewide.

C.4.5 DRINKING WATER ISSUES

Existing data demonstrates that most of the state has very high quality drinking water. However, as population increases and landscapes are altered by human activities, it is critical that New Hampshire implements land conservation practices, best management practices, education and outreach and regulatory enforcement where appropriate to protect water resources. Additionally, as water treatment systems continue to be installed throughout New Hampshire to remove naturally occurring contaminants, regulations and policies will need to continue to be enforced to ensure that these concentrated contaminants or the substances utilized to regenerate treatment devices are not discharged to the surface waters of the state.

C.4.6 WASTEWATER TREATMENT FACILITY ISSUES

C.4.6.1 Upgrading Existing Wastewater Treatment Facilities

As a result of a thirty year construction program, all of the major municipal wastewater treatment facilities in New Hampshire have been built. In accordance with the technology limits of state and federal law, all municipal discharges, with the exception of Portsmouth's advanced primary wastewater treatment facility receive at least secondary treatment. Subsequent monitoring and modeling efforts, [i.e. wasteload allocation or Total Maximum Daily Load (TMDL) studies], however, have shown that in order to meet instream water quality standards

advanced treatment will probably be necessary at some facilities for pollutants such as biochemical oxygen demand, phosphorus and/or nitrogen. Additionally, the fact that the majority of wastewater facilities are beyond their design life will warrant the need for upgrades, equipment replacement, and the like.

C.4.6.2 Combined Sewer Overflows

The combined sewer overflow (CSO) program is addressed in Section C.2.2.2. As mentioned, there are currently 38 CSOs located in the six New Hampshire communities of Berlin (1 CSO), Lebanon (7 CSOs), Manchester (17 CSOs), Nashua (8 CSOs), Portsmouth (4 CSOs), and Exeter (1 CSO). Each of these communities has implementation plans to abate CSO pollution. Studies to date suggest that bacteria and floatables are the major pollutants of concern. To expedite implementation of CSO abatement plans, federal funding assistance will be needed.

C.4.7 NONPOINT SOURCES

The major contributors to nonpoint source (NPS) pollution are people at home, work and play. To address such NPS issues it is necessary to 1) convince people that a problem exists, 2) develop reasonable solutions and 3) fund the solutions. Stormwater runoff is a major contributor of nonpoint source pollution in many areas. To date numerous solutions (i.e., best management practices or BMPs) have been developed to abate NPS pollution. Education and funding, therefore, are major obstacles which must be overcome to resolve NPS water quality concerns.

A combination of approaches is necessary to improve water quality through nonpoint source pollution prevention and control efforts. Education and outreach are essential since many water quality impairments are the result of the cumulative impacts of individual actions. Integration of land use planning, land protection, and BMP implementation remains a challenge in preventing and controlling NPS pollution. Permanent protection of critical lands, including riparian buffers and headwater streams, is essential to maintaining water quality, particularly in urbanizing areas. Assisting communities with complying with Phase II of the federal NPDES stormwater permitting requirements will also help to abate urban stormwater pollution. If development is located away from critical areas, then best management practices (BMPs) can do their job.

C.4.8 INTRODUCTION OF NON-NATIVE NUISANCE AQUATIC SPECIES

Preventing the spread of new exotic aquatic plants and animals into state waters is a major concern in New Hampshire. In 1997, legislation was passed to prohibit the sale, transport and introduction of exotic aquatic weeds in the state. In 1999, rules were adopted pursuant to this legislation, further restricting activities that would result in new introductions of non-native species. These rules were revised and expanded in 2007. The Exotic Species Program must continue to prevent the introduction and spread of non-native nuisance aquatic species in New Hampshire's surface waters so as to protect the ecological, recreational, aesthetic, and economic values of our waterbodies. Unfortunately, during the summer of 2007, an invasive alga (*Didymosphenia geminata*) became a new problem to the waters of New Hampshire. Now, in addition to battling infestations of exotic aquatic plants in over 70 waterbodies, we have the added problem of a microscopic alga that is posing a problem as well. With limited resources for control, DES continues to work strongly towards prevention and early detection of new

infestations, while trying to manage existing infestations as best as possible with limited funds. For additional information about the exotics species control program, see section C.2.7.

C.4.9 COASTAL ISSUES- SHELLFISHING AND EUTROPHICATION

C.4.9.1 Opening Shellfish Beds

The State of New Hampshire has been actively working on reopening shellfish harvesting areas since 1993, when an interagency committee (Department of Health and Human Services, Office of state Planning, Fish and Game Department, Department of Environmental Services, and UNH/Jackson Estuarine Laboratory) began work in Hampton/Seabrook Harbor and successfully reopened some beds in 1994, and again in 1995. This group's work was expanded in the mid 1990s with the creation of the New Hampshire Estuaries Project (part of EPA's National Estuary Program), and additional openings were realized in areas such as Little Bay, Hampton/Seabrook, and others.

In 1999 the New Hampshire General Court transferred authority for shellfish water classification from the Department of Health and Human Services to the Department of Environmental Services, which then created a full-time program within Watershed Management Bureau. Since late 1999 two program staff have worked full time toward the NHEP goal (also a DES Strategic Plan objective) of classifying all estuarine shellfish waters. Through 2007, over $2.2 million in state and federal funds have been applied toward this goal. Currently, 88.5 percent of the estuarine shellfish waters have been classified, and 47 percent of estuarine shellfish waters are open for harvest.

Efforts to identify pollution sources and classify shellfish growing areas have resulted in the reopening of over 850 acres of estuarine waters for harvest. These efforts have included the inspection of almost 1700 properties and the identification of 790 potential/actual pollution sources. Of these sources, 96 have been confirmed as actual pollution sources and are receiving some level of follow-up investigation by the DES Watershed Assistance Section and/or the DES Shellfish Program. The major remaining point sources of pollution are four CSOs located in Portsmouth and one CSO in Exeter. Efforts to mitigate CSO pollution are discussed in Section C.2.2.2

In addition to the work in estuarine areas, the DES Shellfish Program reopened nearly all of the Atlantic Coast for harvesting in late 2000. That, plus the development of a shellfish classification program that complies with the National Shellfish Sanitation Program, led to the state of New Hampshire obtaining federal recognition as a "shellfish producing state." This recognition has subsequently allowed for the development of a commercial aquaculture industry in the state. The state aquaculture industry includes offshore blue mussel and estuarine oyster culture operations.

C.4.9.2 Estuarine Eutrophication

Nitrogen concentrations in Great Bay have increased by 59 percent in the past 25 years. Negative effects of excessive nitrogen, such as algae blooms and low dissolved oxygen levels, are beginning to show in some of the estuarine tributaries. The estuary cannot continue to receive increasing nitrogen levels indefinitely without experiencing a further lowering of water quality

and ecosystem changes. Two ecosystem changes of particular concern are the loss of eelgrass and shellfish. The causes of eelgrass declines are uncertain but loss of water clarity, disease, excess nitrogen, and nuisance macroalgae are all contributing factors. Oyster and clam populations are at or approaching the lowest levels ever recorded. Trends suggest that clam populations follow a boom-and-bust pattern, but the oyster populations appear to be experiencing a slow decline. In 2005, DES initiated a process to develop numeric nutrient criteria for NH's estuaries. DES will continue to work on this issue in the coming years to identify an appropriate threshold for nitrogen loading to the estuaries.

C.4.10 MERCURY IN FISH

As discussed in Section D.6.3, statewide fish consumption advisory was issued in 1994 for all inland freshwater bodies because of mercury levels found in fish tissue. The advisory recommends limiting the amount of fish eaten per month. The advisory was updated in 2001 and another update is anticipated in 2008 to incorporate findings from additional mercury fish tissue analysis. Symptoms of mercury poisoning can include loss of sensation in the extremities (paresthesia), loss of coordination in walking, slurred speech, diminution of vision and/or loss of hearing. As a result of the statewide advisory, all surface waters are considered impaired for fish consumption due to elevated levels of mercury in fish tissue.

Human related sources that may emit mercury into the atmosphere include coal combustion, smelting, and waste incineration. Although New Hampshire sources emit some amounts of mercury, substantial quantities are also emitted in states upwind and carried east by prevailing winds. Modeling by NESCAUM shows that only 14 percent of the mercury deposition falling on the northeast region (New England and New York) originates within the region. The emitted mercury is then deposited on the lakes and soils of New Hampshire, is methylated by bacteria and is concentrated as it moves up the food chain into fish and fish-consuming animals, including humans.

In New Hampshire, a state level mercury reduction strategy (section C.2.13) was drafted and released in October, 1998. The strategy contains 40 recommended actions to reduce mercury releases in New Hampshire, including those from medical and municipal waste incineration and power generation. Implementation of the strategy has resulted in greater than a 60% reduction in regional mercury releases to date, with a long-term goal of the virtual elimination of man-made mercury releases. Legislation passed in 1999 imposes a stringent mercury emissions limit on the States' largest municipal waste combustor. Similarly, regulations put in place for medical waste incinerators have reduced emissions for that source by 98%. Most recently, legislation was passed to limit emissions from the State's coal-fired utilities, with full implementation required by 2013. The strategy also emphasizes source reduction, and legislation was passed in 2007 that bans the sale of many types of mercury-added products in the State, beginning January 1, 2008. In addition, a separate bill makes it illegal to dispose of any mercury-added product in a landfill, transfer station and incinerator. To encourage proper recycling and disposal NH DES has been working with private and municipal partners to conduct outreach and develop free recycling programs for consumers. Other ongoing mercury reduction outreach efforts are targeted to hospitals, businesses, schools, dentists, municipalities and citizens.

New Hampshire also continues to actively participate (including co-chairing) an effort led by the Conference of the New England Governors and the Eastern Canadian Premiers to

implement the Regional Mercury Action Plan, adopted by the Governors and Premiers in June, 1998. Although significant progress has been made since the release of the mercury reduction strategy, much remains to be done.

New Hampshire also participated in the development of a mercury TMDL for the northeast region. The TMDL was coordinated and prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) with assistance from the northeast states and was recently approved by EPA. The TMDL indicates that reductions are needed in anthropogenic sources of mercury from in-region and especially out-of-region sources to reduce mercury concentrations in fish to levels more acceptable for fish consumption.

C.4.11 ACID DEPOSITION (ACID RAIN)

The passage of the Clean Air Act Amendments in 1990 has resulted in a decrease in sulfur dioxide emissions from in-state and out-of-state sources. Unfortunately, this has resulted in little if any improvement in the acidity or acid neutralizing capacity status of New Hampshire surface waters. As a result, hundreds of waterbodies in the state do not meet state water quality standards for the protection of aquatic life due to low pH (i.e. acidic conditions).

A number of reasons contribute to this lack of improvement in surface waters and the need for further cuts in emissions. Nitrogen emissions have not decreased substantially region-wide and wet deposition of nitrogen has remained largely unchanged since the 1980s. Additionally, the loss of acid-neutralizing minerals from the soil and the long-term accumulation of sulfur and nitrogen in the soil have left many ecosystems more sensitive to the input of additional acids, further delaying recovery from acid deposition.

Computer model results for the Hubbard Brook Experimental Forest show that the 1990 Clean Air Act Amendments will have a positive effect on sulfate deposition but will not facilitate full recovery for acid-sensitive ecosystems in the Northeast. Results of the Hubbard Brook model further suggests that deeper cuts in electric utility sulfur emissions (at least 80 percent beyond the Clean Air Act) will be needed for greater and faster recovery from acid deposition in the Northeast (Driscoll *et al.* 2001).

C.4.12 CHLORIDES AND ROAD SALT

Monitoring data have shown increasing levels of sodium, chloride, and conductivity in surface waters, presumably from deicing runoff. Most lakes continue to meet the chronic chloride criteria of 230 mg/L but increases of well over 100 percent in all three parameters have been documented in many lakes over the past 25 to 30 years, with the greatest increases occurring in recent years. The most impacted lakes are lakes that drain salted roads, highways, and urban areas. Streams also show increases in conductivity and streams in urban areas may violate criteria. Total Maximum Daily Load (TMDL) studies were recently drafted for four brooks in the I-93 corridor in conjunction with the expansion of I-93 because the four brooks fail to meet the water quality criteria for chloride. DES expects to submit the TMDLs to EPA for final approval in 2008. Efforts are underway to work with DOT and stakeholders to decrease salt loadings in the region and to educate the public on the issue.

C.4.13 CYANOBACTERIA BLOOMS

DES considers Cyanobacteria (formerly referred to as blue-green algae) a significant public health risk to people who recreate in infected waters and increases the likelihood of animal mortality if infected waters are ingested. Nutrient enriched waterbodies increase the potential for nuisance blue-green scums that are potentially toxic to the aquatic ecology. Historically this occurred in New Hampshire when treated sewage effluent was allowed to be discharged to lakes (e.g., Winnisquam, Kezar, and Glen). Cyanobacteria begin their cycle by deriving nutrients from the sediments before their journey to the surface for more sunlight. When favorable growth conditions exist, cyanobacteria reproduction is rapid, forming surface scums that accumulate along downwind shores. Scums can be fatal to all animals that consume the water and can cause severe illness or skin rashes if ingested or contacted by humans. To protect the public and environmental health, DES has taken a proactive approach by issuing advisories for designated public bathing beaches impacted by cyanobacteria and issuing press releases to warn shoreland owners that cyanobacteria scums are present around the waterbody.

PART D. SURFACE WATER MONITORING AND ASSESSMENT

D.1 MONITORING PROGRAM

New Hampshire has numerous water resource monitoring programs including three very active volunteer monitoring programs (i.e., the Volunteer Lake Assessment Program or VLAP, the Volunteer Rivers Assessment Program or VRAP, and the Volunteer March Monitors Program). The majority of these programs are summarized in the New Hampshire "Water Monitoring Strategy" (DES, 2005), a copy of which is provided in Appendix 3. DES plans to update the strategy in 2009.

The strategy specifies a process for determining water monitoring data required to address New Hampshire's water management needs. It describes a vision for collection, management, and analysis of water data in a way that supports public management decisions about protection and restoration of our water resources. The first edition focuses on surface water quality data for all waterbody types, with an emphasis on water quality assessment under the Clean Water Act (CWA). It is expected that future editions will incorporate other objectives, including groundwater and flow monitoring.

The purpose of developing the strategy is to provide a vehicle for planning and coordination among all organizations that collect water data in New Hampshire – federal, state, and local government, as well as non-government and academic. Furthermore, it fulfills the EPA requirement for a Strategy to implement the Elements of a State Water Monitoring and Assessment Program (USEPA, 2003) in the context of surface water quality assessment and reporting under sections 305(b) and 303(d) of the Clean Water Act. In a broader context, the strategy aims to provide unifying concepts, purposes, and methods for all who collect water quality data, leading to more efficient water monitoring, more available data, more complete and informed analysis, and ultimately better public decision-making about actions affecting water resources.

The strategy is underlain by the following three principles all of which are described in more detail in Appendix 3:

1) Water management decisions should be data-driven, and framed on a watershed basis.
2) The purpose for collecting water data should be clearly understood.
3) Water data should be accessible and interoperable, with documented data quality and metadata.

Implementation of these underlying principles in all New Hampshire water monitoring efforts depends on a statewide mechanism for coordination, communication, collaboration, and data sharing among all entities that collect, manage, or use monitoring data. For this mechanism, DES proposes to create a state water monitoring council, the New Hampshire Monitoring Network. Steps are currently underway to initiate formation of the network. The network's purpose will be to join the individual efforts of the disparate agencies and organizations that now collect monitoring data into a coordinated, integrated, and mutually understood process for data-driven decision making, using the principles described above. DES has committed to forming

the network in FY 06, as a participant with EPA and USGS in a pilot project to integrate USEPA and USGS water quality monitoring and assessment activities in New Hampshire and New England.

To ensure that the purpose for collecting water quality data is clearly understood (i.e., underlying principal #2), DES is implementing a data-driven decision making paradigm, which is based on the Data Quality Objectives (DQO) process developed by EPA (USEPA, 2000). Using this concept, the entire strategic plan for monitoring becomes a dynamic composite of objectives as the seven steps of the DQO process frame, quantify, and analyze key management questions. The seven steps are described in detail in the Strategy. DES is encouraging other agencies and organizations to partner with DES in its use.

Part of the DQO process includes establishing monitoring objectives. Interim objectives identified in the strategy are shown in Table 7. Numbered objectives are either required by EPA for Clean Water Act reporting purposes, or they are the basis for ongoing surface water quality monitoring at DES. Lettered objectives are draft placeholders for inclusion in subsequent editions of the strategy. DES expects this interim list to grow and be refined in subsequent editions. The DQO process, consistently applied, will concisely link the objectives shown in Table 7 with the water monitoring data needed to fulfill them.

Table 7: Interim Water Monitoring Objectives

Objective #	Description	CWA Section
1	Determining surface water quality standards attainment	305(b), 314
2	Identifying impaired surface waters, waters meeting standards, and high quality waters	303(d)
3	Assessing surface water quality trends	305(b), 314
4	Support surface water quality modeling studies such as TMDLs and Diagnostic Feasibility Studies	303(d)), 314
5	Identifying causes and sources of surface water quality impairments	303(d), 305(b)
6	Supporting the evaluation of program effectiveness.	303, 305, 402, 314, 319
7	Supporting surface water compliance and enforcement Actions	
8	Investigating surface water quality complaints	
9	Establishing, reviewing, and revising surface water quality standards	303(c)
10	Supporting special research projects, including emerging public and environmental health issues	
11	Supporting the implementation of surface water quality management programs	303, 305, 402, 314, 319
12	Supporting protection for high quality surface waters under the	314, 303(c)

Objective #	Description	CWA Section
	surface water antidegradation policy	
A	Supporting contaminated site remediation	
B	Providing data for dam management and operation	
C	Providing data for flood and drought control and prediction	
D	Providing data for water management plans for surface and groundwater use and dam operation	
E	Assessing groundwater quality for domestic water supply	
F	Providing data for source water protection for surface and groundwater supplies	
G	Assessing surface water impacts of groundwater and surface water withdrawals	

With regards to Objective 1, it is apparent that a census approach to meeting this objective is unworkable as it would mean that all 5200+ surface water assessment units would have to be monitored and assessed for all uses every five to ten years. This is simply not feasible. Consequently, too achieve this objective (pending the availability of funding) DES proposes to conduct probabilistic assessments of all New Hampshire surface waters, grouped into six strata by waterbody type. The probabilistic assessment will be repeated for each stratum every 10 years. More details regarding the proposed probabilistic monitoring are provided in Appendix 3 .

Although probabilistic assessments satisfy Objective 1, they do not provide any information toward Objective 2 – identifying impaired waterbodies. This is because the amount of data collected in each assessment unit does not meet minimum CALM requirements. Therefore it is neither useful for reporting to EPA under CWA section 303(d) nor for local watershed management decisions that require complete assessment of targeted waterbodies. Plans for achieving Objective 2 are included in the strategy and focus on use of modeling tools to make assessments in less populated areas and ways to expand and better integrate volunteer monitoring to achieve Objective 2 as well as the monitoring objectives of the volunteers. To this end, DES intends to aggressively pursue building statewide capability for enhanced volunteer monitoring. This will include seeking additional staff so that DES can provide direct technical support to more volunteer groups, making the DES Environmental Database (EMD) easy to use for organizations outside DES, and better coordination with organizations that have their own monitoring capabilities, such as UNH Lay Lakes Monitoring Program, GLOBE, Plymouth State University Center for the Environment, UNH Jackson Lab, Lake Sunapee Protective Association, and others. The New Hampshire Monitoring Network will be an important communication tool for this effort.

With regards to resources, traditional long term federal funding sources for monitoring and assessment include federal Clean Water Act Section 106 and 604(b) grants for rivers and streams, state general funds for lakes, and federal Coastal Zone Management and National Estuaries Program funds for tidal waters. These sources have essentially stayed level over the

last few years. Meanwhile salaries and benefits, as well as laboratory analysis costs, continue to increase, resulting in less actual monitoring activity on a per site visit basis.

In fiscal years (FY) 03-05 DES was able to maintain its base monitoring and assessment programs for rivers and streams by supplementing long term funding sources with PPG carryover funds from previous grant years and by applying for short term competitive funds such as Section 104(b) (3) grants. After FY08, however, it is projected that carryover money will be essentially exhausted. In order to maintain existing levels of monitoring effort, DES will need to become more efficient by reducing staff costs per site visit, and secure additional funding. DES will continue work with ASIWPCA, ECOS, other states and EPA to present the needs to Congress for federal budget action. DES also intends to explore state and watershed-based funding possibilities, as is presently being done, for example by the DES Shellfish Program.

Table 8 shows staffing and funding needs to fully implement New Hampshire's Monitoring Strategy. This analysis was conducted in 2005.

Table 8: Staffing and Funding Needed to Implement NH Monitoring Strategy

Element	2006 (Year 1)				Peak Year (in 2005 dollars)			
	Total Cost	Available Funds	Surplus / Deficit	Total # Staff Required (New Staff)	Total Cost	Available Funds	Surplus / Deficit	Total # Staff Required (New Staff)
# 1	$2.17 M	$2.17 M	$0	24.0 (6.3)	$3.06 M	$ 2.17 M	($0.89 M)	33.8 (15.5)
# 2	$0.22 M	$0.22 M	$0	2.5 (0.0)	$0.34 M	$0.22 M	($0.12 M)	4.5 (2.0)
# 3	$0.14 M	$0.14 M	$0	1.6 (0.0)	$0.21 M	$0.14 M	($0.07 M)	2.6 (1.0)
TOTAL	$2.53 M	$2.53 M	$0	28.1 (6.3)	$3.61 M	$2.53 M	($1.09 M)	40.9 (18.5)

NOTES:

1. Element # 1 = MONITORING AND QA/QC
   Element # 2 = DATA MANAGEMENT
   Element #3 = ASSESSMENT OR ANALYSIS AND REPORTING.
2. M = Million

As shown in Table 8, it is estimated that DES spent approximately $2.53 M in 2006 on all three elements addressed in the strategy (monitoring and QA/QC, data management and assessment/ reporting). This effort will require approximately 28.1 full time equivalent (fte) staff

of which, 21.8 fte are existing and 6.3 fte are new (part time interns which are hired by DES every summer). Sufficient funds were available to cover expenses in 2006.

To fully implement the strategy, Table 8 (peak year) shows that approximately $3.61 M (in 2005 dollars) is needed on an annual basis, the majority of which is needed for monitoring ($3.06 M). Assuming that future funding from existing sources remains at 2006 levels, this results in a $1.09 M deficit. The peak year requires approximately 40.9 fte, of which approximately 18.5 would be new. This includes 10 new full time staff and 2.8 fte in additional part time interns to the 6.3 fte of part time interns which are currently hired each summer. Projects requiring additional full time staff for strategy implementation are shown in Table 9. All of these projects are currently functioning with no more than one full time staff member.

Table 9: Projects Requiring Additional Staff for Strategy Implementation

Number of New Full Time Staff	Project
2	Ambient River Monitoring Programs
2	Total Maximum Daily Load (TMDL) Program
2	Volunteer Lake and River Assessment Programs (VLAP and VRAP)
1	DES Limnology Center
2	Data Management
1	Assessment and Reporting

Vehicles for transportation to sampling events are a major additional equipment need. The Peak Year scenario includes 3 vehicles. Other major equipment needs in the future include datasondes and biomonitoring equipment.

D.2 ASSESSMENT METHODOLOGY

The purpose of the Consolidated Assessment and Listing Methodology (CALM) is to describe, in detail, how surface water quality data are analyzed and how assessment decisions for 305(b) reporting and 303(d) listing purposes are made. The CALM also includes descriptions and definitions of the many terms used in the assessment tables and lists presented in the following sections. Readers are strongly encouraged to read the CALM before reviewing assessments as it will help one to better understand and interpret assessment results.

Examples of topics addressed in the CALM include:

- Waterbody coverage, types and assessment units
- Designated uses
- Data sources

- Data quality
- Data age
- Core parameters
- Definition of independent samples
- Spatial coverage per sample site
- Minimum number of samples for various parameters
- Magnitude of exceedance criteria
- Specific assessment criteria for each designated use
- Section 303(d) listing and delisting
- Total Maximum Daily Load (TMDL) priority ranking

Assessment methodologies often change as new information and assessment techniques become available. Consequently, DES reviews and updates its CALM a minimum of every 2 years. These periodic updates should result in more accurate and reliable assessments, and therefore, better management of water resources in the future.

The first edition of the CALM was prepared for New Hampshire's 2002 Section 305(b) and 303(d) Surface Water Quality Report. Since then, the CALM has been updated in 2004, 2006 and 2008. A copy of the 2008 CALM is available in Appendix 4 and Appendix 5 at http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm . Prior to being finalized, a draft of the 2008 CALM was released for public comment. For more information regarding the public participation process for the CALM, see section F.2.

D.3 ASSESSMENT RESULTS

D.3.1 OVERVIEW

In this section, the water quality of the state's waters is discussed. In accordance with EPA guidance, the assessment addresses the overall use support, the individual use support, as well as the causes (i.e., the pollutants), and probable sources of nonsupport. Tables and graphs are provided that summarize each of the assessed waterbody types.

New this year is the addition of wetlands to the Assessment Database. In all, 23,626 wetland assessment units covering 286,906 acres were added. This does not include wetlands in open water to avoid overlap with existing AUs in other waterbody types. Although none of the wetlands were assessed this cycle, this represents a significant first step to ultimately being able to assess and report on wetland water quality. As discussed in section C.2.16, DES is currently developing GIS-based criteria using the characteristics of adjacent land uses. This information will be used to conduct preliminary or "screening level" assessments of wetlands in the future.

D.3.2 OVERALL USE SUPPORT SUMMARY

The Clean Water Act goal is to assess 100 percent of the State's waters for all designated uses. Figure 13 shows the percent assessed based on size (i.e., miles, acres, etc) and site specific assessments (see section D.4) for each waterbody type and designated use. As shown, there is reasonably good to very good coverage based on site-specific assessments for aquatic life, primary and secondary contact recreation in estuaries, oceans, lakes, and impoundments. For the same uses, the percent assessed in rivers is much lower. All tidal waters were assessed for

shellfishing. All surface waters were assessed for fish consumption whether including or excluding the fish consumption advisory due to mercury. All surface waters were assessed for the use of drinking water supply based on state law which requires all such waters to be suitable for drinking after adequate treatment. None of the surface waters were assessed for the use of wildlife since criteria have not yet been developed to assess this use.

Figure 13: Overall Percent Assessed

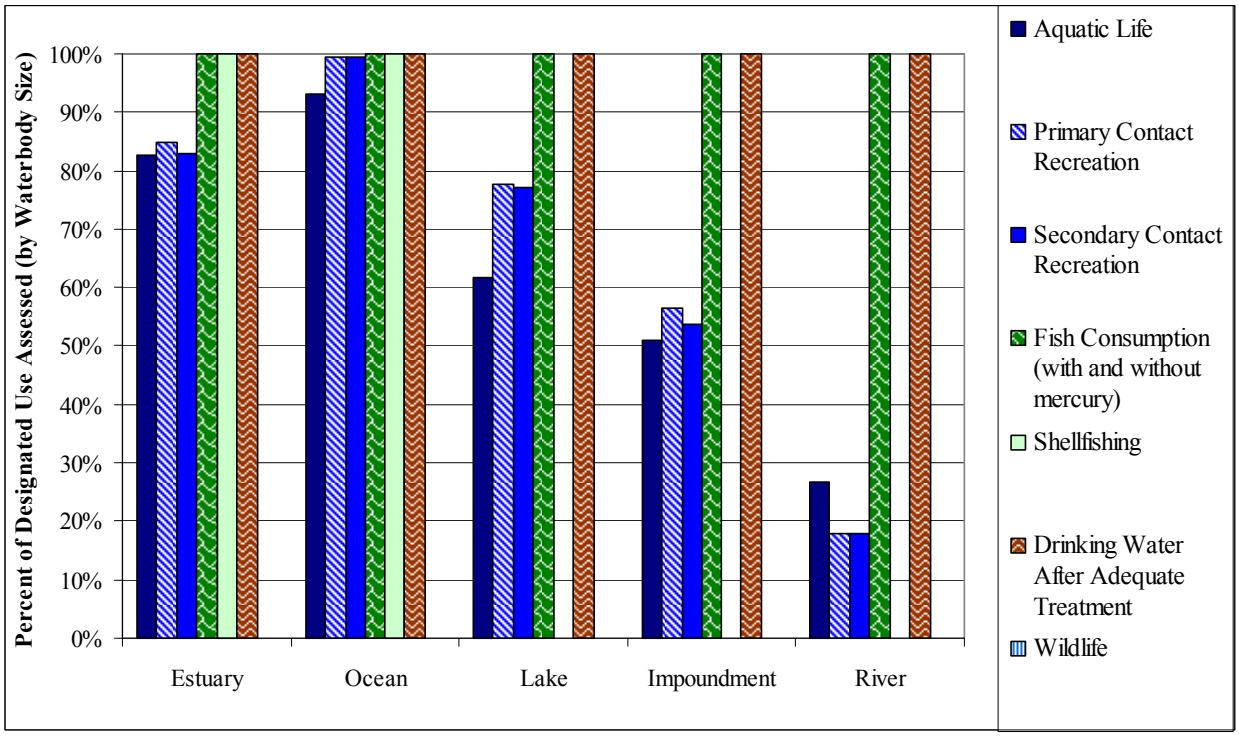


Table 10 and Table 11 presented at the end of this section show the values for the percent assessed used to develop Figure 13 as well as overall use support status for each waterbody type using EPA's assessment categories (i.e., 1, 2, 3, 4a, 4b, 4c, and 5). Two tables are presented to show the difference in assessment results with and without the statewide mercury fish consumption advisory which affects all surface waters in New Hampshire (see section D.6.3) Definitions for each category are provided at the bottom of Table 10 and Table 11. Percents shown in the two tables are in terms of total size (i.e., miles, acres, etc.). Also shown in Table 10 and Table 11 are assessment results based solely on site specific assessments (SSA) as well as those based on a combination of site specific and probabilistic assessments (PA). Descriptions of these two types of assessments are provided in section D.4.

In addition to the information provided in Table 10 and Table 11, overall assessment results are also presented graphically in Figure 14 and Figure 15. The bar graphs presented in Figure 14 and Figure 15 are based on the values provided in Table 10 and Table 11 respectively. For example, for estuaries based on site specific assessments (SSA), Table 10 shows 25.8% of all uses and waters in estuaries meet water quality standards (the sum of category 1 and 2 waters), 21.3% have insufficient information or no data to assess the uses (category 3 waters), and 52.9% are impaired for one or more uses (the sum of categories 4a, 4b, 4c and 5). The total assessed is 88.7% which is the sum of the percent meeting water quality standards and percent that are

impaired. These same results are shown in the first bar graph in Figure 14 with waters meeting one or more designated uses with none impaired or threatened in green, waters with one or more uses that are impaired or threatened in red, and waters with insufficient information to assess any use in grey. The total assessed is the sum of the green and red areas.

The bar graphs presented in Figure 14 and Figure 15 are very helpful because one can tell at a glance how well we are progressing towards meeting the ultimate goal of having all waters attain all designated uses. If this goal was achieved, all the bar graphs shown in these two figures would be entirely green. If all waters were impaired for all uses, each bar graph would be entirely red and if there was insufficient information to assess any water for any use, each bar graph would be entirely grey. As previously mentioned, the total percent assessed can be easily obtained by adding the green (attaining) and red (impaired) percentages together. As discussed in section C.2.1.2, all freshwaters have six designated uses and all tidal waters have seven designated uses. Therefore, for freshwaters (impoundments, lakes and rivers) , each designated use represents 16.7% (100%/6) of the total bar graph and for tidal waters (estuaries and ocean) each designated use represents 14.3% (100%/7) of the total bar graph. Of the 14.3% or 16.7%, the percent assessed as attaining, impaired or insufficient information is based on the individual use assessments presented in section D.3.4 through D.3.8. For example, for estuaries, the individual use support assessment (see Table 12 in section D.3.4.1) for aquatic life use shows that 4.0% of the estuaries is fully supportive, 78.7% of the estuary is impaired and 17.2% had insufficient information to assess the aquatic life use. In the bar graphs presented in Figure 14 and Figure 15, this represents 0.6% (4.0%/ 7 uses) of the green area (attaining), 11.2% (i.e., 78.7% / 7 uses) of the area in the red zone (impaired) and 2.5% (17.2%/ 7 uses) in the gray area (insufficient information). The sum of the green, red and gray areas in Figure 14 and Figure 15 for aquatic life use is therefore 14.3% (0.6% + 11.2% + 2.5%) which agrees the earlier statement that each designated use for tidal waters represents 14.3% (100% /7) of the total bar graph in these figures.

All waters are considered assessed and impaired for fish consumption due to Statewide fish and shellfish consumption advisories. The advisory was issued for all New Hampshire surface waters because of elevated levels of mercury in fish/shellfish tissue (see section D.6 for more information on fish advisories). Consequently, in Table 10 and Figure 14 a large portion of the impairments are attributable to mercury.

For comparison purposes, Table 11 and Figure 15 are presented which show what the overall use support would be if the mercury issue was resolved and the state-wide mercury fish/shellfish consumption advisory was no longer in effect. A list and map of all impaired waters excluding the mercury advisory are provided in Appendix 6 and Appendix 7 respectively. In the absence of the state-wide fish consumption mercury advisory, no other state-wide advisories are in effect which would result in all being assessed as impaired. This is considered a reasonable assumption based on fish tissue analyses done to date and the fact that most New Hampshire surface waters are not believed to be subject to any significant toxic discharges (other than mercury) that would impact fish consumption. Consequently, in Table 11 and Figure 15 a large portion of the supporting waters are attributable to fish consumption. Other localized fish consumption advisories are in effect for tidal waters and specific freshwaters (see section D.6.3)

Figure 14: Overall Use Support With Mercury

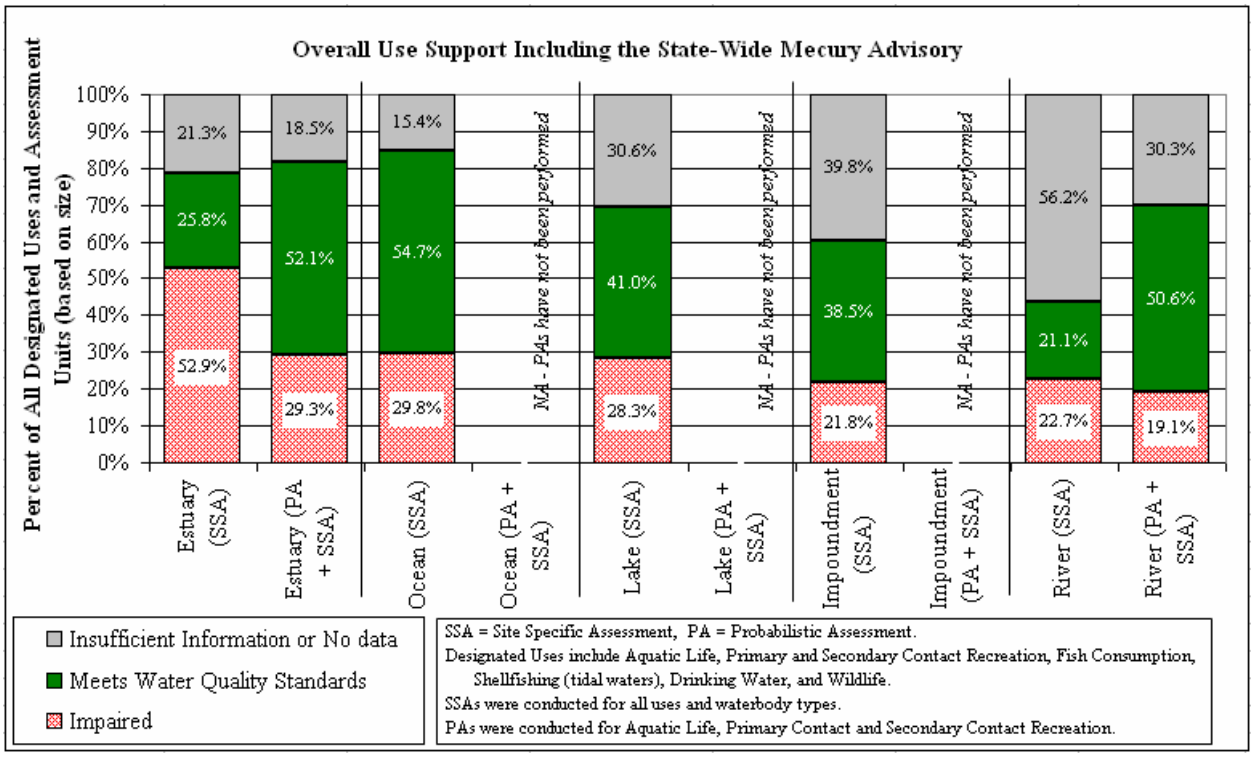
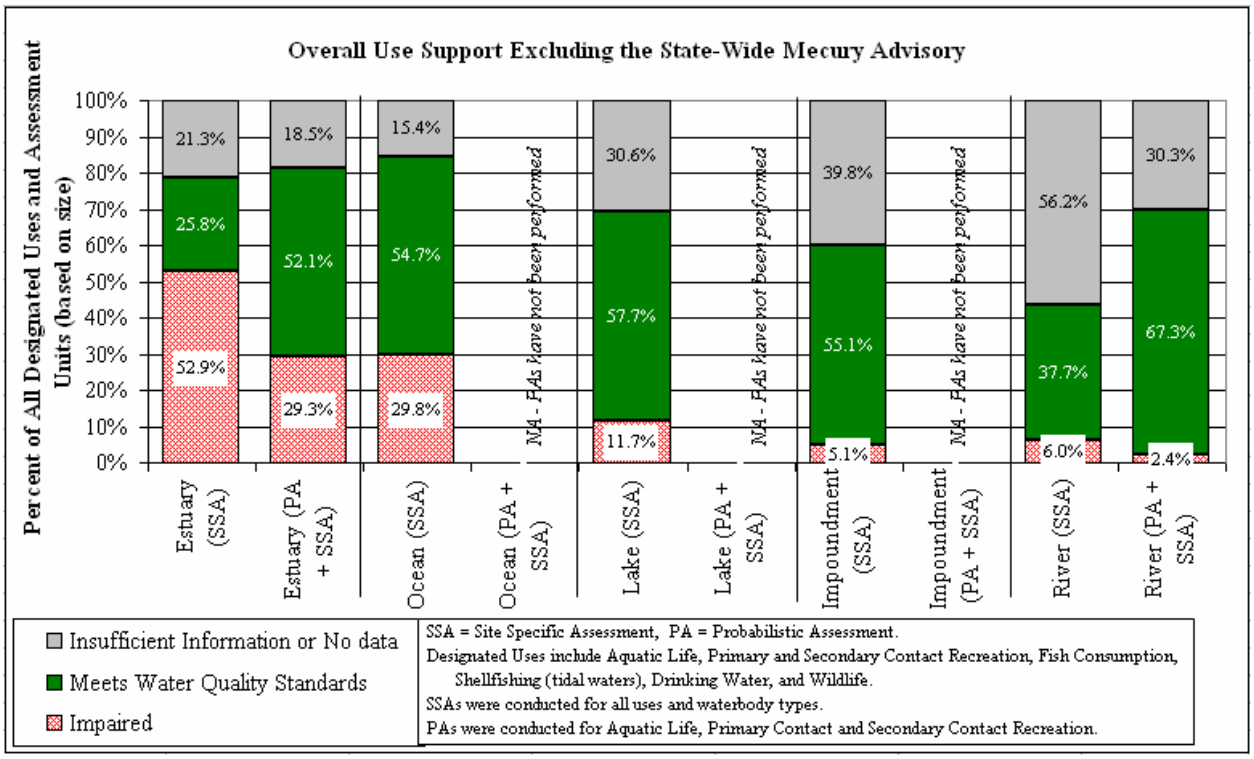


Figure 15: Overall Use Support Without Mercury



Excluding the mercury advisory, 57.7 percent, 55.1 percent and 37.7 percent of designated uses on lakes, impoundments, and rivers respectively are considered fully supporting. There is no difference between the mercury included and mercury excluded graphics for tidal waters as all tidal waters are impaired due to other fish consumption advisories that are in effect (i.e., dioxin and PCBs).

There are approximately 9,627.7 miles of rivers and streams (1:100,000 scale mapping) all of which have six designated uses. Based on site specific assessments or probabilistic assessments (where available), 69.7 percent of the mileage and designated use combinations were assessed. Without the statewide freshwater fish consumption advisory due to mercury included in the assessment, 67.3 percent of the rivers and streams met water quality standards and 2.4 percent were impaired while 30.3 percent of the resource remains unassessed. With the statewide fish consumption advisory included, 50.6 percent of the rivers and streams met water quality standards and 19.1 percent were impaired while 30.3 percent of the resource remains unassessed. By way of the site specific assessments 43.7 percent of the mileage and designated use combinations were assessed. Without the statewide freshwater fish consumption advisory due to mercury included in the assessment, 37.7 percent of the rivers and streams met water quality standards and 6.0 percent were impaired while 56.2 percent of the resource remains unassessed. With the statewide fish consumption advisory included in the assessment, 21.1 percent of the rivers and streams met water quality standards and 22.7 percent were impaired while 56.2 percent of the resource remains unassessed.

There the approximately 164,472 acres of lakes and ponds all of which have six designated uses. By way of the site specific assessments, 69.4 percent of the acreage and designated use combinations were assessed. Without the statewide freshwater fish consumption advisory due to mercury included in the assessment, 57.7 percent of the lakes and ponds met water quality standards and 11.7 percent were impaired while 30.6 percent of the resource remains unassessed. With the statewide fish consumption advisory included in the assessment, 41.0 percent of the lakes and ponds met water quality standards and 28.3 percent were impaired while 30.6 percent of the resource remains unassessed.

There are approximately 21,406 acres of impoundments on rivers and streams (1:100,000 scale mapping), all of which have six designated uses. By way of the site specific assessments, 60.2 percent of the acreage and designated use combinations were assessed. Without the statewide freshwater fish consumption advisory due to mercury included in the assessment, 55.1 percent of the impoundments met water quality standards and 5.1 percent were impaired while 39.8 percent of the resource remains unassessed. With the statewide fish consumption advisory included in the assessment, 38.5 percent of the impoundments met water quality standards and 21.8 percent were impaired while 39.8 percent of the resource remains unassessed.

With respect to tidal waters, none of New Hampshire's 70.2 square miles of open ocean waters under the state's jurisdiction, or 17.92 square miles of estuaries are fully supportive of all uses. This is because of a bluefish consumption advisory due to concerns with PCBs in fish tissue which impacts all tidal waters and shellfish consumption advisories in the estuaries due to bacteria in the water column and PCB concentrations found in lobster tomalley (see section D.6.3 and D.6.4).

There are 17.92 square miles of estuarine waters, all of which have seven designated uses. By way of the site specific assessments, 78.7 percent of the square mileage and designated use combinations were assessed. With or without the statewide freshwater fish consumption

advisory due to mercury included in the assessment, 25.8 percent of estuarine waters met water quality standards and 52.9 percent were impaired while 21.3 percent of the resource remains unassessed. By way of the combined probabilistic and site specific assessments, 81.5 percent of the square mileage and designated use combinations were assessed. With or without the statewide freshwater fish consumption advisory due to mercury included in the assessment, 51.2 percent of estuarine waters met water quality standards and 29.3 percent were impaired while 18.5 percent of the resource remains unassessed.

There are 70.2 square miles of ocean waters, all of which have seven designated uses. By way of the site specific assessments, 84.6 percent of the square mileage and designated use combinations were assessed. With or without the statewide freshwater fish consumption advisory due to mercury included in the assessment, 54.7 percent of ocean waters met water quality standards and 29.8 percent were impaired while 15.4 percent of the resource remains unassessed.

Details regarding the parameters causing impairment as well as the probable sources of impairment are provided in sections D.3.4 through D.3.8.

Table 10: Overall Use Support (including mercury)

Waterbody Type and Assessment Type	CATEGORY						Fully Meets WQS	Insufficient Information or No Data	Impaired	Total Assessed
	2	3	4a	4b	4c	5				
Estuary (SSA) Percent of Assessment Units and Designated Uses	25.8%	21.3%	0.2%	0.0%	0.0%	52.6%	25.8%	21.3%	52.9%	78.7%
Estuary (PA + SSA) Percent of Assessment Units and Designated Uses	-	-	-	-	-	-	51.2%	18.5%	29.3%	81.5%
Ocean (SSA) Percent of Assessment Units and Designated Uses	54.7%	15.4%	0.0%	0.3%	0.0%	29.6%	54.7%	15.4%	29.8%	84.6%
Lake (SSA) Percent of Assessment Units and Designated Uses	41.0%	30.6%	24.2%	0.0%	0.3%	3.9%	41.0%	30.6%	28.3%	69.4%
Impoundment (SSA) Percent of Assessment Units and Designated Uses	38.5%	39.8%	17.0%	0.2%	0.3%	4.2%	38.5%	39.8%	21.8%	60.2%
Rivers (SSA) Percent of Assessment Units and Designated Uses	21.1%	56.2%	16.7%	0.1%	0.1%	5.8%	21.1%	56.2%	22.7%	43.8%
Rivers (PA + SSA) Percent of Assessment Units and Designated Uses	-	-	-	-	-	-	67.3%	30.3%	2.4%	69.7%

* Notes:

Category 1: All designated uses are attained and no use is threatened.
Category 2: Attaining some designated uses, no uses are threatened and there is insufficient information to assess remaining uses.
Category 3: Insufficient or no data and information is available to determine if a designated use is attained (i.e., more monitoring is needed to assess a use).
Category 4a: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because a TMDL has been completed.
Category 4b: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future.
Category 4c: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because the impairment is not caused by a pollutant(s), and
Category 5: Impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL (this is the 303(d) List).

SSA = Site Specific Assessment
PA = Probabilistic Assessment

Table 11: Overall Use Support (excluding mercury)

Waterbody Type and Assessment Type	CATEGORY						Fully Meets WQS	Insufficient Information or No Data	Impaired	Total Assessed
	2	3	4a	4b	4c	5				
Estuary (SSA) Percent of Assessment Units and Designated Uses	25.8%	21.3%	0.2%	0.0%	0.0%	52.6%	25.8%	21.3%	52.9%	78.7%
Estuary (PA + SSA) Percent of Assessment Units and Designated Uses	-	-	-	-	-	-	51.2%	18.5%	29.3%	81.5%
Ocean (SSA) Percent of Assessment Units and Designated Uses	54.7%	15.4%	0.0%	0.3%	0.0%	29.6%	54.7%	15.4%	29.8%	84.6%
Lake (SSA) Percent of Assessment Units and Designated Uses	57.7%	30.6%	7.5%	0.0%	0.3%	3.9%	57.7%	30.6%	11.7%	69.4%
Impoundment (SSA) Percent of Assessment Units and Designated Uses	55.1%	39.8%	0.4%	0.2%	0.3%	4.2%	55.1%	39.8%	5.1%	60.2%
Rivers (SSA) Percent of Assessment Units and Designated Uses	37.7%	56.2%	0.0%	0.1%	0.1%	5.8%	37.7%	56.2%	6.0%	43.8%
Rivers (PA + SSA) Percent of Assessment Units and Designated Uses	-	-	-	-	-	-	67.3%	30.3%	2.4%	69.7%

*Notes:

Category 1: All designated uses are attained and no use is threatened.
Category 2: Attaining some designated uses, no uses are threatened and there is insufficient information to assess remaining uses.
Category 3: Insufficient or no data and information is available to determine if a designated use is attained (i.e., more monitoring is needed to assess a use).
Category 4a: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because a TMDL has been completed.
Category 4b: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future.
Category 4c: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because the impairment is not caused by a pollutant(s), and
Category 5: Impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL (this is the 303(d) List).

SSA = Site Specific Assessment
PA = Probabilistic Assessment

D.3.3 SECTION 303(D) LIST OF THREATENED AND IMPAIRED WATERS

As previously mentioned, Section 303(d) of the CWA requires submittal of a list of surface waters (i.e., the "303(d) List") that are:

- impaired or threatened by a pollutant or pollutant(s),
- not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices for nonpoint sources and,
- require development and implementation of a comprehensive water quality study (i.e., called a Total Maximum Daily Load or TMDL study) that is designed to meet water quality standards.

It is important to note that the Section 303(d) List only includes waters that are impaired or threatened by pollutants that require Total Maximum Daily Load studies (TMDLs). Consequently, the 303(d) List represents a subset of all impaired waters as not all impairments require a TMDL. In the EPA Assessment Database, Category 5 is used to represent the 303(d) List.

The Consolidated Assessment and Listing Methodology (DES, 2008a) provided in Appendix 4 describes the process used to develop the Section 303(d) List and how TMDL schedules are established for waterbodies on the list. A description of the public participation process used to develop the 2008 Section 303(d) List is included in section F.3.

A copy of the 2008 Section 303(d) List is provided in Appendix 8 and on the DES website (http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm). A map of the 303(d) surface waters (excluding the mercury advisory) is provided in Appendix 9.

The List is sorted by waterbody type and then Assessment Unit ID number or AUID (each waterbody has a unique AUID). Each record includes the use support status for each designated use in that assessment unit, the cause and source of impairment (if applicable) and the estimated date that the TMDL will be completed.

Finally, Appendix 10 includes a list of waters removed from the 2008 303(d) list and the reasons why they were removed.

D.3.4 ESTUARIES

D.3.4.1 Estuaries: Individual Designated Use Support

The following table and figures provide a summary of the use support status for all designated uses in estuarine waters. Results are presented with and without the statewide mercury fish consumption advisory to reveal the status masked by the mercury advisory. Definitions of terms used in the tables (i.e., fully supporting, not supporting, threatened, fully supporting – marginal condition, etc.) may be found in the Consolidated Assessment and Listing Methodology (DES, 2008a) a copy of which is provided in Appendix 4.

The percent assessed for each use with and without mercury is shown in Table 12 and Figure 16. Individual use support information is shown in Table 12 and Figure 17. The table and figures present the individual use assessments with the statewide mercury fish consumption advisory in effect (see section (D.6)) as well as assuming that the advisory did not exist. Additionally the table and figures present DES's more refined definitions of use support which give an idea of the degree of water quality standard attainment or impairment (Fully Supporting-Good, Fully Supporting – Marginal, Not Supporting – Marginal and Not Supporting -Poor).

Table 12: Estuaries: Individual Designated Use Support

Designated Use	Total	Total Assessed	Fully Supporting (FS) = Attaining Water Quality Standards			Not Supporting (NS) = Not Attaining Water Quality Standards = Impaired			Threatened	Insufficient Data and Information
			FS - Good	FS - Marginal	FS - Total	NS - Marginal	NS - Poor	NS - Total		
Aquatic Life										
Square Miles	17.8	14.8	0.0	0.7	0.7	1.0	13.1	14.0	6.7	3.1
% of Total	100.0%	82.8%	0.0%	4.0%	4.0%	5.3%	73.4%	78.7%	37.4%	17.2%
% of Assessed		100.0%	0.0%	4.9%	4.9%	6.5%	88.7%	95.1%	45.2%	
Fish Consumption (excluding mercury advisory)										
Square Miles	17.8	17.8	0.0	0.0	0.0	17.8	0.0	17.8	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	
Fish Consumption (including mercury advisory)										
Square Miles	11.6	17.8	0.0	0.0	0.0	17.8	0.0	17.8	0.0	0.0
% of Total	100.0%	154.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	
Shellfishing										
Square Miles	17.8	17.8	0.0	0.0	0.0	17.1	0.7	17.8	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	96.0%	4.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	96.0%	4.0%	100.0%	0.0%	
Primary Contact Recreation										
Square Miles	17.8	15.1	3.2	0.3	3.4	0.1	11.5	11.7	0.0	2.7
% of Total	100.0%	84.8%	17.9%	1.4%	19.3%	0.8%	64.7%	65.5%	0.0%	15.2%
% of Assessed		100.0%	21.1%	1.7%	22.7%	0.9%	76.3%	77.3%	0.0%	
Secondary Contact Recreation										
Square Miles	17.8	14.8	10.2	0.0	10.2	1.9	2.7	4.6	0.0	3.0
% of Total	100.0%	83.0%	57.1%	0.0%	57.1%	10.7%	15.2%	25.9%	0.0%	17.0%
% of Assessed		100.0%	68.8%	0.0%	68.8%	12.9%	18.3%	31.2%	0.0%	
Drinking Water (after Treatment)										
Square Miles	17.8	17.8	17.8	0.0	17.8	0.0	0.0	0.0	0.0	0.0
% of Total	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of Assessed		100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	
Wildlife (Not Assessed)										
Square Miles	17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.8
% of Total	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
% of Assessed										

Figure 16: Estuaries: Percent Assessed by Use

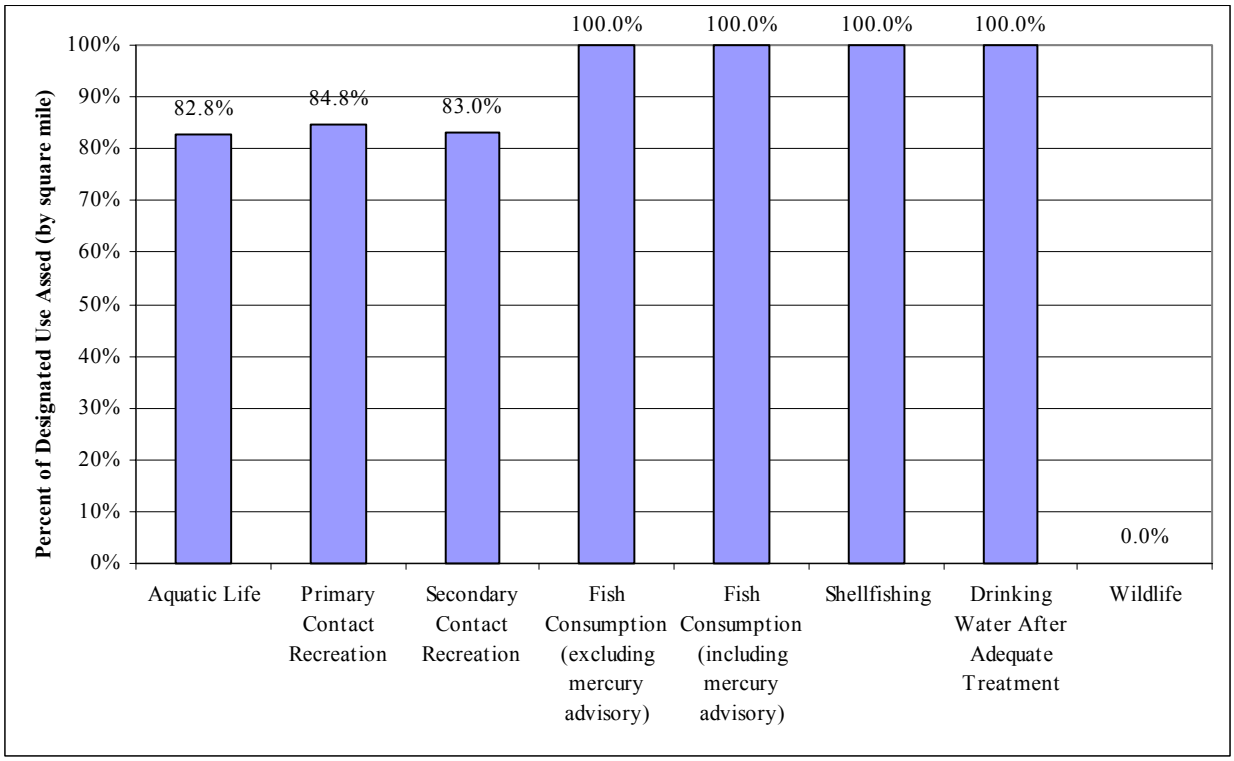
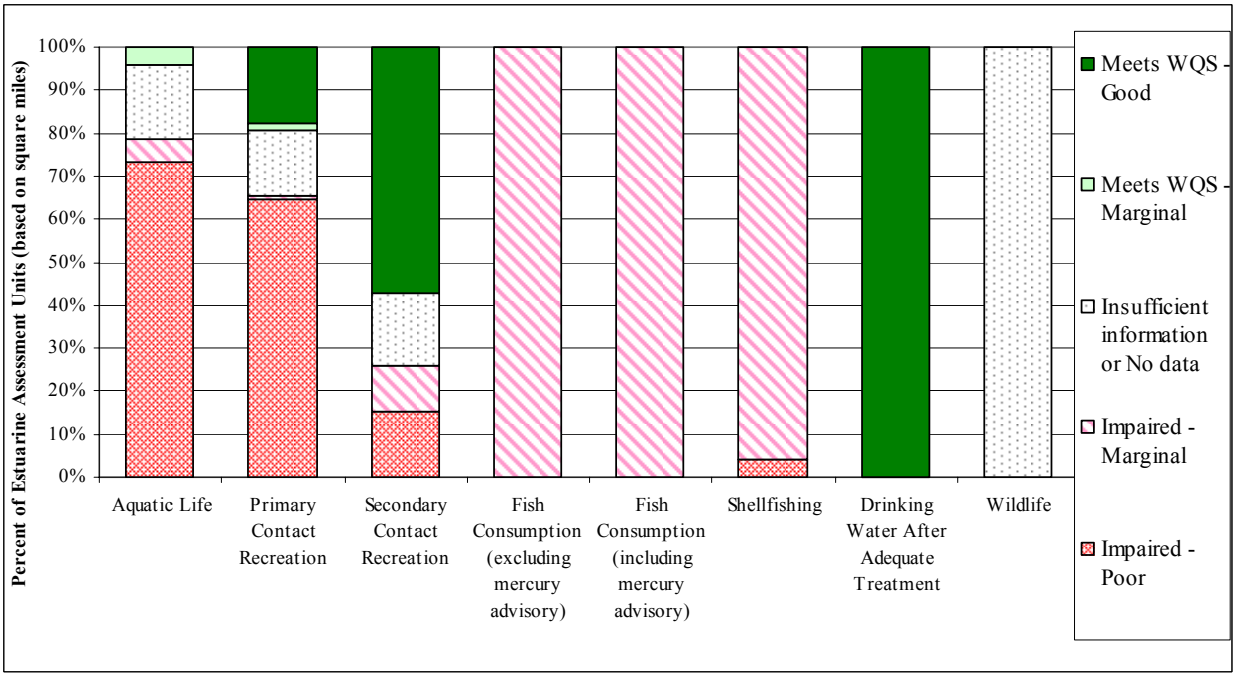


Figure 17: Estuaries: Individual Designated Use Support of Assessed Waters



D.3.4.2 Estuaries: Causes and Sources of Impairment

Table 13 shows the total square miles of estuaries impaired or threatened by various pollutants and nonpollutants (i.e. causes of impairment).

Table 13: Estuaries: Causes of Threatened or Impairment Status

Rank	Impairment	Total Size (Square Miles)	Number of AUs
1	Dioxin (including 2,3,7,8-TCDD)	17.842	64
2	Mercury	17.842	64
3	Polychlorinated biphenyls	17.842	64
4	Estuarine Bioassessments	13.368	27
5	Enterococcus	11.690	23
6	Fecal Coliform	9.316	35
7	pH	7.722	10
8	Oxygen, Dissolved	7.334	8
9	Chlorophyll-a	1.359	4
10	Nitrogen (Total)	1.359	4
11	Dissolved oxygen saturation	0.889	3
12	2-Methylnaphthalene	0.400	2
13	Anthracene	0.400	2
14	Benzo(a)pyrene (PAHs)	0.400	2
15	Benzo[a]anthracene	0.400	2
16	Chrysene (C1-C4)	0.400	2
17	DDD	0.400	2
18	DDE	0.400	2
19	DDT	0.400	2
20	Dibenz[a,h]anthracene	0.400	2
21	Fluoranthene	0.400	2
22	Fluorene	0.400	2
23	Naphthalene	0.400	2
24	Pyrene	0.400	2
25	Acenaphthene	0.240	1
26	Acenaphthylene	0.240	1
27	Benzo[g,h,i]perylene	0.240	1
28	Biphenyl	0.240	1
29	Dieldrin	0.240	1
30	Indeno[1,2,3-cd]pyrene	0.240	1
31	Phenanthrene	0.240	1

Table 14 shows the total square miles of estuaries impaired or threatened by various sources of impairment.

Table 14: Estuaries: Sources of Threatened or Impairment Status

Rank	Source of Impairment	Total Size (Square Miles)	Number of AUs
1	Atmospheric Deposition - Toxics	17.842	64

Rank	Source of Impairment	Total Size (Square Miles)	Number of AUs
2	Source Unknown	17.842	64
3	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	2.478	22
4	Combined Sewer Overflows	1.735	3
5	Animal Feeding Operations (NPS)	0.470	1
6	Sanitary Sewer Overflows (Collection System Failures)	0.393	4
7	Illicit Connections/Hook-ups to Storm Sewers	0.363	2
8	Petroleum/natural Gas Activities	0.160	1
9	Unpermitted Discharge (Domestic Wastes)	0.123	1
10	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)	0.110	1

Algae / Nutrients (Macronutrients/Growth Factors) – Four estuarine assessment units were listed as impaired due to chlorophyll-a and total nitrogen covering 1.359 square miles. The four assessment units were the tidal portions of the Salmon Falls River, Squamscott River, Oyster River, and Lamprey River. Chlorophyll-a is a primary symptom of excessive nitrogen in estuarine waters, therefore, total nitrogen was added as an impairment where estuarine waters are impaired for chlorophyll-a. No specific source of the impairments has been identified.

Biological Integrity – Initiated by comments received on the February 23, 2008 Draft 303(d), the New Hampshire Department of Environmental Services (DES) developed an assessment methodology for determining compliance with water quality standards for biological integrity (Env-Wq 1703.19) using eelgrass (*Zostera marina*) cover in the Great Bay Estuary as an indicator (see Appendix 5: Methodology and Assessment Results related to Eelgrass and Nitrogen in the Great Bay Estuary). DES reviewed eelgrass cover data from 1948 to 2005. Eight regions of the estuary were found to have significant eelgrass loss based upon the degree of historic loss or recent declining trends accounting for natural variability and were listed as impaired on the 303(d) . Those eight regions cover 6.79 square miles (20 AUIDs). One region, Great Bay, was found to be threatened for significant eelgrass loss and was listed as insufficient information but threatened on the 303(d). That region covers 6.58 square miles (7 AUIDs). Eelgrass based assessments are labeled as "Estuarine Bioassessments". No specific source of the impairments has been identified.

Low Dissolved Oxygen – Eight estuarine assessment units were listed as impaired due to low dissolved oxygen covering 7.3343 square miles. The impairments primarily occur in the tidal tributaries to the Great Bay: Squamscott River, Lamprey River, Oyster River, and the Salmon Falls River. However, the Great Bay itself is also listed as impaired (3 assessment units). The dissolved oxygen measurements for these assessments were made with in-situ datasondes that record dissolved oxygen every 30 minutes from April through December. The source of these impairments is unknown. One more impairment was documented in South Mill Pond through monthly point measurements.

Metals – Sixty-four estuarine assessment units were listed as impaired due to metals covering 17.8418 square miles. All of the impairments were due to a state-wide fish consumption

advisory for mercury. Every estuarine assessment unit was listed as impaired for fish consumption and shellfish consumption designated uses due to this advisory.

Pathogens (Bacteria) – Forty-seven estuarine assessment units were listed as impaired due to pathogens covering 13.9343 square miles.

Enterococcus concentrations violated the water quality standards for the primary contact recreation designated use in 23 assessment units covering 11.6898 square miles. The violations were observed in Hampton-Seabrook Harbor, Little Harbor, Sagamore Creek, Witch Creek, Berrys Brook, North Mill Pond, South Mill Pond, the Piscataqua River, Great Bay, Little Bay, and most of the tidal tributaries to Great Bay. In 12 of these units (covering 4.614 square miles), the enterococcus concentrations exceeded the criteria for secondary contact recreation as well.

The shellfishing designated use was not supported because of fecal coliform concentrations in 35 assessment units covering 9.3162 square miles. The source of pathogens to these assessment units was mostly unknown; however, the following specific sources have been identified: Wet weather discharges (Point Source and Combination of Stormwater, SSO or CSO) and sanitary sewer overflows (collection system failure).

DES has completed bacteria TMDLs for Hampton-Seabrook Harbor and Little Harbor which cover many of these assessment units

Pesticides – Two estuarine assessment units were listed as impaired due to pesticides covering 0.4 square miles. The assessment units covered the tidal portions of the Lamprey and Cocheco Rivers and the impairments are based on sediment contamination. The source of the pesticides was unknown.

pH – Ten estuarine assessment units were listed as impaired due to caustic conditions covering 7.7217 square miles. The assessment units with impairments were the Squamscott River, Lamprey River, Salmon Falls River, Great Bay (five assessment units), South Mill Pond, and North Mill Pond. The source of the low pH conditions was unknown but is likely related to high river flow periods.

Toxic Organics – Sixty-four estuarine assessment units were listed as impaired due to toxic organic compounds covering 17.8418 square miles. However, almost all of the impairments were due to a state-wide marine fish consumption advisory for polychlorinated biphenyls and dioxin. Every estuarine assessment unit was listed as impaired for fish consumption and shellfish consumption designated uses due to this advisory. Only two assessment units were listed as impaired for a reason besides the fish consumption advisory: the tidal portions of the Lamprey River and the Cocheco River (covering a total of 0.4 square miles). The impairments in these rivers were due to sediment contamination coincident with degraded benthic communities.

D.3.5 IMPOUNDMENTS

D.3.5.1 Impoundments: Individual Designated Use Support

The following tables and figures provide a summary of the use support status for all designated uses in impoundments. Results are presented with and without the statewide

mercury fish consumption advisory to reveal the status masked by the mercury advisory. Definitions of terms used in the tables (i.e., fully supporting, not supporting, threatened, fully supporting – marginal condition, etc.) may be found in the Consolidated Assessment and Listing Methodology (DES, 2008a) a copy of which is provided in Appendix 4.

The percent assessed for each use with and without mercury is shown in Table 15 and Figure 18. Individual use support information is shown in Table 15 and Figure 19. The table and figures present the individual use assessments with the statewide mercury fish consumption advisory is in effect (see section (D.6)) as well as assuming that the advisory did not exist. Additionally the table and figures present DES's more refined definitions of use support which give an idea of the degree of water quality standard attainment or impairment (Fully Supporting-Good, Fully Supporting – Marginal, Not Supporting – Marginal and Not Supporting -Poor).

Table 15: Impoundments: Individual Designated Use Support

Designated Use	Total	Total Assessed	Fully Supporting (FS) = Attaining Water Quality Standards			Not Supporting (NS) = Not Attaining Water Quality Standards = Impaired			Threatened	Insufficient Data and Information
			FS - Good	FS - Marginal	FS - Total	NS - Marginal	NS - Poor	NS - Total		
Aquatic Life										
Acres	21,395.4	10,909.2	3,820.0	2,835.0	6,655.0	2,810.3	1,444.0	4,254.2	52.1	10,486.2
% of Total	100.0%	51.0%	17.9%	13.3%	31.1%	13.1%	6.7%	19.9%	0.2%	49.0%
% of Assessed		100.0%	35.0%	26.0%	61.0%	25.8%	13.2%	39.0%	0.5%	
Fish Consumption (excluding mercury advisory)										
Acres	21,395.4	21,395.4	0.0	21,011.3	21,011.3	384.1	0.0	384.1	0.0	0.0
% of Total	100.0%	100.0%	0.0%	98.2%	98.2%	1.8%	0.0%	1.8%	0.0%	0.0%
% of Assessed		100.0%	0.0%	98.2%	98.2%	1.8%	0.0%	1.8%	0.0%	
Fish Consumption (including mercury advisory)										
Acres	21,395.4	21,395.4	0.0	0.0	0.0	21,395.4	0.0	21,395.4	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	
Shellfishing (Not Applicable)										
Acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% of Total										
% of Assessed										
Primary Contact Recreation										
Acres	21,395.4	12,107.0	5,429.1	4,934.5	10,363.6	1,134.7	608.7	1,743.4	43.1	9,288.4
% of Total	100.0%	56.6%	25.4%	23.1%	48.4%	5.3%	2.8%	8.1%	0.2%	43.4%
% of Assessed		100.0%	44.8%	40.8%	85.6%	9.4%	5.0%	14.4%	0.4%	
Secondary Contact Recreation										
Acres	21,395.4	11,490.6	6,999.7	3,948.4	10,948.1	41.5	501.0	542.5	0.0	9,904.8
% of Total	100.0%	53.7%	32.7%	18.5%	51.2%	0.2%	2.3%	2.5%	0.0%	46.3%
% of Assessed		100.0%	60.9%	34.4%	95.3%	0.4%	4.4%	4.7%	0.0%	
Drinking Water (after Treatment)										
Acres	21,395.4	21,395.4	21,395.4	0.0	21,395.4	0.0	0.0	0.0	0.0	0.0
% of Total	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of Assessed		100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	
Wildlife (Not Assessed)										
Acres	21,395.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21,395.4
% of Total	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
% of Assessed										

Figure 18: Impoundments: Percent Assessed by Use

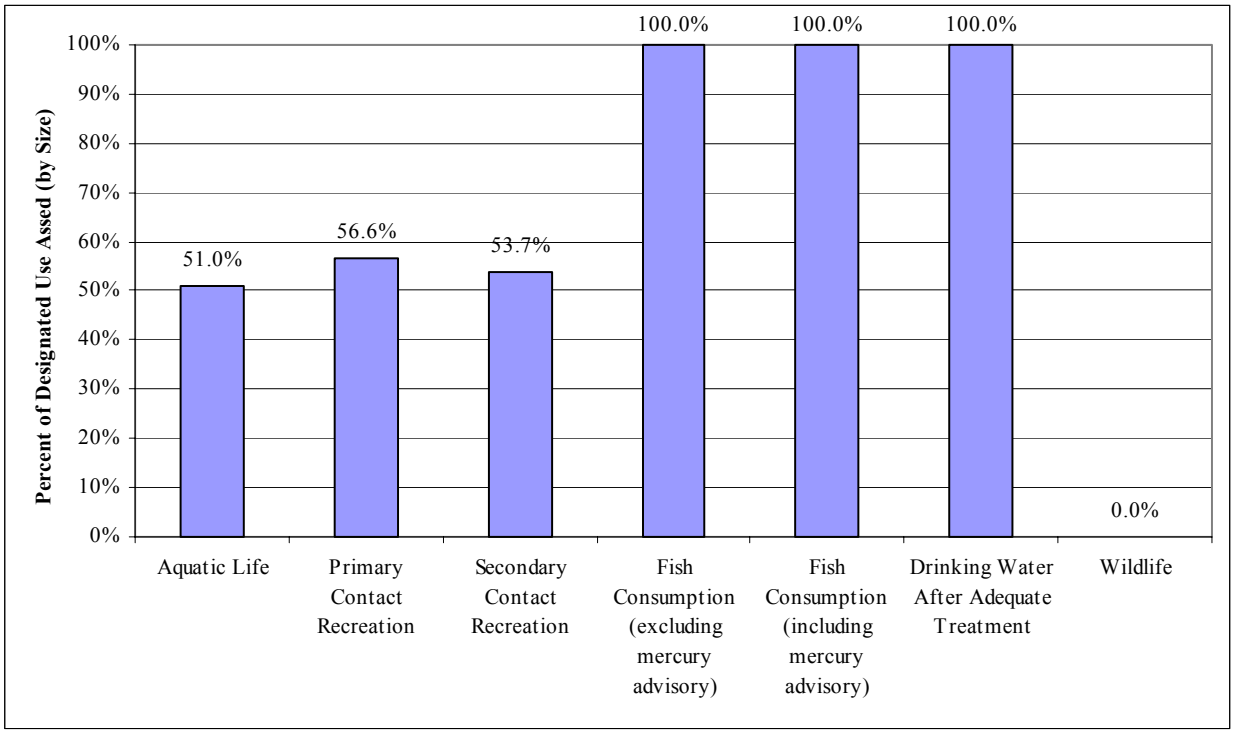
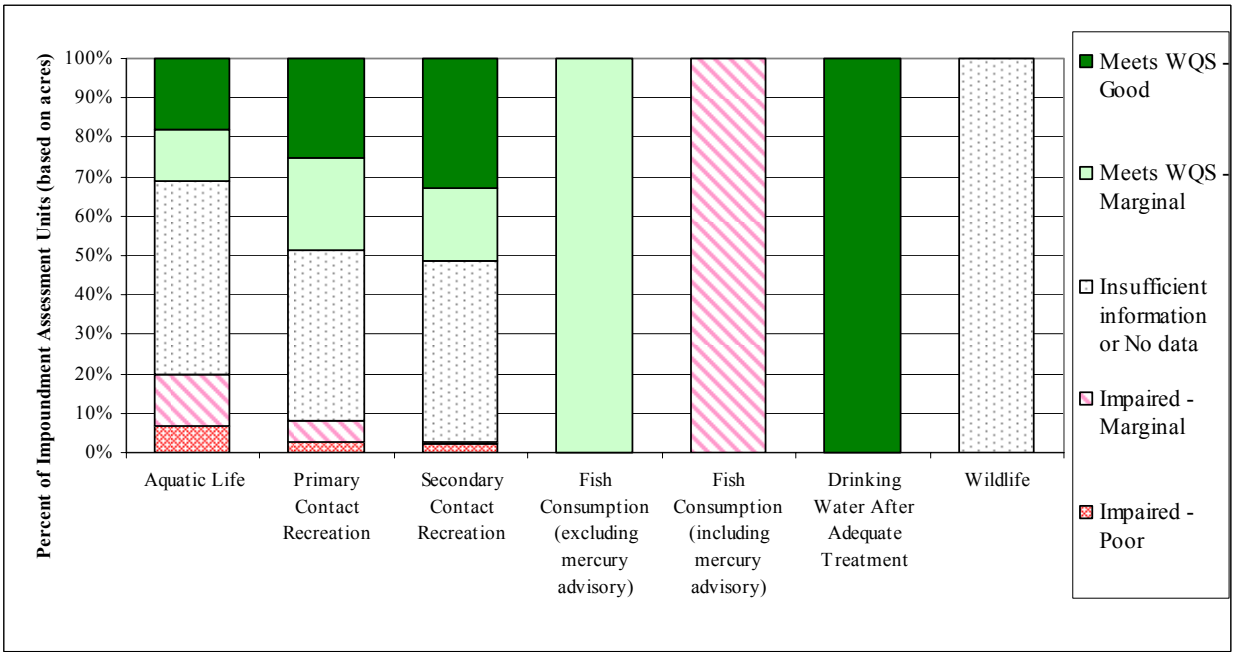


Figure 19: Impoundments: Individual Designated Use Support of Assessed Waters



D.3.5.2 Impoundments: Causes and Sources of Impairment

Table 16 shows the total acres of impoundments impaired or threatened by various pollutants and nonpollutants (i.e. causes of impairment).

Table 16: Impoundments: Causes of Threatened or Impairment Status

Rank	Impairment	Total Size (Acres)	Number of AUs
1	Mercury	21395.4	812
2	pH	3629.8	39
3	Escherichia coli	1426.5	39
4	Non-Native Aquatic Plants	1191.3	14
5	Dissolved oxygen saturation	757.7	13
6	Dioxin (including 2,3,7,8-TCDD)	384.1	8
7	Oxygen, Dissolved	331.2	20
8	Chlorophyll-a	239.1	8
9	Cyanobacteria hepatotoxic microcystins	213.8	1
10	Chloride	60.0	1
11	Phosphorus (Total)	43.1	3
12	2-Methylnaphthalene	10.0	1
13	Acenaphthene	10.0	1
14	Benzo(a)pyrene (PAHs)	10.0	1
15	Benzo[a]anthracene	10.0	1
16	Benzo[b]fluoranthene	10.0	1
17	Benzo[k]fluoranthene	10.0	1
18	Chrysene (C1-C4)	10.0	1
19	DDD	10.0	1
20	DDE	10.0	1
21	Dieldrin	10.0	1
22	Endrin	10.0	1
23	Heptachlor	10.0	1
24	Indeno[1,2,3-cd]pyrene	10.0	1
25	Lindane	10.0	1
26	Pyrene	10.0	1
27	Other flow regime alterations	5.0	1
28	Sedimentation/Siltation	3.5	1

Table 17 shows the total acres of impoundments impaired or threatened by various sources of impairment.

Table 17: Impoundments: Sources of Threatened or Impairment Status

Rank	Source of Impairment	Total Size (Acres)	Number of AUs
1	Atmospheric Deposition - Toxics	21395.4	812
2	Source Unknown	4854.5	64
3	Municipal Point Source Discharges	609.1	7
4	Combined Sewer Overflows	562.0	6

5	Impacts from Hydrostructure Flow Regulation/modification	500.0	1
6	Industrial Point Source Discharge	393.1	10
7	Illicit Connections/Hook-ups to Storm Sewers	239.1	9
8	Highway/Road/Bridge Runoff (Non-construction Related)	63.5	2
9	Commercial Districts (Shopping/Office Complexes)	60.0	1
10	Municipal (Urbanized High Density Area)	60.0	1
11	Atmospheric Deposition - Acidity	55.0	1
12	Freshettes or Major Flooding	5.0	1
13	Pollutants from Public Bathing Areas	4.1	3
14	Highways, Roads, Bridges, Infrastructure (New Construction)	3.5	1

Algae – Seven impoundment assessment units (AUs) are listed as threatened or impaired due to algae covering 453 acres. Three impoundments covering 43 acres are located in Peterborough. In one of the three impoundments, algae exceedances were measured as well as predicted by a calibrated model prepared by DES for the upper Contoocook River. Exceedances in the other two impoundments are based solely on the calibrated model and are therefore considered threatened.

The Contoocook River listings for algae are primarily associated with Municipal Point Source Discharges. The Mine Falls Dam impoundment on the Nashua River (60 acres) is listed due to Municipal (Urbanized High Density Area). The probable source has not been identified for the additional algae impairments documented in the South Berwick Impoundment on the Salmon Falls River in Rollinsford, the Exeter River Dam in Exeter, and the Oyster River dam in Durham.

Metals – With the statewide fish consumption advisory, metals are the leading cause of impairment in impoundments. In the absence of the fish consumption advisory, there are no documented metals exceedances in impoundments.

Nutrients (Macronutrients/Growth Factors) – Total Phosphorus is the nutrient of concern under this heading. Phosphorus itself is not toxic, however excess phosphorus can lead to excessive algal growth thereby affecting primary contact recreation. Evening algae respiration and fall die off leads to diminished dissolved oxygen which can also affect aquatic life use support. Consequently, excessive nutrients are linked to algae and sometimes dissolved oxygen violations. There are three impoundments listed as impaired due to nutrients because of algae violations and also because of dissolved oxygen violations. As previously discussed in the section on algae all three impoundments are in Peterborough. The Contoocook River listings are principally associated with Municipal Point Source Discharges although there are likely unknown sources as well.

Low Dissolved Oxygen – Twenty-two impoundment assessment units are listed as impaired due to low dissolved oxygen in 891 acres of impounded area. Some of the AUs are impaired based on the dissolved oxygen saturation criteria, some based on the dissolved oxygen concentration, and some based on both criteria.

The source of the impairment for the majority of the waters that are listed as impaired due to low dissolved oxygen is unknown (282 acres, 15 AUs). Additional investigations are necessary on these waterbodies to identify the sources, some of which may be natural. Twenty percent of the dissolved oxygen impairments where the source is unknown are considered "marginal" impairments. "Marginal" impairment for dissolved oxygen means there were measured dissolved oxygen values below the water quality criteria but all such measurements were within the margin of measurement accuracy. With regards to the minimum dissolved oxygen criteria of 5 mg/L, impairments were considered marginal if measured values were less than 5 mg/L but greater than or equal to 4.5 mg/L. The remaining 80 percent of dissolved oxygen impairments with unknown sources had one or more samples outside the measurement accuracy (i.e., one or more samples less than 4.5 mg/L).

The Rollinsford Dam on the Salmon Falls River (57 acres) is listed due to exceedances of the dissolved oxygen concentration. A TMDL was completed and approved for this segment in 1999. Additional sampling is required before theses waters can be delisted.

Three impoundments covering 43 acres in Peterborough were listed for dissolved oxygen concentration and dissolved oxygen saturation based on a DES calibrated water quality model for the upper portion of the Contoocook River . The Contoocook River listings are principally associated with Municipal Point Source Discharges although Unknown Sources likely contribute as well.

Two impoundments of the Sugar River, one in Newport and one in Claremont are listed based upon a calibrated water quality model. The probable sources of these impairments are Industrial Point Source Discharge and Municipal Point Source Discharges.

Pathogens (Bacteria) –Bacteria (*E. coli*) is used to assess both primary and secondary contact recreation. Primary contact recreation includes activities like swimming where there is a high likelihood in water ingestion. Secondary contact recreation entails activities like boating where there is typically only accidental or incidental water ingestion. Thirty-five impoundment assessment units are listed due to bacteria covering 1291 acres. In impoundments, pathogens are the third largest group (by acreage) of impairments when the statewide fish consumption advisory due to atmospheric deposition of mercury is not included.

As discussed in section C.2.2.2 while eight CSOs have been removed since 2000, there are 38 remaining active CSOs in the state. These CSOs directly impact six impoundment AUs covering 562 acres of impoundments along the;

- Androscoggin River in Berlin,
- Nashua River in Nashua,
- Merrimack River in Manchester, and the
- Mascoma River Lebanon.

Efforts to control CSOs are well underway in each community. In general, all CSO communities are either implementing a plan to eliminate remaining CSOs or have undertaken studies for their eventual abatement.

Illicit discharges directly impact nine AUs covering 239 acres of impoundments. Many of listed AUs are on the Androscoggin in Berlin. In 1991 Berlin began investigating and

disconnecting cross connections. This work was completed in 1999 but confirmation sampling has not been conducted. Additional illicit discharges are still active on the,

- Winnipesaukee River in Franklin,
- Cocheco River in Dover,
- Souhegan River in Greenville, and the
- Salmon Falls River in Somersworth.

In 2007, efforts initiated by the DES Watershed Management Bureau resulted in the elimination of five illicit discharge connections (four in the Coastal and one in the Merrimack River watersheds). The bureau estimates that there are six to eleven illicit discharges remaining in the Coastal Watershed.

Pollutants created at Public Bathing Areas currently impact three beach AUs on impoundments (4.1 acres). In all cases, bather load is the probable source. The affected beaches are Vilas Pool on the Cold River, the Town Beach on Corcoran's Pond, and Moose Brook State Park Beach.

Primary Contact Recreation is impaired by unknown sources in the majority of the bacteria impaired impoundment segments (i.e., 23 AUs , 1114 acres). All of the impairments are considered severe. The severe determination is made when one or more samples is more then two times the water quality criteria. Secondary Contact Recreation is impaired by unknown sources in four AUs (539 acres). All of those impairments are considered severe as defined above.

Pesticides – One impoundment assessment unit (10 acres) is listed as impaired due to pesticides. The Fisk Mill Hydro impoundment on the Ashuelot River is impaired for, DDD, DDE, Dieldrin, Endrin, Heptachlor, and Lindane which were detected at levels above the threshold effect concentration and probable effect concentrations in sediment samples.

pH – Thirty-nine impoundment assessment units are listed as impaired due to low pH covering 3629.8 acres. In the absence of the statewide fish consumption advisory due to atmospheric deposition of mercury, low pH is the second largest group of impairments by acreage.

Four AUs have approved pH TMDLs (i.e., acid pond TMDLs). The listed source for the remaining 3208.84 acres (35 AUs) of pH impaired impoundments is "Source Unknown". This is because pH in impoundments is a function of many factors such as surficial geology and habitat, underlying geology, acidified precipitation, and system productivity (a seasonal component) and it is not currently known which are the primary contributors to low pH.

Toxic Organics – Nine impoundment assessment units are listed as impaired due to toxic organics covering 394.1 acres of impoundments. Dioxin (including 2,3,7,8-TCDD) had been released from Industrial Point Source Discharges (paper mills) until 1994 when the mill changed its bleaching process. The downstream eight impoundment AUs (384 acres) of the Androscoggin River in Berlin Gorham, and Shelburne are still under a fish consumption advisory for dioxin due primarily to historic discharges. It is expected that fish tissue concentrations will

eventually to decline to levels that will allow the dioxin fish consumption advisory to eventually be rescinded.

One impoundment assessment unit (10 acres) is listed as impaired due to pesticides. The Fisk Mill Hydro impoundment on the Ashuelot River is impaired for, 2-Methylnaphthalene, Acenaphthene, Benzo(a)pyrene (PAHs), Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Chrysene (C1-C4), Indeno[1,2,3-CD]pyrene, and Pyrene detected at levels above the threshold effect concentrations in sediment samples.

Other Impairments – Sixteen impoundment assessment units are listed as impaired due to other pollutants not yet discussed above and affect 1199.8 acres.

Chloride has been documented to exceed water quality criteria in one impoundment AU affecting 60 acres for aquatic life use. The largest source of chlorides is presumed to be deicing activities on state roads, municipal roads, private roads and commercial parking lots.

Non-Native Aquatic Plants are present in 14 impoundment AUs (1191.3 acres). The infestation is considered severe in seven of the affected AUs (537.8 acres) and marginal in the remaining 7 AUs (635.5 acres). The Exotic Species Control Program (section C.2.7) initiated in 1981, has five focus areas: 1) Prevention of new infestations, 2) Monitoring for early detection of new infestations to facilitate rapid control activities, 3) Control of new and established infestations, 4) Research towards new control methods with the goal of reducing or eliminating infested areas, and 5) Regional cooperation.

Other Flow Regime Alterations is the cause of impairment in an impoundment on the Suncook River in Epsom. In floods of 2007, the Suncook river changed it course entirely bypassing the 5 acre impoundment.

Sedimentation/Siltation has resulted in rapid shoaling in the Cain's Brook impoundment in Seabrook. This 3.5 acre impoundment has received 1-2 feet of sediment in the last 4 years. The DES, Watershed Management Bureau is working with the town to implement best management practices before any dredging work begins.

D.3.6 LAKES AND PONDS

D.3.6.1 Lakes and Ponds: Individual Designated Use Support

The following tables and figures provide a summary of the use support status for all designated uses in lakes and ponds. Results are presented with and without the statewide mercury fish consumption advisory to reveal the status masked by the mercury advisory. Definitions of terms used in the tables (i.e., fully supporting, not supporting, threatened, fully supporting – marginal condition, etc.) may be found in the Consolidated Assessment and Listing Methodology (DES, 2006) a copy of which is provided in Appendix 4.

The percent assessed for each use with and without mercury is shown in Table 18 and Figure 20. Individual use support information is shown in Table 18 and Figure 21. The table and figures present the individual use assessments with the statewide mercury fish consumption advisory in effect (see section (D.6)) as well as assuming that the advisory did not exist. Additionally the table and figures present DES's more refined definitions of use support which

give an idea of the degree of water quality standard attainment or impairment (Fully Supporting-Good, Fully Supporting – Marginal, Not Supporting – Marginal and Not Supporting -Poor).

It should be noted that all of the above referenced tables and charts for this section are presented in terms of acreage. Lake sizes in New Hampshire range from roughly one to 45,000 acres. If results were presented in terms of the number of lakes rather than acreage, the summary statistics shown below would be different. Finally, the lake assessments presented below include the assessment of beaches on lakes.

Table 18: Lakes and Ponds: Individual Designated Use Support

Designated Use	Total	Total Assessed	Fully Supporting (FS) = Attaining Water Quality Standards			Not Supporting (NS) = Not Attaining Water Quality Standards = Impaired			Threatened	Insufficient Data and Information
			FS - Good	FS - Marginal	FS - Total	NS - Marginal	NS - Poor	NS - Total		
Aquatic Life										
Acres	164,615.4	101,495.7	0.0	257.8	257.8	95,199.9	6,038.0	101,237.8	0.0	63,199.7
% of Total	100.0%	61.7%	0.0%	0.2%	0.2%	57.8%	3.7%	61.5%	0.0%	38.3%
% of Assessed		100.0%	0.0%	0.3%	0.3%	93.8%	5.9%	99.7%	0.0%	
Fish Consumption (excluding mercury advisory)										
Acres	164,615.4	164,615.4	0.0	164,615.4	164,615.4	0.0	0.0	0.0	0.0	0.0
% of Total	100.0%	100.0%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	
Fish Consumption (including mercury advisory)										
Acres	164,615.4	164,615.4	0.0	0.0	0.0	164,615.4	0.0	164,615.4	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	
Shellfishing (Not Applicable)										
Acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% of Total										
% of Assessed										
Primary Contact Recreation										
Acres	164,615.4	127,945.7	102,703.7	13,161.2	115,864.9	9,990.3	2,090.6	12,080.8	0.0	36,669.7
% of Total	100.0%	77.7%	62.4%	8.0%	70.4%	6.1%	1.3%	7.3%	0.0%	22.3%
% of Assessed		100.0%	80.2%	10.3%	90.6%	7.8%	1.6%	9.4%	0.0%	
Secondary Contact Recreation										
Acres	164,615.4	126,750.5	122,699.7	1,977.7	124,677.4	2,073.1	0.0	2,073.1	0.0	37,864.9
% of Total	100.0%	77.0%	74.5%	1.2%	75.7%	1.3%	0.0%	1.3%	0.0%	23.0%
% of Assessed		100.0%	96.8%	1.6%	98.4%	1.6%	0.0%	1.6%	0.0%	
Drinking Water (after Treatment)										
Acres	164,615.4	164,615.4	164,615.4	0.0	164,615.4	0.0	0.0	0.0	0.0	0.0
% of Total	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of Assessed		100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	
Wildlife (Not Assessed)										
Acres	164,615.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	164,615.4
% of Total	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
% of Assessed										

Figure 20: Lakes and Ponds: Percent Assessed by Use

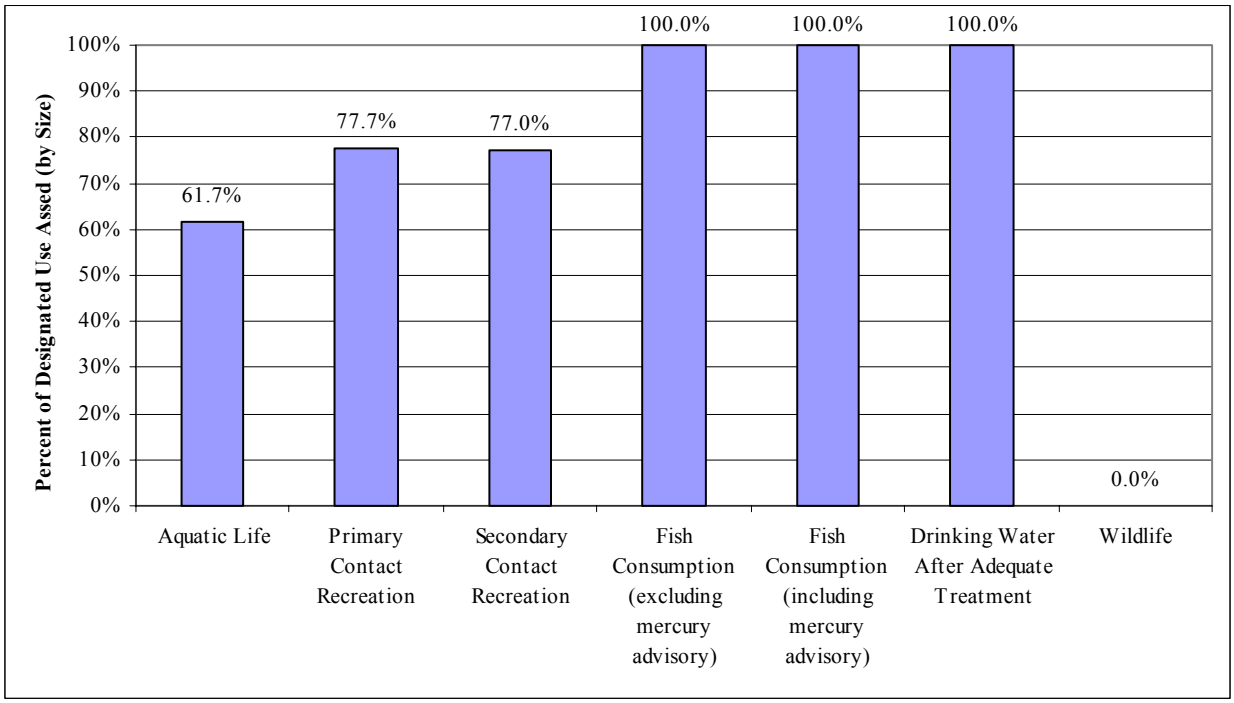
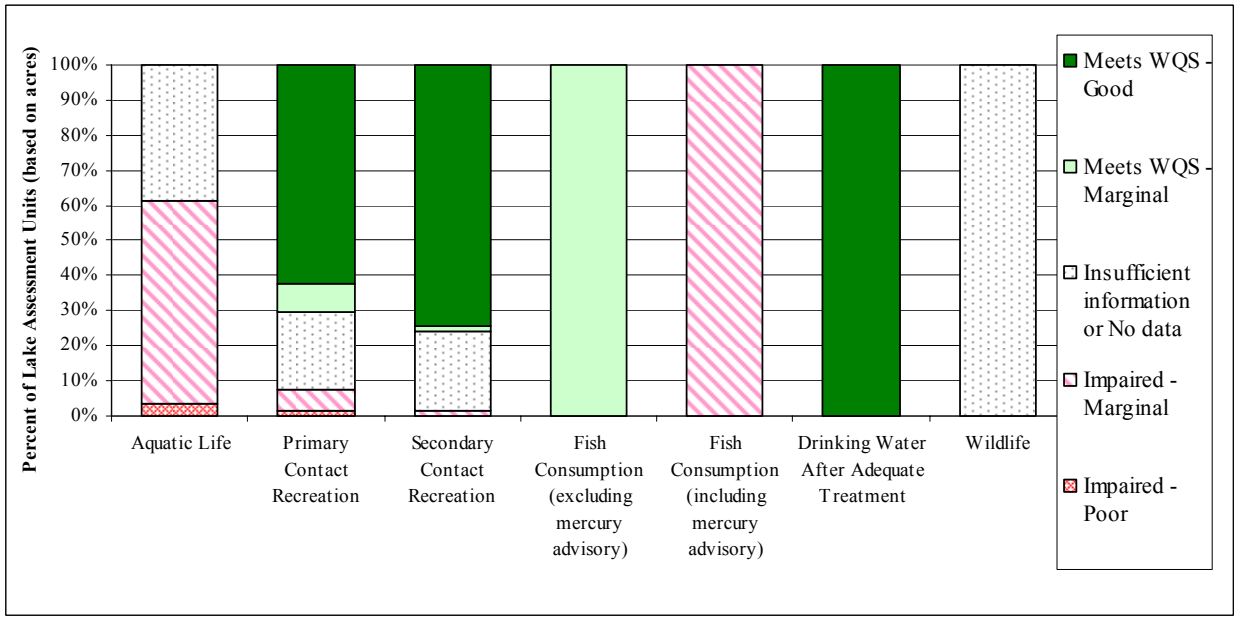


Figure 21: Lakes and Ponds: Individual Designated Use Support of Assessed Waters



D.3.6.2 Lakes and Ponds: Causes and Sources of Impairment

Table 19 shows the total acres of lakes and ponds impaired or threatened by various pollutants and nonpollutants (i.e. causes of impairment).

Table 19: Lakes and Ponds: Causes of Threatened or Impairment Status

Rank	Impairment	Total Size (Acres)	Number of AUs
1	Mercury	164,615.4	1153
2	pH	93,717.1	406
3	Non-Native Aquatic Plants	67,832.7	56
4	Dissolved oxygen saturation	16,290.9	98
5	Cyanobacteria hepatotoxic microcystins	8,454.1	51
6	Oxygen, Dissolved	8,398.6	26
7	Turbidity	4,249.8	2
8	Chlorophyll-a	3,026.7	30
9	Escherichia coli	2,851.7	100
10	Aluminum	647.2	22
11	Sedimentation/Siltation	210.6	2
12	Other flow regime alterations	86.0	1
13	Chloride	49.2	3
14	Excess Algal Growth	1.3	1

Table 20 shows the total acres of lakes and ponds impaired or threatened by various sources of impairment.

Table 20: Lakes and Ponds: Sources of Threatened or Impairment Status

Rank	Source of Impairment	Total Size (Acres)	Number of AUs
1	Atmospheric Deposition - Toxics	164,615.4	1153
2	Atmospheric Deposition - Acidity	89,735.3	371
3	Source Unknown	83,285.8	275
4	Highways, Roads, Bridges, Infrastructure (New Construction)	4,249.8	2
5	Municipal Point Source Discharges	482.9	1
6	Municipal (Urbanized High Density Area)	374.6	9
7	Waterfowl	230.0	7
8	Unpermitted Discharge (Domestic Wastes)	223.3	2
9	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)	222.0	1
10	Streambank Modifications/destabilization	210.0	1
11	Channel Erosion/Incision from Upstream Hydromodifications	210.0	1
12	Package Plant or Other Permitted Small Flows Discharges	142.2	1
13	Impacts from Hydrostructure Flow Regulation/modification	86.0	1
14	Residential Districts	62.2	2
15	Commercial Districts (Shopping/Office Complexes)	49.2	3
16	Highway/Road/Bridge Runoff (Non-construction Related)	49.2	3
17	Flow Alterations from Water Diversions	42.4	1
18	Industrial Point Source Discharge	22.4	2
19	Pollutants from Public Bathing Areas	16.0	17
20	Animal Feeding Operations (NPS)	14.8	1
21	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	6.8	5
22	Yard Maintenance	0.6	1

Six different groups of parameters caused impairments to lakes in 2008. The impairments for each group are summarized below along with the sources of the pollutants. Please keep in mind that a lake can be impaired by more than one parameter within a group and by more than one group. Additionally, an impairment can have multiple sources.

Algae –The primary contact use (i.e. swimming) can be impaired by algae, either too much algae (as measured by chlorophyll a) or by concentrations of algae that causes nuisance surface scums (as measured by cyanobacteria scums, previously called blue-green algae). A total of 53 lakes and 18 beaches were listed as impaired for algae. Twenty lakes were listed due to chlorophyll a alone, 23 were listed due to cyanobacteria alone, and ten lakes contained both algal impairments. All 18 algal-impaired beaches were listed because of cyanobacteria scums. Phosphorus is the limiting nutrient in NH lakes and the cause of increased plant growth. Phosphorus TMDLs are currently underway for 30 of the lakes impaired because of algae. The goal of a TMDL is to reduce phosphorus inputs to a lake to the extent that the algal impairments no longer occur.

Nearly all lakes listed "unknown source" as one of the sources of the phosphorus causing the algal growth. Other sources were listed for a few of the lakes but no other source was listed for more than one lake. Other listed sources ranged from "commercial districts" (Dorrs Pond in Manchester) to "industrial discharge" (fish hatchery waste to York Pond in Berlin) to "waterfowl" (Baboosic Lake in Amherst). The sources of the beach algal impairments were also mostly "unknown".

Metals –Two metals were found to cause lake impairments. The fish consumption designated use is impaired in all lakes and at all the lake beaches because of the statewide fish consumption advisory due to mercury contamination. Atmospheric deposition is listed as the source of this mercury contamination. New Hampshire's efforts to reduce mercury loading are described in Section C.2.13.

Twenty lakes and two beaches located on two of the 20 lakes were listed as impaired because of elevated aluminum levels. Elevated aluminum levels cause impairments to the aquatic life use due to its toxicity to the survival and reproduction of fish. Acid deposition causes aluminum (an abundant and natural component of soils) to be leached from the soil and become dissolved in lake water at levels that are toxic to various life stages of fish. Consequently, the documented source of the impairment is described as atmospheric deposition for all the lakes listed, even though the aluminum originates in the soil. Acid pond TMDLs were completed for all 20 lakes. It is expected that as the acidity of atmospheric deposition declines, the leaching of aluminum into the lakes will also decline.

Low Dissolved Oxygen – The aquatic life use can be impaired by oxygen depletions as indicated by either the concentration of dissolved oxygen (e.g. < 5 mg/L in Class B waters) or the percent saturation of dissolved oxygen (< 75 percent daily average). A total of 57 lakes and 42 beaches on those lakes were impaired by oxygen depletion. Of the impaired lakes, 17 were impaired by both concentration and percent saturation, 39 by percent saturation only, and one by concentration only. The CALM protocol causes beaches to inherit the impairment of the parent lake; if a lake has a DO impairment at the deep spot, the beach is also listed as impaired for DO even though the DO may be fine in the beach area.

Oxygen depletion is generally caused by the decomposition of organic matter or nocturnal respiration in highly productive lakes, both of which consume the available dissolved

oxygen. The source of organic matter can be from in-lake production or can enter the lake from the surrounding watershed (eg. leaves, pine needles, fertilizers, poor septage management, etc). Organic rich bottom sediments, which have accumulated in the lake over time, exert a strong oxygen demand on the overlying waters and, although bottom waters are not included in the assessments, the sediment is the main reason for low DO levels in lake bottom waters. Similar to the algal impairments, the amount of in-lake organic matter production is related to nutrient (phosphorus) levels in the lake. It is not surprising to observe many of the same lakes impaired for oxygen depletion as were impaired for algae. The sources of the impairments were also similar.

"Source unknown" was listed as the source of the impairment for most of the lakes. Four lakes (Cobbetts Pond in Windham and Stevens and Dorrs Ponds and Crystal Lake, all in Manchester) were also listed for "urbanized high density" runoff and two lakes (Dorrs and Nutt Ponds in Manchester) were listed for commercial district runoff. No other source was applied to more than one lake. The other sources ranged from "municipal point sources" (Powder Mill Pond in Hancock) to "package plant discharges" (Pearly Lake in Rindge) to "flow alterations (Pine Island Pond in Manchester). Ten of the 57 lakes impaired for oxygen depletion are scheduled for phosphorus TMDLs in 2008 to 2009.

Pathogens (Bacteria) – Pathogens, as measured by *Escherichia coli* bacteria, can impair both the primary contact (swimming) and secondary contact (boating, etc.) uses. It should be pointed out that if a bacteria violation occurs, the entire lake is listed as impaired, not just the area of the contamination. This is important to understand because bacteria levels, unlike many other parameters, tend to be localized. The impairment focuses attention on the correct waterbodies while site specific projects focus attention on the localized areas of concern. Eight lakes were listed as impaired for the swimming use because of elevated bacteria levels. "Source unknown" was listed as the source of the bacteria for all nine lakes. Baboosic Lake also listed "on-site treatment systems" as a bacteria source based on findings from a diagnostic/feasibility study. Federal 319 funds were obtained to address the bacteria issue at Baboosic Lake. A community septic system was designed for the problem area and is being constructed in three phases. Phases I and II have been completed with 22 units connected to the system. An additional 13 units will be connected in the summer of 2008 as part of Phase III.

The exception to the second sentence above (…if a bacteria violation occurs, the entire lake is listed as impaired…) is the situation for public swimming beaches. Beaches are considered separate entities for the purpose of assessments due to their stricter bacteria limits. A bacterial impairment at a beach does not cause the entire lake to be listed as impaired. A total of 92 beaches were listed as impaired for bacteria. Sources for the bacteria impairments included unknown (72 beaches), bacteria from bathing area (17 beaches), waterfowl (5 beaches) and wet weather discharges (4 beaches). Recall that impairments can have more than one source so these numbers total more than 92.

Three lakes (Jenness, Northwood, and Kelly Falls) and two beaches (Weirs and Ahern State Park) were also listed as impaired for the secondary contact use (boating, wading, etc.).

pH – Values from all water depths and all seasons were used and compared to the pH water quality criterion of 6.5 to 8.0 unless due to natural causes to make pH-caused impairment decisions. An apparent color of 30 was used to distinguish naturally acidic waters (> 30 color units) from human induced acidic waters (</= 30 color units). A total of 252 lakes and 154 beaches were listed as impaired because of pH. Atmospheric deposition – acidity was listed as

the source of the impairments for most of the lakes and beaches. A few were listed as 'source unknown". Acid pond TMDLs have been developed and approved for essentially all of these lakes and beaches.

Other Impairments – Six additional parameters listed under the "other" grouping also caused impairments to aquatic life. Chloride impaired three lakes (Dorrs, Nutt and Stevens Ponds in Manchester). Excess algae impaired one beach (Baboosic town beach), non-native plants impaired 53 lakes and 3 beaches, and flow regime alteration impaired one lake (Willand Pond, Somersworth). Sedimentation/siltation (2 lakes – Rust Pond, Wolfeboro and Railroad Pond, Belmont) and turbidity (2 lakes – Lake Winnisquam, Laconia and Railroad Pond, Belmont) were the other two impairment parameters. A variety of sources were listed for the various impairments.

D.3.6.3 Lakes and Ponds: Section 314 Clean Lake Requirements

Section 314 of the CWA includes six requirements which states must address in their Section 305(b) report. The following is in response to these requirements.

CWA Section 314 Requirement 1: An identification and classification according to eutrophic condition of all publicly owned lakes in such state.

Although the term "significant" is not in statute (see above requirement as listed in section 314 of the Clean Water Act), previous and current guidance has always requested that trophic status be reported for "significant" publicly owned lakes. The current guidance provides a table as the "recommended format for reporting on the trophic status of 'significant' publicly owned lakes". New Hampshire has adopted this recommended format (adding a 'percent' column to the table) and the requested information is provided in Table 21 below.

New Hampshire's definition of a significant lake, for the purposes of the Section 314 Clean Lakes Program, is as follows and is unchanged from previous 305(b) reports.

> A "significant lake" is any freshwater lake or pond that has a surface area of 10 or more acres, is not private, and does not prohibit recreational activity. It includes both natural and manmade lakes. Significant lakes do not include saltwater ponds, public water supplies (unless recreational activities are not prohibited), wetlands, or river impoundments (unless the impoundment functions as a lake both hydrologically and recreationally). A lake does not need an unencumbered public access to be considered significant. However, a lake completely surrounded by private land under one ownership, and where access is not granted to the general public, is considered to be private for the purposes of Section 314 of the Clean Water Act. This includes natural ponds that are legally "public waters". In addition, trout ponds less than 10 acres that are stocked by the N.H. Fish and Game Department and are open to the general public for fishing are considered to be significant lakes.

It is important to note that the Clean Lakes Program is directed toward accessible recreational lakes. While public water supplies and wetlands are not considered significant under the Clean Lakes program, clearly they are significant under other DES programs.

The system used to trophically classify lakes and ponds in New Hampshire is presented in Table 22. The system consists of four criteria that measure the biological production that

occurs in a lake as a result of both nutrient inputs and lake aging (filling in). This approach was selected because these are the parameters that are visible to lake users, unlike a system based on nutrient (phosphorus) concentration only. It results in a trophic classification based on in-lake biological production.

Summary statistics on the trophic status of significant lakes in New Hampshire, as requested in the guidance, is presented in Table 21 below. For larger lakes with multiple stations, the deepest spot station was used so that each lake is assigned one trophic state only.

Table 21: Trophic Status of Significant Lakes

Description	Number of Lakes [1]	Percent	Acres of Lakes	Percent
Total in state	667	40.2 [2]	155,698	83.8 [2]
Assessed	663	99.4	155,601	99.9
Oligotrophic	187	28.0	115,075	73.9
Mesotrophic	329	49.3	33,454	21.5
Eutrophic	147	22.0	7,072	4.5

Note:

[1] Values include some impoundments which are considered Significant Publicly Owned Lakes.

[2] The percentage of significant lakes to all NH lakes is based on a total lake + impoundment number of 1658 and total lake + impoundment acres of 185,877 as listed in the atlas (Table 2).

Several important facts can be gleaned from Table 21. The first is that the non-significant lakes tend to be small. While the significant lakes account for only 40 percent of the total lakes, they represent over 84 percent of the total lake acres. A second conclusion is that oligotrophic lakes tend to be the larger lakes while eutrophic ponds tend to be small. The 187 lakes that are oligotrophic represent nearly 74 percent of the total lake acres. Only 4.5 percent of lake acres are eutrophic despite being 22 percent of the total number of lakes.

Table 22: Trophic Classification System for New Hampshire Lakes and Ponds

1. Summer Bottom Dissolved Oxygen:	**Trophic Points**
a. D.O. > 4 mg/L	0
b. D.O. = 1 to 4 mg/L & hypolimnion volume ≤ 10% of lake volume	1
c. D.O. = 1 to 4 mg/L & hypolimnion volume > 10% of lake volume	2
d. D.O. < 1 mg/L in < 1/3 hypo. volume & hypo. volume < 10% lake volume	3
e. D.O. < 1 mg/L in ≥ 1/3 hypo. volume & hypo. volume ≤ 10% lake volume	4
f. D.O. < 1 mg/L in < 1/3 hypo. volume & hypo. volume > 10% lake volume	5
g. D.O. < 1 mg/L in ≥ 1/3 hypo. volume & hypo. volume > 10% lake volume	6
2. Summer Secchi Disk Transparency:	**Trophic Points**
a. > 7 m	0
b. > 5 m - 7 m	1
c. > 3 m - 5 m	2
d. > 2 m - 3 m	3
e. > 1 m - 2 m	4
f. > 0.5 m - 1 m	5
g. ≤ 0.5 m	6
3. Aquatic Vascular Plant Abundance:	**Trophic Points**
a. Sparse	0
b. Scattered	1
c. Scattered/Common	2
d. Common	3
e. Common/Abundant	4
f. Abundant	5
g. Very Abundant	6
4. Summer Epilimnetic Chlorophyll-a (mg/M^3):	**Trophic Points**
a. < 4	0
b. 4 - < 8	1
c. 8 - < 12	2
d. 12 - < 18	3
e. 18 - < 24	4
f. 24 - < 32	5
g. ≥ 32	6

Trophic Points

Trophic Classification	Stratified	*Unstratified
Oligotrophic	0-5	0-3
Mesotrophic	6-10	4-6
Eutrophic	11-21	7-15

*Lakes without hypolimnions are not evaluated by the bottom dissolved oxygen criterion.

CWA Section 314 Requirement 2: A description of procedures, processes and methods (including land use requirements) to control sources of pollution of such lakes.

The state has numerous laws, rules, and regulations designed to protect lakes. The laws are based on the philosophy that it is easier, cheaper, and more logical to protect lakes from degradation than it is to restore degraded lakes. The New Hampshire Department of Environmental Services (DES) has long had a policy of removing point discharges of sewage and waste from lakes and from tributaries to lakes. During the two decades of the 1980s and '90s, a major effort was made through the Construction Grants program to remove such discharges, and, with few exceptions, New Hampshire lakes and lake tributaries are free from point discharges. New Hampshire also has surface water quality standards that protect lakes as well as all other surface waters. More information on water quality standards and point source control can be found in sections C.2.1 and C.2.2.

In addition to point source controls and water quality standards, DES has many other programs in place to further protect New Hampshire's lakes and ponds. Many are listed in section C.2 and include the Section 319 Nonpoint Source, Alteration of Terrain, 401 Water Quality Certification, and Total Maximum Daily Load (TMDL) programs.

A brief summary of some of the laws and regulations that help protect New Hampshire lakes is presented below.

1. All lakes are classified at least B (RSA 485-A:11), which means they're suitable for fishing, swimming, and other recreational activities (RSA 485-A:8-II), and violations of assigned classifications are not allowed (RSA 485-A:12-II).
2. No discharge is allowed to a lake without a permit (RSA 485-A:13-I).
3. No trash can be dumped in or on the banks of a lake (RSA 485-A:15).
4. Marine toilets cannot be discharged into a lake (RSA 487:2).
5. Graywater (sink and shower wastes) from boats cannot be discharged into a lake (RSA 487:3).
6. No new or increased discharge of phosphorus or nitrogen to lakes are allowed, no new or increased discharges of phosphorus or nitrogen to tributaries of lakes are allowed that would contribute to cultural eutrophication or growth of weeds or algae, and existing discharges containing either phosphorus or nitrogen which encourage cultural eutrophication shall be treated to remove phosphorus or nitrogen (Env-Wq 1703.14).

7. Existing high quality lakes shall be maintained at their existing high quality (WS439.02).

8. No automobiles may be washed in or driven into any lake (uncodified regulation - may not be enforceable).

9. Automobiles and other petroleum powered vehicles lost through the ice into a lake must be removed (RSA 485-A:14).

10. No dredge and fill activities are allowed in or around a lake without a permit (RSA 482-A:3; 485-A:17).

11. No activity that alters the terrain, such as construction, earth moving, excavation, timber harvesting, etc., of 100,000 square feet, or 50,000 square feet in the protected shoreland zone, can occur without a permit that limits runoff both during and after the activity (RSA 485-A:17; Env-Ws 415).

12. No earth moving activities are allowed near a lake without a permit (RSA 485-A:17).

13. No subsurface disposal system may be installed near a lake without a permit and certain minimum standards met (RSA 485-A:29).

14. No pesticides can be applied to a lake without a permit (RSA 430:31 & 32 and Pes 600) and no pesticide can be applied to a lake of 10 acres or larger without the recommendation of DES (Pes 601.01(b).

15. No pesticide can be applied within the 50 foot waterfront buffer (RSA 483-B:9(V)) or, for any lake not covered under the 50 foot waterfront buffer of the Comprehensive Shoreland Protection Act, within 25 feet of a lake's shoreline or beyond 25 feet in a manner that would result in the presence of pesticides within 25 feet of the lake (Pes1001.01).

16. Cottages near lakes or tributaries to lakes cannot be converted from seasonal to year-round use unless an application for approval of the sewage disposal system has been submitted and approved (RSA 485-A:38).

17. Cottages near lakes or tributaries to lakes cannot be expanded in size such that the load on the sewage disposal system is increased unless an application for approval of the sewage disposal system is submitted (RSA 485-A:38).

18. No property with a sewage disposal system located within 200 feet of a great pond can be offered for sale until a licensed sewage disposal designer has performed a site assessment to determine if the site meets current standards for sewage disposal systems (RSA 485-A:39).

19. The Lakes Management and Protection Program established a lakes coordinator and lakes management advisory committee to prepare: (1) statewide lake management criteria and (2) guidelines for the development of local lake management and shoreland protection plans (RSA 483-A).

20. The Comprehensive Shoreland Protection Act (RSA 483-B) provides minimum protective standards for activities occurring within 250 feet of lakes and ponds with a surface area of 10 acres or more.

21. No household cleansing products except those used in dishwashers shall be distributed, sold or offered for sale in New Hampshire which contain a phosphorus compound in excess of a trace quantity (RSA 485-A:56).

22. No exotic aquatic weeds shall be offered for sale, distributed, sold, imported, purchased, propagated, transported, or introduced in the state (RSA 487:16a).

23. DES is directed to prevent the introduction and further dispersal of exotic aquatic weeds and to manage or control exotic aquatic weed infestations in the lakes of the state RSA 487:17,II).

24. Permits are also required for the following activities, and permits would not be issued if lake water quality were endangered:

    A. groundwater discharges (RSA 485-A:13)
    B. underground storage tanks (RSA 146-A)
    C. solid waste landfills (RSA 149-M)
    D. sludge pits (RSA 149-M)
    E. hazardous waste sites (RSA 147-A)

With most point sources eliminated, the greatest threats to the continued health of New Hampshire lakes are atmospheric deposition (including both acid rain impacts and mercury), the introduction of non-native aquatic organisms and the overuse of and over-development around the lakes. Stormwater runoff from developed (urban) areas is probably the greatest threat to the health of New Hampshire lakes. Acid rain and mercury impacts have been and continue to be addressed by state and national (Clean Air Act) legislation. DES adopted a mercury reduction strategy in 1998 that resulted and continues to result in various laws, rules and activities to reduce the amount of mercury discharged to the environment. In December 2007 EPA approved a mercury TMDL for NH and the other New England states and New York, designed to reduce mercury deposition in the state. Programs to address non-native exotic weeds were listed above (22 & 23). Programs to reduce runoff (primarily erosion and nutrients) from the developed watersheds of lakes are managed by above-listed programs (10-13) along with the 401 certification program, the Alteration of Terrain program and the implementation of best management practices through the 319 program.

Of the 108 recommendations included in the "Lakes Management Criteria for New Hampshire state agencies," ten recommendations called for legislative action. Since the document was released in 1996, the NH General Court has acted upon six of the ten recommendations. The state, through the interagency Council on Resources and Development (CORD) and legislative action, continues to improve its ability to protect lakes from overuse and from stormwater runoff from developed areas.

Section 314 Requirement 3: A description of methods and procedures, in conjunction with appropriate federal agencies, to restore the quality of such lakes.

Procedures and methods to protect lakes by controlling sources of pollution were discussed in the previous section. In this section, activities to ameliorate poor water quality conditions that may occur despite the above regulations controlling pollution are discussed.

Lake restoration efforts usually take one of two basic approaches, or a combination of the two. The first is to attack the cause of the problem; the second is to treat the problem. As discussed above the major problems for lakes are acid and mercury issues related to atmospheric deposition, the introduction of exotic plants, and nutrient and sedimentation issues from stormwater runoff. The different problems may require the use of different approaches. For example, reducing mercury emissions is an example of controlling the cause of a problem whereas applying herbicides to exotic milfoil is an example of treating a problem.

Lake restoration techniques have been reviewed periodically in the literature, including EPA's 1990 document "The Lake and Reservoir Restoration Guidance Manual," second edition, and NALMS' 2001 document "Managing Lakes and Reservoirs," third edition. Reports such as these include a listing of restoration techniques. In this section, procedures that New Hampshire has carried out to restore lake water quality are discussed.

Cause Treatment

Controlling sources of pollution involves controlling both point and non-point sources.

Point Sources:

Point sources of phosphorus to a lake are usually removed or reduced by two basic methods. The most common is to divert the discharge away from the lake. A number of New Hampshire lakes have been restored or protected by sewage diversions, including Lakes Winnisquam, Kezar, Winnipesaukee, Glen, Kellys Falls and Mascoma. A second method to reduce a point source of phosphorus is to provide tertiary treatment to the discharge. Lakes protected through tertiary treatment include Sunapee and Winnipesaukee (spray irrigation), Pearly Pond (phosphorus precipitation) and Kezar (wetlands uptake). In at least one case (Lake Skatutakee) restoration occurred as a result of the cessation of a discharge (a woolen mill closed).

Nonpoint sources:

The Water Division of DES deals with non-point sources of pollution, including phosphorus and erosion. As discussed in the previous section, the state has a number of laws that reduce phosphorus and sediment runoff from logging operations, earth moving activities, dredge and fill operations and subsurface disposal systems. The Department also works closely with local planning agencies, the Natural Resources Conservation Service, Cooperative Extension and others to develop and implement best management practices for non-point sources. Public information and education is a large part of this process. A general discussion of the non-point program can be found in C.2.3. Examples of non-point control projects to protect lakes are found in the Clean Lakes – 319 projects section below.

Problem Treatment

Algae:

Historically the Department used copper sulfate to control algal blooms caused by cultural sources of phosphorus. As point sources were eliminated, the need for the chemical

control of algae diminished greatly. The DES Biology Section personnel continue to maintain pesticide applicator licenses and continue to have the ability to treat algal blooms if conditions warrant. In recent years most copper sulfate treatments have been related to taste and odor or filter clogging problems associated with public water supplies.

Copper sulfate treatments that have occurred since the 2006 report include Rochester Reservoir, Rochester (2006) and Harris Pond, Nashua (2007).

Rooted Aquatic plants:

The state funds a program designed to stop the spread of exotic aquatic plants in the state. The money can be used to eradicate new small infestations of exotic plants and to make matching grants for the management of existing infestations. Table 23 shows the lakes where exotic plants have been eradicated or managed. Funds are also available for public informational and educational efforts to stop the spread of exotic plants and for research.

Funds are not available to manage native plants and very few herbicide treatments occur to control native plant growth. Since 1990, only two ponds, Long Pond in Pelham (1995, 1997) and Pillsbury Lake in Webster (multiple years) have been treated with herbicides to control non-exotic plants. Lake drawdown has been used, with limited success, to control native aquatic plants in a few lakes.

Table 23: Lakes Where Exotic Plants have been Eradicated or Managed

Lake	Town	Method
Arlington Mill Reservoir	Salem	drawdown
Balch Pond	Wakefield	Herbicide, hand removal, bottom barrier, Restricted Use Area
Belleau Lake	Wakefield	herbicide
Broad Bay	Ossipee	hand removal, herbicide, bottom barrier
Captain Pond	Salem	hand removal, herbicide
Cheshire Pond	Jaffrey	drawdown
Cobbetts Pond	Windham	herbicide
Contoocook Lake	Jaffrey	herbicide, hand removal, bottom barrier
Crescent Lake	Wolfeboro	herbicide, hand removal, bottom barrier
Crystal Lake	Manchester	herbicide
Forest Lake	Winchester	Herbicide, bottom barrier, hand removal
Danforth Pond, Middle	Freedom	Herbicide, hand removal
Dublin Lake	Dublin	Hand removal, bottom barrier-ERADICATED
Flints Pond	Hollis	hand removal
Gorham Pond	Dunbarton	Herbicide
Halfmoon Pond	Alton	Hand removal
Haunted Lake	Francestown	Herbicide, hand removal, bottom barrier
Hopkinton Lake	Hopkinton	Herbicide, bottom barrier
Horseshoe Pond	Merrimack	herbicide
Island Pond	Derry	drawdown
Jones Dam Pond	New Durham	herbicide

Leavitt Bay	Ossipee	herbicide, hand removal, drawdown, bottom barrier
Lees Pond	Moultonboro	biological (aquatic insects), herbicide, hand removal, bottom barrier
Locke Lake	Barnstead	herbicide
Mascoma Lake	Enfield	hand removal
Massabesic, Lake	Manchester	bottom barrier, hand removal, restricted use area
Massasecum Lake	Bradford	herbicide, hand removal, bottom barrier, harvesting, restricted use area, replacement planting, suction harvesting
Melendy Pond	Brookline	herbicide
Milville Lake	Salem	drawdown, dredging
Monomonac, Lake	Rindge	herbicide, bottom barrier, hand removal, drawdown
Mountain Lake	Brookfield	drawdown
Nashua River	Nashua	Hand removal
Northwood Lake	Northwood	herbicide, hand removal, drawdown
Nutt Pond	Manchester	Herbicide, bottom barrier, hand removal
Opechee Bay	Laconia	dredging, hand removal, bottom barrier
Otternick Pond	Hudson	herbicide
Paugus Bay	Laconia	Harvesting, herbicide
Phillips Pond	Sandown	bottom barrier, herbicide
Pemigewasset River	Sanbornton	herbicide
Potanipo Pond	Brookline	herbicide
Robinson Pond	Hudson	herbicide
Rocky Pond	Gilmanton	Herbicide, hand removal
Silver Lake	Tilton	hand removal, herbicide
Squam Lake, Little	Holderness	hand removal, herbicide, benthic barrier
Squam Lake, Big	Ashland	Hand removal, bottom barrier, restricted use area
St. Paul's School Pond	Concord	harvesting, hydro raking, herbicide
Sunapee, Lake	New London	hand removal, bottom barrier
Suncook Pond, Lower	Barnstead	bottom barrier, hand removal, herbicide
Suncook River	Barnstead	Herbicide, drawdown, hand removal
Sunrise Lake	Middleton	herbicide, bottom barrier
Turkey Pond, Big	Concord	Harvesting, herbicides
Turkey Pond, Little	Concord	Harvesting, herbicides
Turtle Pond	Concord	herbicide
Waukewan, Lake	Meredith	herbicide, hand removal, bottom barrier-ERADICATED
Wentworth, Lake	Wolfeboro	bottom barrier, herbicide
Winnipesaukee, Lake (several bays & coves)	Alton	herbicide, bottom barrier, hand removal, harvesting, suction harvesting
Winnisquam, Lake	Laconia	hand removal, bottom barrier, herbicide

Clean Lakes Diagnostic Studies

The Department participated in the federal Clean Lakes Program (Section 314) when funds were available. A number of Phase I diagnostic/feasibility studies were conducted using existing state personnel as the 30 percent match. One 314-funded Phase II implementation project and one Phase III monitoring project were completed. Although only one Phase II project was funded, locally implemented controls, such as outreach and zoning changes, were implemented for a number of lakes as a result of recommendations presented in the Phase I reports. A state-funded Clean Lakes Program was established in 1990 and several diagnostic studies have been completed under this program with assistance from volunteers in the Volunteer Lake Assessment Program. Watershed implementation projects for these lakes were funded through the non-point source (319) program and the 104(b)(3) programs. The following Phase I, II, III, state diagnostic studies, 319 and 104(b)(3) projects have been undertaken and/or completed at New Hampshire lakes.

Phase I:

- Kezar Lake, Sutton
- Dorrs Pond, Manchester
- Crystal Lake, Manchester
- Northwood Lake, Northwood
- Silver Lake, Hollis (205 (j))
- Baboosic Lake, Amherst (205 (j))
- French Pond, Henniker (205 (j))
- Keyser Pond, Henniker (205 (j))
- Webster Lake, Franklin
- Mendums Pond, Barrington
- Beaver Lake, Derry
- Robinson/Ottarnic Ponds, Hudson
- Pawtuckaway Lake, Nottingham
- Flints Pond, Hollis
- Great Pond, Kingston

Phase II:

Kezar Lake, Sutton: sediment phosphorus inactivation through aluminum salts application and management of an upstream wetlands

Phase III:

Kezar Lake, Sutton: monitoring of the long-term effectiveness of hypolimnetic alum treatment to inactivate sediment phosphorus, and evaluation of long-term impacts of aluminum additions to aquatic biota.

state funded lake diagnostic studies:

- Lake Wentworth, Wolfeboro
- Silver Lake, Harrisville
- Baboosic Lake, Amherst
- Pleasant Lake, Deerfield
- Partridge Lake, Littleton
- Rust Pond, Wolfeboro
- Perkins Pond, Sunapee

319 Projects:

- Baboosic Lake, Amherst: development of a watershed based plan to address chlorophyll-a impairment and watershed phosphorus loading.
- Pawtuckaway Lake, Nottingham: development of a watershed based plan to address Cyanobacteria impairment and watershed phosphorus loading.
- Partridge Lake, Littleton: development of a watershed based plan to address Cyanobacteria impairment and watershed phosphorus loading.
- Chalk Pond, Newbury: development of a stormwater ordinance and guide for the Town of Newbury to address small site development.
- Baboosic Lake, Amherst: design and installation of a community septic system. Phase I of multi-phase project completed. multi-phase project to serve 20-40 households upon completion of Phase II.
- Webster Lake, Franklin: development of a watershed based plan occurred in 2006 to address Cyanobacteria impairment.
- Webster Lake, Franklin: implementation of stormwater BMP identified in the watershed based plan, 2006.
- Silver Lake, Harrisville: design and installation of roadway BMPs, boat launch BMPs, and septic system maintenance and outreach.
- Granite Lake, Nelson: development of a high quality water watershed based plan.

104(b)(3):

Crystal Lake, Manchester: installation of a StormTreat system to treat stormwater runoff from an urban area, with post-installation monitoring using 319 funds.

Supplemental Environmental Projects (SEP):

Manchester, NH: As part of a long-term combined sewer overflow (CSO) strategy, the City of Manchester is implementing a broad environmental program (the SEP) as well as standard CSO mitigation measures. One aspect of the SEP is an Urban Ponds Restoration project which includes cooperative watershed assessments, restoration, education and outreach for the following urban ponds in Manchester: Maxwell Pond; Nutt Pond; Stevens Pond; McQueston Pond; Pine Island Pond; Dorrs Pond; and Crystal Lake.

Miscellaneous:

Lake Winnisquam, Belmont: Cooperative approach between NHDES and NHDOT to address potential short-term water quality impacts during Rte. 3/11 road construction and potential long-term water quality impacts by designing and installing stormwater treatment. First phase completed in 2006-2007. The last and final phase will be completed in 2007-2008.

Newfound Lake, Bristol: Cooperative approach between NHDES and NHDOT to address potential short-term water quality impacts during Rte. 3A road construction and potential long-term water quality impacts by designing and installing stormwater treatment. Start of construction anticipated for summer, 2009.

The Section 314 Clean Lakes Program was extremely beneficial to the lakes programs of New Hampshire. It helped develop many of the lake monitoring programs that provided information for the lake assessments used in this 305(b) report. Unfortunately, with the elimination of federal funding for the program, the lakes programs suffered. Phase I, II and III projects are no longer conducted. The number of lakes monitored and the parameters analyzed are reduced from previous levels. The state has provided additional state funds to the lakes programs to help offset this loss. State funds were provided to implement the Shoreland Protection Act, to expand the beach and pool inspection program, and to expand the exotic species control and volunteer lake diagnostic study program. Modified diagnostic studies are conducted through the volunteer and state Clean Lakes programs. The purpose of these studies is to work with volunteers to identify pollution (primarily phosphorus and sediment) sources and to develop recommendations to ameliorate those sources in order to protect the lake from becoming impaired. Once causes and sources of water quality declines are determined, 319 funds (rather than Phase II 314 funds) are now used for lake watershed implementation projects.

The TMDL program is used to restore impaired lakes. Total phosphorus TMDLs on 30 lakes impaired by high chlorophyll values (algae) and/or cyanobacteria scums are currently underway.

CWA Section 314 Requirement 4: Methods and procedures to mitigate the harmful effects of high acidity, including innovative methods of neutralizing and restoring buffering capacity of lakes and methods of removing from lakes toxic metals and other toxic substances mobilized by high acidity.

New Hampshire has not and has no plans to mitigate the aquatic impacts of acid deposition by trying to treat the symptoms of the problem. With this issue the only rational solution is to treat the cause of the problem – reduce the emissions of sulfur dioxide and nitrogen

oxides. The Department of Environmental Services, as well as the Governor and Congressional delegation, strongly supported the Clean Air Act Amendments of 1990 to reduce sulfur dioxide and nitrogen oxide emissions, and continue to support state, regional and national efforts to further reduce acid-causing emissions. It makes no sense to treat the symptoms of the problem without treating the causes. The only valid reason for liming a lake is to protect a commercial fishery, a heritage strain of fish for broodstock or a threatened or endangered fish species until such time as acid rain controls are in place. This situation does not exist in New Hampshire.

New Hampshire, along with the other states in the region, has implemented legislation to reduce in-state emissions of sulfur dioxide and is a participant in the NEG/ECP Acid Rain Action Plan to reduce in-region sources of SO_2 and NO_x. Out-of-region sources of acidifying compounds, particularly sulfur emissions from the mid-west, continue to be a major cause of acid deposition in New Hampshire. New Hampshire completed and EPA approved acid rain TMDLs on 223 different lakes and their beaches. These TMDLs called for reductions in acidifying emissions from both in-state and out-of-state sources. New Hampshire was a participant in the lawsuit against EPA that was recently won by the states and found that EPA's current rules implementing the Clean Air Act requirements were improper.

CWA Section 314 Requirement 5: A list and description of those publicly owned lakes in such state for which uses are known to be impaired, including those lakes which are known not to meet applicable water quality standards or which require implementation of control programs to maintain compliance with applicable standards and those lakes in which water quality has deteriorated as a result of high acidity that may be reasonably due to acid deposition.

See sections D.3.6.1 and D.3.6.2 for the assessment result tables which show the acres of lakes that are supporting and not supporting each designated use as well as the acres impacted by each cause and suspected source of impairment.

CWA Section 314 Requirement 6: An assessment of the status and trends of water quality in lakes in such state, including but not limited to, the nature and extent of pollution loading from point and non-point sources and the extent to which the use of lakes is impaired as a result of such pollution, particularly with respect to toxic pollution.

Acid Rain Trends

The passage of the Clean Air Act Amendments in 1990 resulted in a decrease in sulfur dioxide emissions from in-state and out-of-state sources. This has resulted in a similar decline in sulfate deposition to the state and, to a lesser extent, a decline in sulfate concentrations in surface waters. Unfortunately, this has resulted in little if any improvement in the acidity or acid neutralizing capacity status of NH lakes. Computer model results for the Hubbard Brook Experimental Forest show that the 1990 Clean Air Act Amendments will have a positive effect on sulfate deposition but will not facilitate full recovery for acid-sensitive ecosystems in the Northeast. Deeper cuts in electric utility sulfur emissions (at least 80 percent beyond the Clean Air Act) will be needed for greater and faster recovery from acid deposition in the Northeast (Driscoll *et al.* 2001).

A number of reasons contribute to this lack of improvement in surface waters and the need for further cuts in emissions. While sulfur emissions have decreased, nitrogen emissions

have not decreased substantially region-wide and wet deposition of nitrogen has remained largely unchanged since the 1980s. Additionally, the loss of acid-neutralizing minerals from the soil and the long-term accumulation of sulfur and nitrogen in the soil have left many ecosystems more sensitive to the input of additional acids, further delaying recovery from acid deposition.

For many years, the state has monitored the effects of acid deposition on waterbodies in New Hampshire by regularly taking water samples from lakes and ponds. As defined by the U.S. Environmental Protection Agency, waters that have an ANC of zero or less, which corresponds to a pH of about 5.2, are considered to be acidified. A 2005 evaluation of lake data revealed that 3 percent of all lakes and 17 percent of remote, mostly high elevation ponds are acidic based on this definition. These values are unchanged from a similar assessment conducted five years previously.

A number of reports have been published in recent years that support the acid rain trend conclusions discussed above, and DES contributed data to some of these studies. Selected references include:

- Driscoll, C.T. et al. 2001. Acid Rain Revisited : advances in scientific understanding since the passage of the 1970 and 1990 Clean Air Act Amendments. Hubbard Brook Research Foundation. Science Links:1(1).
- Dupont, J. et al. 2000. Temporal Trends in Surface Water Quality in Northeastern America. NEG/ECP Acid Rain Steering Committee report.
- Dupont, J. et al. 2005. Estimation of Critical Loads of Acidity for Lakes in Northeastern United States and Eastern Canada. Env. Mon & Assess. 109.
- Kahl, J.S. et al. 2004. Have U.S. Surface Waters Responded to the 1990 Clean Air Act Amendments? ES&T. December 15, 2004.
- Stoddard, J.L. et al. 2003. Response of Surface Water Chemistry to the Clean Air Act Amendments of 1990. EPA 620/R-03/001.
- USEPA. 2005. The EPA Acid Rain Program 2004 Progress Report. http://www.epa.gov/airmarkets/cmprpt/arp04/
- USGAO. 2000. Acid Rain: Emissions Trends and Effects in the Eastern United States. GAO/RCED-00-47.

Trophic Trends

The Volunteer Lake Assessment Program was initiated with one lake in 1985 and has expanded to the point where over 160 lakes currently participate. In general, participating lakes sample once a month for the three summer months. Lakes with at least 10 consecutive years of data were statistically analyzed for trends in four trophic parameters. A linear regression analysis was used (95 percent confidence level) to determine if a specific water quality parameter was increasing, decreasing or not changing. A subjective "eye ball" test was used to determine if the non-changing trend was better characterized as a stable trend or a fluctuating trend.

The results of the trend analysis are summarized in the tables below. Samples are from the deep spot of the lakes. For larger lakes where more than one station was sampled, either the

deeper spot or the worse case trend was used. Approximately 83 lakes were assessed for trophic trends. With approximately 800 lakes over 10 acres in New Hampshire, the trend analysis represents about 10 percent of these lakes. (note: totals may not be exact because of rounding percentages and acres to the nearest whole number).

Table 24: Trend in chlorophyll

Trend	Number of lakes	Percent	Acres of lakes	Percent
Improving	10	12	2102	7
Stable	37	44	18336	64
Degrading	4	5	1625	6
Fluctuating	32	39	6733	23
total	83	100	28797	100

Table 25: Trend in Secchi transparency

Trend	Number of lakes	Percent	Acres of lakes	Percent
Improving	10	12	6299	22
Stable	56	66	14354	49
Degrading	8	9	2107	7
Fluctuating	11	13	6336	22
total	85	100	29096	100

Table 26: Trend in epilimnetic or upper layer total phosphorus

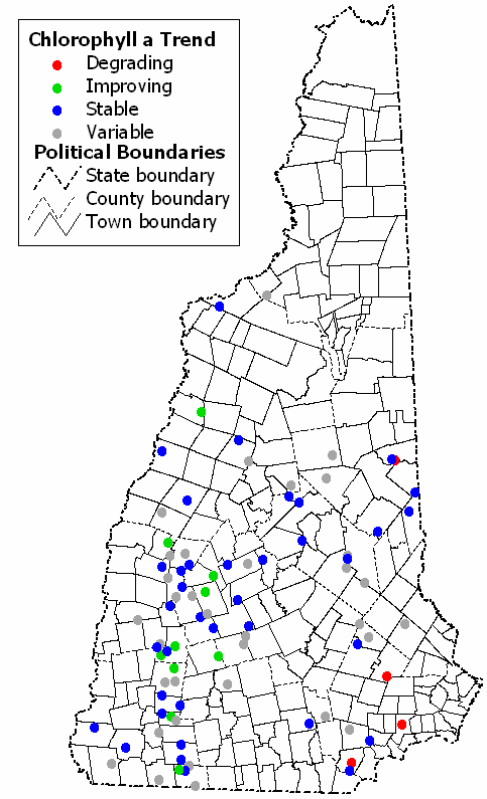
Trend	Number of lakes	Percent	Acres of lakes	Percent
Improving	14	17	7605	26
Stable	36	43	14286	50
Degrading	2	2	1250	4
Fluctuating	31	37	5644	20
total	83	100	28784	100

Table 27: Trend in hypolimnetic or lower layer total phosphorus

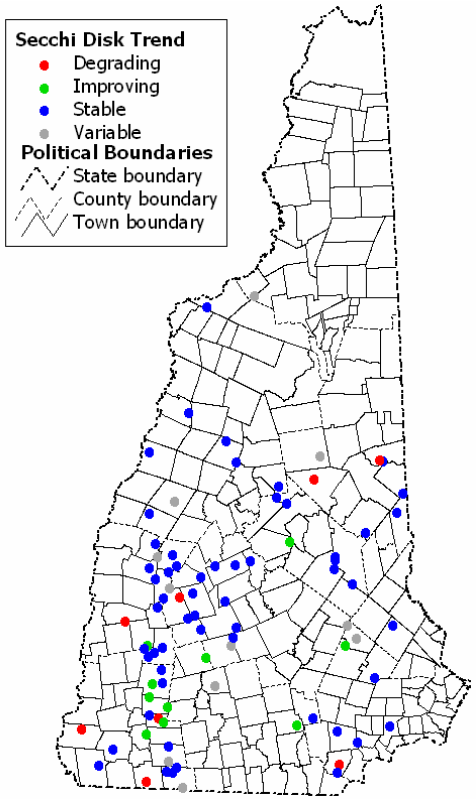
Trend	Number of lakes	Percent	Acres of lakes	Percent
Improving	7	9	4934	17
Stable	20	25	6194	21
Degrading	5	6	1452	5
Fluctuating	49	60	16314	57
total	81	100	28894	100

Figure 22 (A, B, C, & D): Volunteer Lake Assessment Program Trends

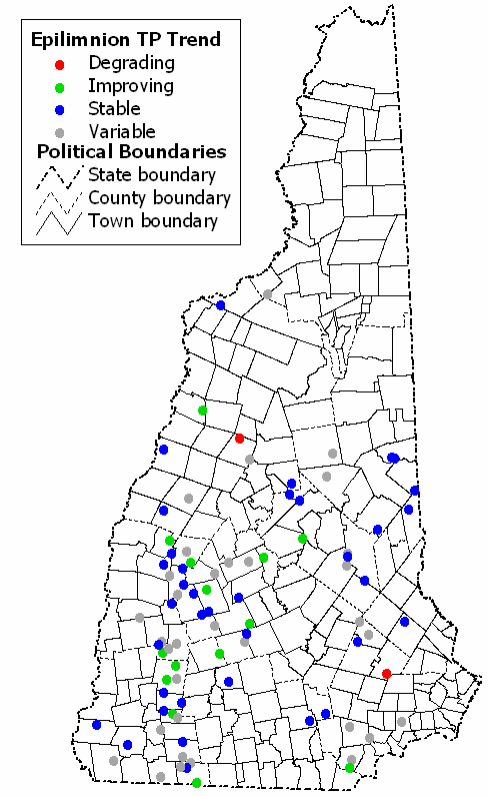
A.



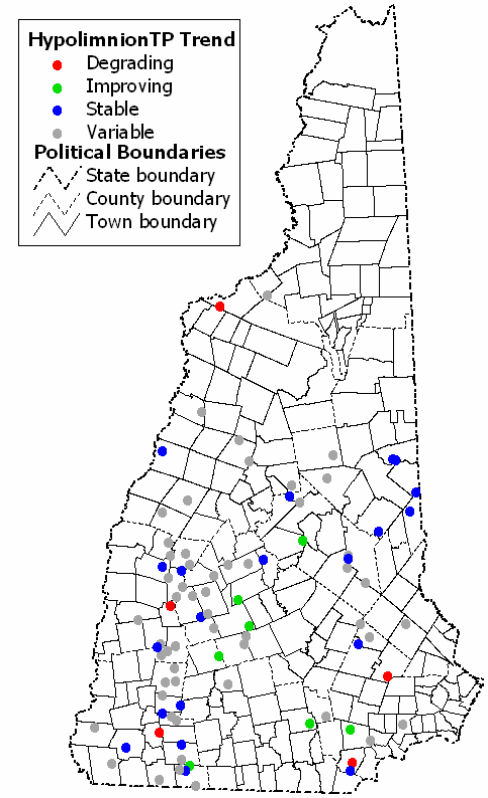
B.



C.



D.



A general assessment of the above trends suggests that most lakes show no trend (are either stable or fluctuating), and of those showing a trend, more are improving than are degrading.

D.3.7 OCEAN

D.3.7.1 Ocean: Individual Designated Use Support

The following tables and figures provide a summary of the use support status for all designated uses in ocean waters in state jurisdiction. Results are presented with and without the statewide mercury fish consumption advisory to reveal the status masked by the mercury advisory. Definitions of terms used in the tables (i.e., fully supporting, not supporting, threatened, fully supporting – marginal condition, etc.) may be found in the Consolidated Assessment and Listing Methodology (DES, 2008) a copy of which is provided in Appendix 4.

The percent assessed for each use with and without mercury is shown in Table 28 and Figure 23. Individual use support information is shown in Table 28 and Figure 24. The table and figures present the individual use assessments with the statewide mercury fish consumption advisory is in effect (see section (D.6)) as well as assuming that the advisory did not exist. Additionally the table and figures present DES's more refined definitions of use support which give an idea of the degree of water quality standard attainment or impairment (Fully Supporting-Good, Fully Supporting – Marginal, Not Supporting – Marginal and Not Supporting -Poor).

Table 28: Ocean: Individual Designated Use Support

Designated Use	Total	Total Assessed	Fully Supporting (FS) = Attaining Water Quality Standards			Not Supporting (NS) = Not Attaining Water Quality Standards = Impaired			Threatened	Insufficient Data and Information
			FS - Good	FS - Marginal	FS - Total	NS - Marginal	NS - Poor	NS - Total		
Aquatic Life										
Square Miles	70.1	65.2	0.0	63.7	63.7	1.3	0.3	1.5	0.0	4.8
% of Total	100.0%	93.1%	0.0%	90.9%	90.9%	1.8%	0.4%	2.1%	0.0%	6.9%
% of Assessed		100.0%	0.0%	97.7%	97.7%	1.9%	0.4%	2.3%	0.0%	
Fish Consumption (excluding mercury advisory)										
Square Miles	70.1	70.1	0.0	0.0	0.0	70.1	0.0	70.1	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	
Fish Consumption (including mercury advisory)										
Square Miles	70.1	70.1	0.0	0.0	0.0	70.1	0.0	70.1	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	
Shellfishing										
Square Miles	70.1	70.1	0.0	0.0	0.0	68.3	1.8	70.1	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	97.4%	2.6%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	97.4%	2.6%	100.0%	0.0%	
Primary Contact Recreation										
Square Miles	70.1	69.6	65.3	0.0	65.4	0.3	4.0	4.2	0.0	0.5
% of Total	100.0%	99.4%	93.3%	0.0%	93.3%	0.4%	5.7%	6.1%	0.0%	0.6%
% of Assessed		100.0%	93.9%	0.0%	93.9%	0.4%	5.7%	6.1%	0.0%	
Secondary Contact Recreation										
Square Miles	70.1	69.7	67.8	1.5	69.3	0.3	0.1	0.5	0.0	0.3
% of Total	100.0%	99.5%	96.7%	2.1%	98.9%	0.5%	0.2%	0.6%	0.0%	0.5%
% of Assessed		100.0%	97.2%	2.2%	99.4%	0.5%	0.2%	0.6%	0.0%	
Drinking Water (after Treatment)										
Square Miles	70.1	70.1	70.1	0.0	70.1	0.0	0.0	0.0	0.0	0.0
% of Total	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of Assessed		100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	
Wildlife (Not Assessed)										
Square Miles	70.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.1
% of Total	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
% of Assessed										

Figure 23: Ocean: Percent Assessed by Use

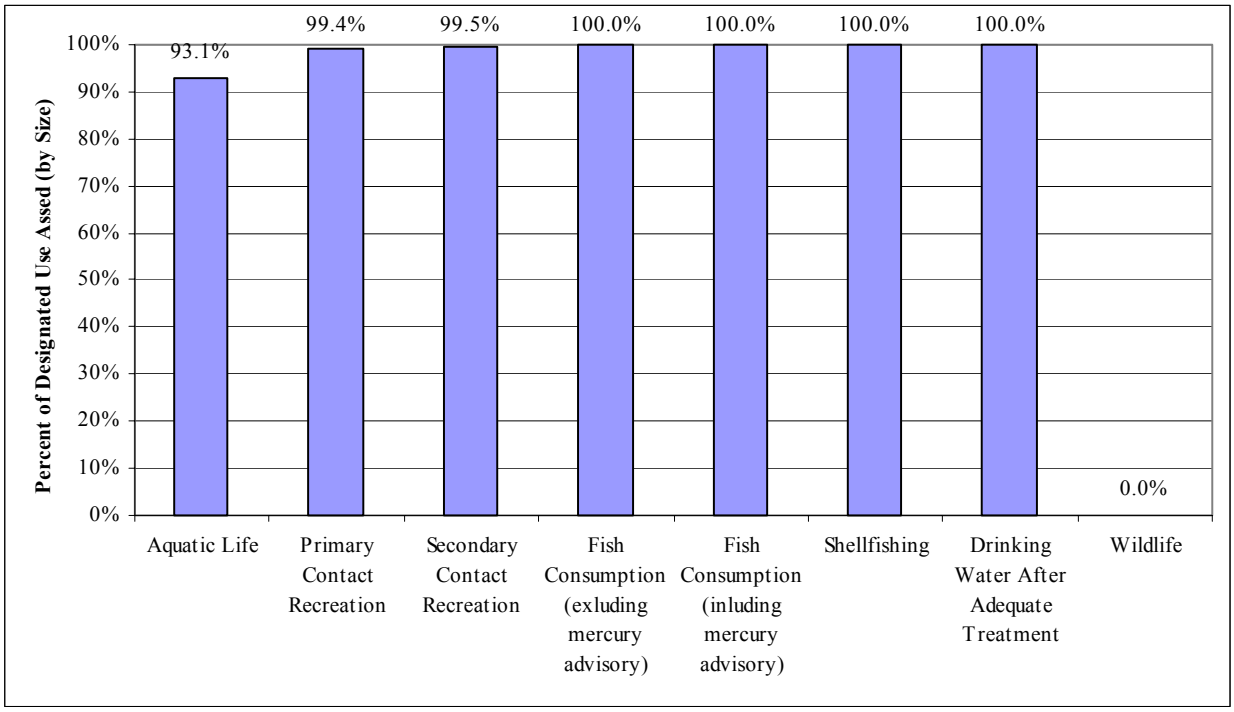
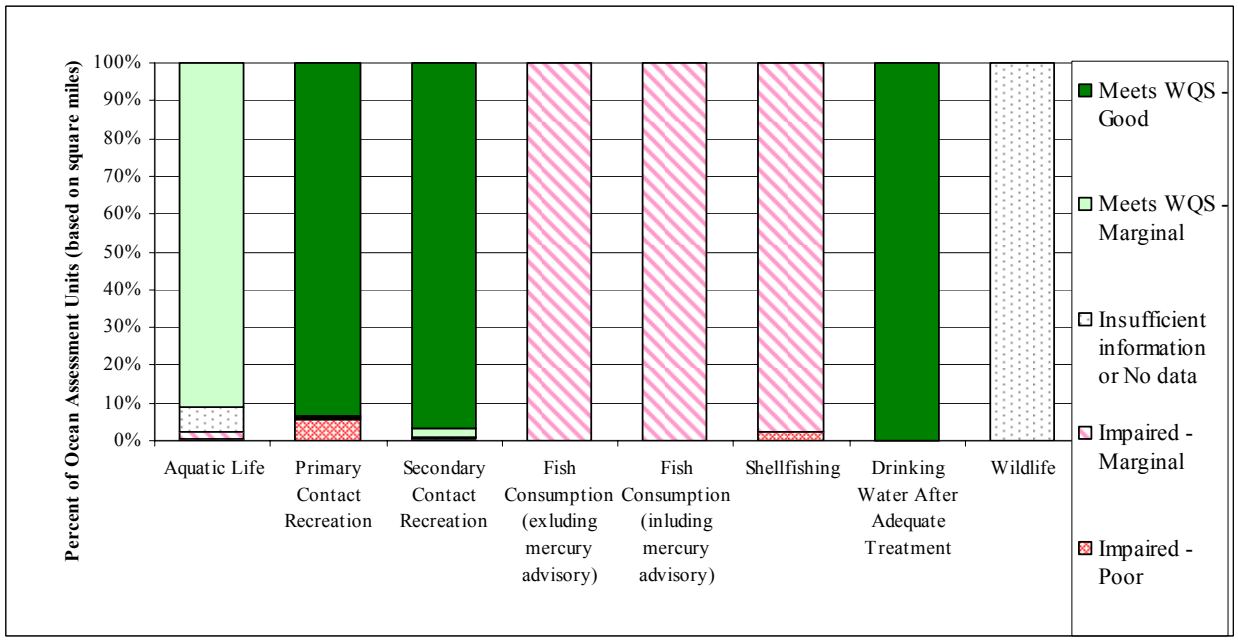


Figure 24: Ocean: Individual Designated Use Support of Assessed Waters



D.3.7.2 Ocean: Causes and Sources of Impairment

Table 29 shows the total square miles of ocean waters within state jurisdiction impaired or threatened by various pollutants and nonpollutants (i.e., causes of impairment).

Table 29: Ocean: Causes of Threatened or Impairment Status

Rank	Impairment	Total Size (Square Miles)	Number of AUs
1	Dioxin (including 2,3,7,8-TCDD)	70.060	25
2	Mercury	70.060	25
3	Polychlorinated biphenyls	70.060	25
4	Enterococcus	4.249	13
5	Fecal Coliform	1.797	8
6	BOD, Biochemical oxygen demand	1.250	1

Table 30 shows the total square miles of ocean waters within state jurisdiction impaired or threatened by various sources of impairment.

Table 30: Ocean: Sources of Threatened or Impairment Status

Rank	Source of Impairment	Total Size (Square Miles)	Number of AUs
1	Atmospheric Deposition - Toxics	70.060	25
2	Source Unknown	70.060	25
3	Forced Drainage Pumping	1.619	2
4	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	1.500	1
5	Municipal Point Source Discharges	1.250	1
6	Waterfowl	0.059	2
7	Unpermitted Discharge (Domestic Wastes)	0.050	1
8	Sewage Discharges in Unsewered Areas	0.030	1

Metals – Twenty six ocean assessment units were listed as impaired due to metals covering 70.1907 square miles. However, all of the impairments were due to a state-wide fish consumption advisory for mercury. Every ocean assessment unit was listed as impaired by mercury for fish consumption and shellfish consumption designated uses due to this advisory.

Pathogens (Bacteria) – Fifteen ocean assessment units were listed as impaired due to pathogens covering 4.4295 square miles. Enterococcus concentrations violated the water quality standards for the primary contact recreation designated use in 13 assessment units covering 4.2485 square miles. Nine of the impairments are at beaches (Bass Beach, Hampton Beach State Park, State Beach, Cable Beach, Sawyer Beach, New Castle Town Beach, Jenness Beach, Pirates Cove Beach, and Seabrook Town Beach). DES conducted investigations at two of the tidal beaches to determine bacterial sources. Chapel Brook, a source to Bass Beach, was studied and a report on the study is available on the DES beach website at: http://des.nh.gov/organization/divisions/water/wmb/beaches/beach_reports/index.htm . An investigation into bacterial sources was also conducted at New Castle beach and the report is also available at http://des.nh.gov/organization/divisions/water/wmb/beaches/beach_reports/index.htm. Three of the other impairments are in tidal streams (Parsons Creek, Little River, and Chapel Creek). Samples were collected at Parson's Creek, Little River, and Eel Pond in the summer of 2007 to examine the bacterial load. The last impaired assessment unit (Bass Beach Brook Outfall Area)

is impacted by discharges from a failing septic system in the town of Rye. The town is taking action to eliminate the source. For five assessment units (covering 0.501 square miles), the enterococcus concentrations exceeded the criteria for secondary contact recreation as well.

The shellfishing designated use was not supported because of fecal coliform concentrations in nine assessment units covering 1.9275 square miles. The source of pathogens to these assessment units was mostly unknown; however, the following specific sources have been identified: Unpermitted discharges (domestic wastes), waterfowl, and forced drainage pumping.

Toxic Organics – Twenty-six ocean assessment units were listed as impaired due to toxic organic compounds covering 70.1907 square miles. However, all of the impairments were due to a state-wide marine fish consumption advisory for polychlorinated biphenyls and dioxin. Every ocean assessment unit was listed as impaired for fish consumption and shellfish consumption designated uses due to this advisory.

D.3.8 RIVERS AND STREAMS

D.3.8.1 Rivers and Streams: Individual Designated Use Support

The following tables and figures provide a summary of the use support status for all designated uses in rivers and streams. Results are presented with and without the statewide mercury fish consumption advisory to reveal the status masked by the mercury advisory. Definitions of terms used in the tables (i.e., fully supporting, not supporting, threatened, fully supporting – marginal condition, etc.) may be found in the Consolidated Assessment and Listing Methodology (DES, 2008a) a copy of which is provided in Appendix 4.

The percent assessed for each use with and without mercury is shown in Table 31 and Figure 25. Individual use support information is shown in Table 31 and Figure 26. The table and figures present the individual use assessments with the statewide mercury fish consumption advisory is in effect (see section (D.6)) as well as assuming that the advisory did not exist. Additionally the table and figures present DES's more refined definitions of use support which give an idea of the degree of water quality standard attainment or impairment (Fully Supporting-Good, Fully Supporting – Marginal, Not Supporting – Marginal and Not Supporting -Poor).

Table 31: Rivers and Streams: Individual Designated Use Support

Designated Use	Total	Total Assessed	Fully Supporting (FS) = Attaining Water Quality Standards			Not Supporting (NS) = Not Attaining Water Quality Standards = Impaired			Threatened	Insufficient Data and Information
			FS - Good	FS - Marginal	FS - Total	NS - Marginal	NS - Poor	NS - Total		
Aquatic Life										
Miles	9,658.5	2,585.5	62.0	43.3	105.2	1,245.1	1,235.2	2,480.3	36.7	7,073.0
% of Total	100.0%	26.8%	0.6%	0.4%	1.1%	12.9%	12.8%	25.7%	0.4%	73.2%
% of Assessed		100.0%	2.4%	1.7%	4.1%	48.2%	47.8%	95.9%	1.5%	
Fish Consumption (excluding mercury advisory)										
Miles	9,658.5	9,658.5	0.0	9,640.0	9,640.0	18.2	0.4	18.5	0.0	0.0
% of Total	100.0%	100.0%	0.0%	99.8%	99.8%	0.2%	0.0%	0.2%	0.0%	0.0%
% of Assessed		100.0%	0.0%	99.8%	99.8%	0.2%	0.0%	0.2%	0.0%	
Fish Consumption (including mercury advisory)										
Miles	9,658.5	9,658.5	0.0	0.0	0.0	9,658.2	0.4	9,658.5	0.0	0.0
% of Total	100.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
% of Assessed		100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	
Shellfishing (Not Applicable)										
Miles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% of Total										
% of Assessed										
Primary Contact Recreation										
Miles	9,658.5	1,732.4	459.3	375.3	834.6	306.5	591.3	897.8	21.0	7,926.1
% of Total	100.0%	17.9%	4.8%	3.9%	8.6%	3.2%	6.1%	9.3%	0.2%	82.1%
% of Assessed		100.0%	26.5%	21.7%	48.2%	17.7%	34.1%	51.8%	1.2%	
Secondary Contact Recreation										
Miles	9,658.5	1,719.2	1,027.9	573.8	1,601.7	52.1	65.4	117.5	0.0	7,939.3
% of Total	100.0%	17.8%	10.6%	5.9%	16.6%	0.5%	0.7%	1.2%	0.0%	82.2%
% of Assessed		100.0%	59.8%	33.4%	93.2%	3.0%	3.8%	6.8%	0.0%	
Drinking Water (after Treatment)										
Miles	9,658.5	9,658.5	9,658.5	0.0	9,658.5	0.0	0.0	0.0	0.0	0.0
% of Total	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
% of Assessed		100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	
Wildlife (Not Assessed)										
Miles	9,658.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9,658.5
% of Total	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
% of Assessed										

Figure 25: Rivers and Streams: Percent Assessed by Use

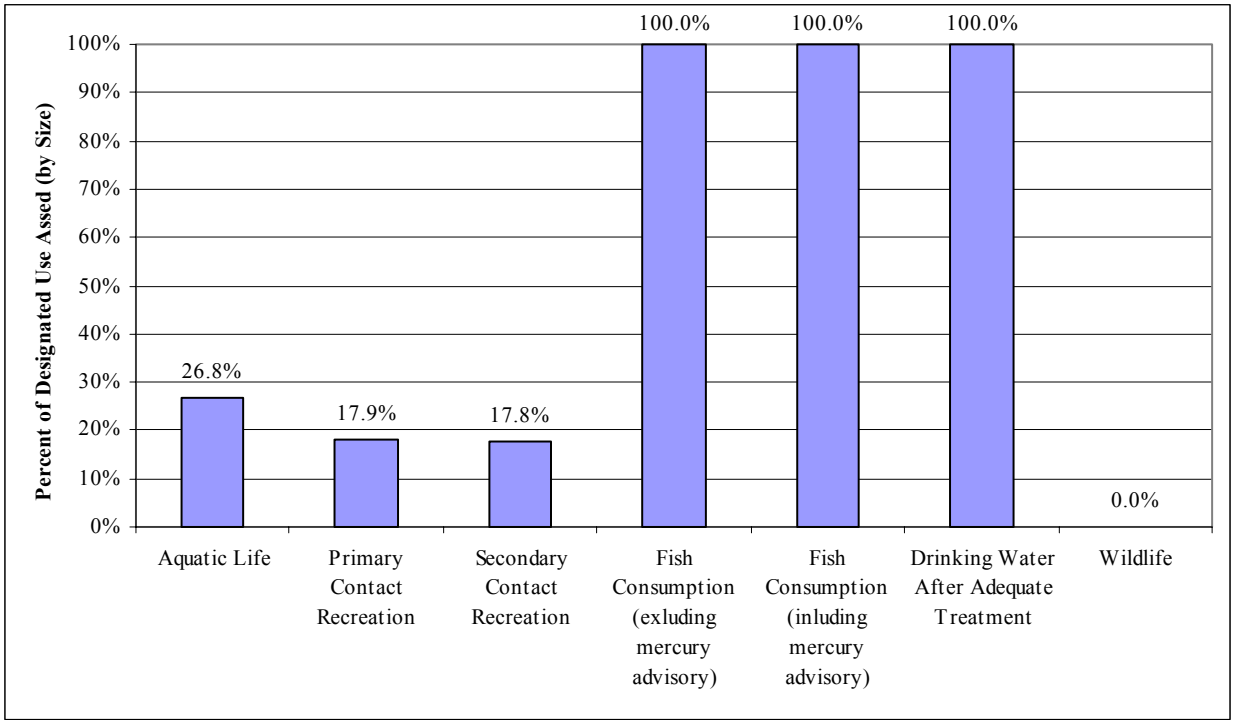
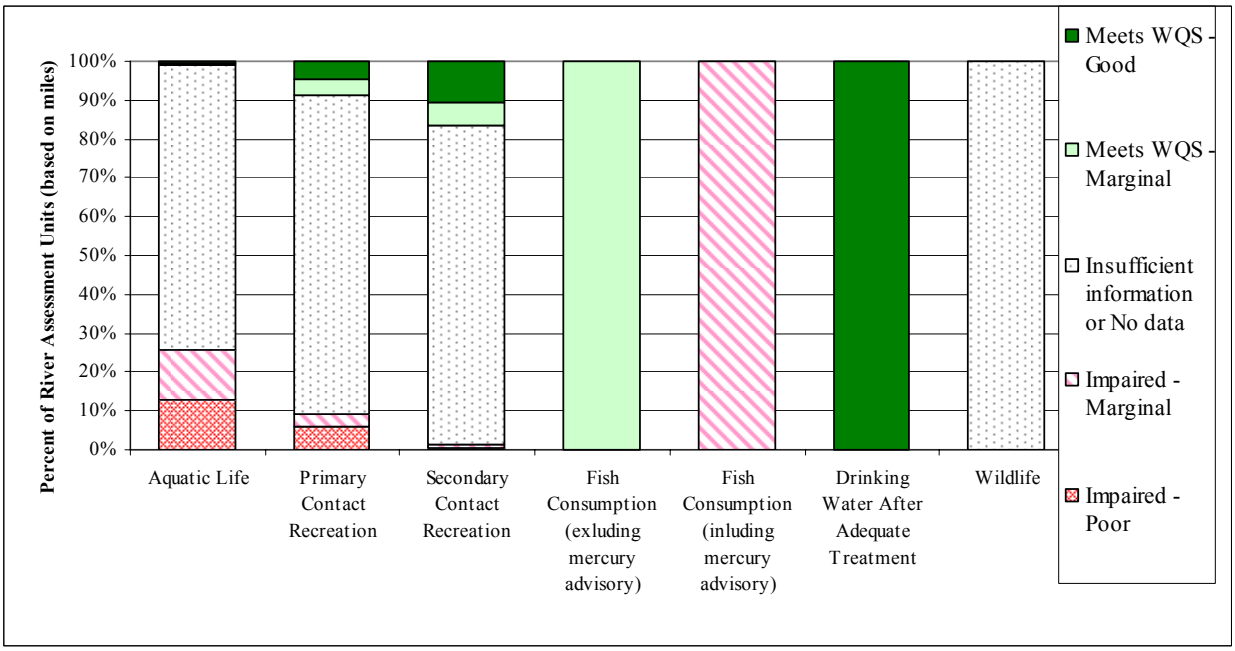


Figure 26: Rivers and Streams: Individual Use Support of Assessed Waters



D.3.8.2 Rivers and Streams: Causes and Sources of Impairment

Table 32 shows the total miles of rivers and streams impaired or threatened by various pollutants and nonpollutants (i.e. causes of impairment).

Table 32: Rivers and Streams: Causes of Threatened or Impairment Status

Rank	Impairment	Total Size (Miles)	Number of AUs
1	Mercury	9,658.51	3219
2	pH	2,098.08	528
3	Escherichia coli	868.25	223
4	Oxygen, Dissolved	380.10	91
5	Aluminum	281.48	61
6	Dissolved oxygen saturation	263.34	66
7	Benthic-Macroinvertebrate Bioassessments (Streams)	256.13	50
8	Habitat Assessment (Streams)	81.14	18
9	Lead	77.84	24
10	Chloride	63.07	24
11	Fishes Bioassessments (Streams)	60.48	11
12	Iron	47.71	15
13	Invasive Aquatic Algae	47.39	5
14	Chlorophyll-a	40.83	9
15	Other flow regime alterations	37.77	12
16	Non-Native Aquatic Plants	34.92	9
17	Copper	28.79	8
18	Phosphorus (Total)	28.78	10
19	Dioxin (including 2,3,7,8-TCDD)	18.19	10
20	Zinc	7.53	4
21	Physical substrate habitat alterations	6.58	1
22	Foam/Flocs/Scum/Oil Slicks	5.43	2
23	Creosote	3.53	1
24	Taste and Odor	3.05	1
25	Manganese	3.00	4
26	Low flow alterations	2.43	1
27	Arsenic	1.50	2
28	Ammonia (Un-ionized)	1.50	1
29	Cadmium	1.00	1
30	Chromium (total)	0.50	1
31	DDD	0.50	1
32	Sedimentation/Siltation	0.46	1
33	Turbidity	0.46	1
34	Benzo(a)pyrene (PAHs)	0.20	1

Table 33 shows the total miles of rivers and streams impaired or threatened by various sources of impairment.

Table 33: Rivers and Streams: Sources of Threatened or Impairment Status

Rank	Source of Impairment	Total Size (Miles)	Number of AUs
1	Atmospheric Deposition - Toxics	9,658.51	3219
2	Source Unknown	2,599.65	658
3	Municipal Point Source Discharges	59.79	20
4	Municipal (Urbanized High Density Area)	49.38	17
5	Combined Sewer Overflows	49.14	17

Rank	Source of Impairment	Total Size (Miles)	Number of AUs
6	Highway/Road/Bridge Runoff (Non-construction Related)	41.23	15
7	Commercial Districts (Shopping/Office Complexes)	40.90	14
8	Illicit Connections/Hook-ups to Storm Sewers	37.35	12
9	Industrial Point Source Discharge	32.77	19
10	Landfills	26.88	10
11	Freshettes or Major Flooding	25.45	4
12	Impervious Surface/Parking Lot Runoff	18.66	5
13	Unspecified Urban Stormwater	18.08	2
14	Streambank Modifications/destabilization	14.18	4
15	Contaminated Groundwater	11.57	2
16	Inappropriate Waste Disposal	8.04	1
17	Manure Runoff	7.27	3
18	Livestock (Grazing or Feeding Operations)	7.01	1
19	Impacts from Hydrostructure Flow Regulation/modification	6.86	5
20	Acid Mine Drainage	5.25	1
21	Airports	4.05	2
22	Industrial/Commercial Site Stormwater Discharge (Permitted)	4.05	2
23	RCRA Hazardous Waste Sites	3.53	1
24	Channelization	3.05	1
25	Unpermitted Discharge (Industrial/commercial Wastes)	2.73	2
26	Flow Alterations from Water Diversions	2.43	1
27	Unpermitted Discharge (Domestic Wastes)	2.38	1
28	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	2.01	2
29	Habitat Modification - other than Hydromodification	1.27	1
30	Salt Storage Sites	0.53	1
31	Highways, Roads, Bridges, Infrastructure (New Construction)	0.46	1
32	Animal Feeding Operations (NPS)	0.30	1
33	Petroleum/natural Gas Activities	0.20	1
34	Pollutants from Public Bathing Areas	0.01	1

Algae – Nine riverine assessment units covering 40.8 miles are listed as threatened or impaired due to algae . The majority of the river miles were listed based on a DES calibrated water quality model for the upper Contoocook River; in addition there were measured exceedances in Jaffrey. The Contoocook River impairment is principally associated with Municipal Point Source Discharges. The probable source is listed as unknown for the other algae listings on the Merrimack River in Nashua, the Ashuelot River in Winchester, and Berry's River in Rye.

Biological Integrity – For the 2008 cycle the new Cold Water Fish Index of Biological Integrity was used to make assessments in rivers. Sixty-one assessment units covering 312.9

miles are listed as impaired due to degraded Biological Integrity with 50 AUs (256.1 miles) based on Benthic-Macroinvertebrate Bioassessments (Streams) ,11 AUs (60.5 miles) based on Fishes Bioassessments (Streams) , and 18 AUs (81.1 miles) based on Habitat Assessment (Streams) .

Land development has been identified as the probable source for a collection of the impaired waters;

- Kelly Brook, Plaistow due to Municipal (Urbanized High Density Area) and Unspecified Urban Stormwater
- Policy Brook, Salem due to Municipal (Urbanized High Density Area)
- Beaver Brook, Derry due to Municipal (Urbanized High Density Area)
- Gues Meadow Brook, Loudon due to Impervious Surface/Parking Lot Runoff, Habitat Modification - other than Hydromodification, and Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)
- Paul's Brook, Portsmouth due to Municipal (Urbanized High Density Area)
- Hodgson's Brook, Portsmouth due to Municipal (Urbanized High Density Area)
- Reservoir Brook, Durham due to Municipal (Urbanized High Density Area)
- College Brook, Durham due to Municipal (Urbanized High Density Area)
- Berry Brook, Dover due to Municipal (Urbanized High Density Area)

The source of the impairment for the remainder of the waters due to degraded Biological Integrity is unknown.

Metals – With the statewide fish consumption advisory due to mercury, metals are the leading cause of impairment in rivers. In the absence of the fish consumption advisory, metals are the fourth leading cause of impairment after pH, pathogens, and oxygen depletion. Excluding mercury, impairment to Aquatic Life Use by metals has been documented in 92 assessment units covering 369.9 miles of rivers. Specific impairments to Aquatic Life Use by metals are discussed below.

Aluminum accounts for metals impairments ion 61 AUs covering 281.5 miles. The source for the majority of the aluminum impairments is unknown. In some areas the aluminum may be associated with increased mobilization due to low pH. At the former Pease Air Force base these is ongoing work to remediate aluminum impairments in Knight Branch (0.56 mile) Pickering Brook and Flagstone Brook, (2.28 miles) from historic landfills and Lower Grafton Brook (0.5 mile) from Industrial Point Source Discharges. Work by the Superfund Program (CERCLA) at the former Pease Air Force Base is detailed at http://des.nh.gov/organization/divisions/waste/hwrb/fss/superfund/summaries/pease.htm. Ore Hill Brook in Warren (5.25 miles) is impaired by Acid Mine Drainage. Remediation by the US Forest Service (USFS) at Ore Hill Brook began in 2006 with stabilization of the tailings pile. Initial results have clearly shown dramatic reductions in the aluminum concentrations but levels have not yet dropped below water quality standards. The Unnamed Brook to Pearly Lake that receives Effluent from Franklin Pierce University WWTF. There are no measured instream concentrations exceeding water quality criteria but the WWTF is in significant non-compliance in regards to their aluminum NPDES permit limit. Work is underway to re-route the outfall so it does not flow into Pearly Lake and to bring the treatment facility into compliance with their permit limit. This is a compliance issue.

Cadmium accounts for one AU covering one mile on Peverly Brook at the former Pease Air Force base Work is ongoing to remediate historic landfill activities.

Chromium (total) accounts for one AU covering 0.5 mile on Lower Grafton Brook at the former Pease Air Force base. The source is listed as historic Industrial Point Source Discharges. Work is ongoing to remediate this site.

Copper accounts for eight AUs covering 30.21 miles. Lower Grafton Brook at the former Pease Air Force base has ongoing work to remediate Industrial Point Source Discharges. Ore Hill Brook in Warren (5.25 miles) is impaired by Acid Mine Drainage which the USFS working on to restore. The source of copper in the Contoocook River in Hopkinton (0.78 mile) and the Connecticut River in Hinsdale (5.99 miles) is unknown. There are three sites that are listed as threatened based on exceedances of NPDES permit conditions at wastewater treatment facilities (WWTFs) and not instream concentrations. Since NPDES / state discharge permits are enforceable documents these are compliance issues. Additionally, since the copper threshold in the NPDES permits are based upon 7Q10 flow it is unlikely that instream exceedances occur at anything but low flow conditions. The affected river areas are,

- Cocheco River, Farmington - 5.1 mile (Farmington WWTF),
- East Branch Pemigewasset River, Woodstock - 0.8 miles (Lincoln WWTF), and
- Johns River, Dalton - 6.1 miles (Whitefield WWTF).

Iron accounts for impairments on 15 AUs covering 47.7 miles. For six of the AUs the source of the pollutant is unknown. With regards to the others, Catamount Brook in Goffstown (2.38 miles) is impaired by unpermitted discharges from a Pig Farm which DES is investigating. Landfill leachate causes iron impairments in the six AUs discussed next. An iron TMDL for Williams Brook, Northfield (7.39 miles) was approved by EPA in September 2002. The following three landfills already have DES Groundwater Management and Release Detection Permits:

- Derry Landfill (capped in 1986) impacts the Beaver Brook, Shields Brook, Ayers Brook AU (4.86 miles) in Londonderry,
- Bethlehem Landfill discharges to an Unnamed tributary to the Ammonoosuc River (0.1 mile)in Bethlehem,
- The Old Turnkey Landfill in Danbury discharges to the Blackwater River via Fraizer Brook (5.07 miles).

The Dover Municipal Landfill discharges to an unnamed tributary to the Cocheco River in Dover (0.15 mile) with no permit in place.

At the former Pease Air Force Base Pickering and Flagstone Brooks in Newington (2.28 miles) are listed as impaired for iron due to discharges from historic landfills. Finally, at the former Pease Air Force Base, historic Industrial Point Source Discharges are listed as the probable cause of iron impairment in Lower Grafton Brook (0.5 mile) and Railway Brook (0.5 mile).

Lead accounts for impairment in 24 AUs covering 77.8 miles. For 21 of the AUs (64.1 miles) the source of the lead is listed as unknown. At the former Pease Air Force Base, the source of lead in Lower Grafton Brook (0.5 mile) is listed as historic Industrial Point Source Discharges. In Hooksett, lead violations in Black Brook (8 miles) are believed to be from groundwater discharges associated with a skeet shooting club; work is ongoing with the DES Hazardous Waste Remediation Bureau to clean up this site. Lead violations in Ore Hill Brook in

Warren (5.25 miles) are primarily due to Acid Mine Drainage. As previously mentioned efforts are underway by the USFS to restore this site.

Manganese accounts for impairments in four AUs covering three miles. Waters impaired by manganese and their probable sources (which are all related to activities at the former Pease Air Force Base), are provided below:

- McIntyre Brook (1 mile) – Airports,
- Peverly Brook (1 mile) – Landfills,
- Lower Newfields Brook (Upper Hodgson Br) (0.5 mile) - Industrial Point Source Discharge, and
- Lower Grafton Brook (0.5 mile) - Industrial Point Source Discharge.

Mercury is the leading cause of impairment for the use of fish consumption due to the statewide mercury fish consumption advisory which applies to all surface waters. Atmospheric deposition is listed as the source of this mercury contamination. New Hampshire's efforts to reduce mercury loading are described in Section C.2.13. Mercury also impairs the use of aquatic life support in three AUs covering 3.5 miles. Two of the AUs with mercury values exceeding the water quality criteria are the Contoocook River in Hopkinton and Black Brook in Manchester. In neither case is the source known. The third mercury impaired AU is the Androscoggin River in Berlin which is attributable to seepage of elemental mercury out of the banks of the Androscoggin River from Unpermitted Discharge of Industrial/Commercial Wastes. The source of the mercury is believed to be from a former industrial facility in Berlin, New Hampshire. In September 2005, the Site was listed on the National Priorities List (Superfund).

Zinc accounts for impairments in four AUs covering 7.5 miles. At the former Pease Air Force Base, Lower Grafton Brook (0.5 mile) receives discharges from historic Industrial Point Source Discharges and Peverly Brook has ongoing work to remediate historic landfill activities. Ore Hill Brook in Warren (5.25 miles) is impaired by Acid Mine Drainage, which the USFS is in the process of remediating. Finally, the Contoocook River in Hopkinton exceeds the zinc criteria but the source is unknown.

While numerous water quality exceedances of metals criteria have been documented, the full impact of the exceedances on the biological community is unknown.

Nutrients (Macronutrients/Growth Factors) – Total Phosphorus is the nutrient of concern for this heading. Phosphorus itself is not toxic, however excess phosphorus can lead to excessive algal growth thereby affecting primary contact recreation. Evening algae respiration and fall die off leads to diminished dissolved oxygen which can also affect aquatic life use support. Consequently, excessive nutrients are linked to algae and sometimes dissolved oxygen violations. Five riverine assessment units (17.9 miles) are listed as threatened or impaired for Aquatic Life Use Support due to Total Phosphorus because of dissolved oxygen violations. Ten riverine assessment units (28.8 miles) are listed as threatened or impaired for Primary Contact Use Support due to Total Phosphorus because of algal violations. The algal and dissolved oxygen violations (which are due in part to phosphorus) are on the Contoocook River in Jaffrey, Peterborough, and Sharon and are based on either measured values and/or results of a DES calibrated water quality model for the upper Contoocook River.

The remaining four AUs shown below were listed for nutrients because of wastewater treatment facilities (WWTFs) that were in significant non-compliance with their permitted, water quality based, phosphorus effluent limit.

- Cocheco River, Farmington WWTF
- Contoocook River, Peterborough WWTF
- Sugar River, Sunapee WWTF
- Sugar River, Newport WWTF

Low Dissolved Oxygen – One hundred and five riverine assessment units (424.2 miles) are listed as impaired due to low dissolved oxygen. Some of the AUs are impaired based on the dissolved oxygen saturation criteria, some based on the dissolved oxygen concentration, and some based on both criteria.

The source of the dissolved oxygen impairment for the majority of the waters is unknown. Additional investigations are necessary on these waterbodies to identify the sources, some of which may be natural.

One-third of the dissolved oxygen impairments where the source is unknown are considered "marginal" impairments. "Marginal" impairment for dissolved oxygen means there were measured dissolved oxygen values below the water quality criteria but all such measurements were within the margin of measurement accuracy. With regard to the minimum dissolved oxygen criteria of 5 mg/L, impairments were considered marginal if the measured values were less than 5 mg/L but greater than or equal to 4.5 mg/L. The remaining two-thirds of dissolved oxygen impairments with unknown sources had one or more samples outside the measurement accuracy (i.e., one or more samples less than 4.5 mg/L).

Point discharges, landfills, and urbanized areas make up the sources of low dissolved oxygen in the remaining 16 AUs covering 50.4 miles.

Two AUs on the Salmon Falls River (1.63 miles) are still listed as impaired due to Municipal Pont Source Discharges. A TMDL for these waters was approved in 1999. Additional sampling is required before theses waters can be delisted.

One AU on the Cocheco River in Farmington (5.12 miles) is listed as impaired due to Municipal Point Source Discharges and groundwater inputs from Landfills. Water quality modeling will likely be needed in the future to help determine appropriate effluent limits for the Farmington WWTF.

One AU on the Cocheco River in Rochester (4.26 miles) is listed as impaired due to Municipal Pont Source Discharges. Since there is an enforceable NPDES / state discharge permit this is a permit compliance issue.

One AUs on the Lamprey River in Epping (3.25 miles) is still listed as impaired due to Municipal Pont Source Discharges. A TMDL for this segment was approved in 2000 and the Epping wastewater treatment facility has since been upgraded. Additional sampling is required before this AU can be delisted.

Eight riverine AUS on the Contoocook River (31.4 miles) in Jaffrey, Peterborough, and Sharon are listed as impaired by Municipal Pont Source Discharges with the three (13.5 miles) downstream most segments also impaired by an Industrial Point Source Discharge. The

upstream five AUs are impaired based on a DES calibrated water quality model while the three downstream AUs are impaired based on measured values.

Two AUs on the Sugar River in Sunapee and Newport (2.2 miles) are listed as impaired due to Municipal and Industrial Pont Source Discharges. Since there are enforceable NPDES / state discharge permits, this is a compliance issue.

One AU on the Ashuelot River in Swanzey (2.6 miles) is listed as impaired due to Municipal Pont Source Discharges. EPA recently issued a permit for the Keene WWTF with stringent effluent limits for phosphorus.

Pathogens (Bacteria) – In rivers bacteria (*E. coli*) is used to assess both primary and secondary contact recreation. Primary contact recreation includes activities like swimming where there is a high likelihood of water ingestion. Secondary contact recreation includes activities such as boating where there is typically only accidental or incidental water ingestion. Two hundred and twenty three riverine assessment units are listed as impaired due to bacteria in 868.3 miles of river. In rivers, pathogens are the third largest group of impairments behind low pH and the statewide fish consumption advisory due to atmospheric deposition of mercury.

Primary Contact Recreation is impaired by unknown sources in the majority of the bacteria impaired river segments (223 AUs , 868.3 miles). One-third of those segments (81 AUs, 289.3 miles), are marginal impairments while 142 AUs (579.0 miles) are considered more sever impairments. Bacteria impairments are severe when one or more samples are more then two times the water quality criteria.

Secondary Contact Recreation is impaired by unknown sources in the majority of the bacteria impaired river segments (32 AUs, 114.5 miles). Three-fifths of those segments (18 AUs, 52.1 miles), are marginal impairments while 14 AUs (62.4 miles) are more sever impairments.

Animal Feeding Operations are the suspected source to one AU (0.3 mile) at the Stuart Dairy Farm. There is an ongoing 319 project at the farm installing a series of best management practices that are anticipated to remedy the source.

Combined sewer overflows (CSOs) directly impact 17 AUs covering 49.1 miles on the following rivers:

- Androscoggin River in Berlin,
- Nashua River in Nashua,
- Piscataquog River in Manchester,
- Merrimack River in Manchester and Nashua,
- Mascoma River and Great Brook in Lebanon, and
- Connecticut River in Lebanon and Plainfield.

Efforts to control CSOs are well underway in each community (see section C.2.2.2). In general, all CSO communities are either implementing a plan to eliminate remaining CSOs or have undertaken studies for their eventual abatement.

Illicit discharges directly impact 12 AUs covering 37.4 miles of rivers. Many of listed AUs are on the Androscoggin impacting Berlin, Gorham, and Shelburne as well as Dead River/Jericho Brook in Berlin. In 1991 Berlin began investigating and disconnecting cross connections. This work was completed in 1999 but confirmation sampling has not been conducted.

In 2007, efforts initiated by the DES Watershed Management Bureau resulted in the elimination of five illicit discharge connections (four in the Coastal and one in the Merrimack River watersheds). The bureau estimates that there are six to eleven illicit discharges remaining in the Coastal Watershed.

Livestock (Grazing or Feeding Operations) from a dairy farm is the listed source of bacteria to Axe Handle Brook (seven miles) in Rochester. The dairy farm has been working closely with NHDES 319 (section C.2.3) and NRCS staff installing BMPs to alleviate the runoff issues.

Manure Runoff in Marlow has impaired two Unnamed Streams to Sand Pond (0.36 mile) Additionally, Crane Brook in Acworth (6.91 miles) is impaired due to Manure Runoff. Both sites are subject to ongoing complaint investigations.

Pollutants from Public Bathing Areas currently only impact one riverine AU (0.01 mile) that makes up the Bean Brook Town Beach in Piermont.

Unpermitted Discharge (Industrial/commercial Wastes) and Unpermitted Discharge (Industrial/commercial Wastes) impact one, 2.4 mile AU known as Catamount Brook in Goffstown. Waste is discharged to the brook from a pig farm. Department staff are investigating and working with the landowner to remedy the situation.

Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO) are listed as the probable source of bacteria impairment in one AU (1.8 miles) known as Unnamed Brook - Governors Park Stream in Laconia. DES staff have conducting bracketed sampling during wet weather to isolate the source or sources.

Pesticides – One riverine assessment unit (0.5 mile) is listed as impaired due to pesticides. The Source is a relic Industrial Point Source Discharge to Paul's Brook in Portsmouth from the former Pease Air Force Base. Work by the Superfund Program (CERCLA) is ongoing at the former Pease Air Force Base http://des.nh.gov/HWRB/supfun.asp?theLink=pease .

pH – Five hundred and twenty eight riverine assessment units are listed as impaired due to low pH covering 2098.1 miles of river. After the statewide fish consumption advisory due to atmospheric deposition of mercury low pH is the next largest group of impairments.

Acid Mine Drainage is the primary source of pH impairment to Ore Hill Brook in Warren (5.25 miles). As mentioned previously, the remediation efforts by the USFS are underway.

The old Derry Landfill is listed as the probable source of low pH in one AU called "Beaver Brook, Shields Brook, Ayers Brook" in Londonderry (4.9 miles). The landfill was capped in 1986 and has an enforceable Groundwater Management Permit in place.

The listed source for the remaining 2088.8 miles of pH impaired rivers is "Source Unknown". This is because pH in impoundments is a function of many factors such as surficial geology and habitat, underlying geology, acidified precipitation, and system productivity (a seasonal component) and it is not currently known which are the primary contributors to low pH.

Toxic Organics – Twelve riverine assessment units are listed as impaired due to toxic organics covering 21.9 miles of river.

Dioxin (including 2,3,7,8-TCDD) had been released from Industrial Point Source Discharges (paper mills) in Berlin until 1994 when the mill changed its bleaching process. The downstream ten AUs (18.2 riverine miles) of the Androscoggin River in Berlin Gorham, and Shelburne are still under a fish consumption advisory for dioxin to primarily to historic discharges. It is expected that fish tissue concentrations will eventually decline to levels that will allow the dioxin fish consumption advisory to be rescinded.

Creosote from a wood treatment site in Nashua has resulted in contaminated groundwater at a RCRA Hazardous Waste Site on the Merrimack River in Nashua (3.5 miles). Free product is entering the river. DES is working with the owner to remediate the contamination.

Benzo(a)pyrene (PAHs) remaining from Petroleum/natural Gas Activities impairs Mill Creek in Keene (0.2 mile). PSNH and KeySpan submitted a work plan for remediation of the sediments in the southern portion of Mill Creek in 2006.

Other Impairments – Fifty-four riverine assessment units (187.5 miles) are listed as impaired due to other pollutants not yet discussed above.

Arsenic impairs two AUs for aquatic life use at the former Pease Air Force Base. The probable sources of impairment in Lower Grafton Brook (0.5 mile) are discharges from historic Industrial Point Source Discharges. In Peverly Brook (1 mile) work is ongoing to remediate the impacts of arsenic from historic landfill activities associated with the former Air Force Base.

Chloride has been documented to exceed water quality criteria in 24 AUs impacting 63.1 river miles for aquatic life use. The largest source of chlorides in these rivers is presumed to be deicing activities on state roads, municipal roads, private roads and commercial parking lots, as well as the discharge from septic systems and water-softening systems. An estimated 35.9 miles are considered severe, or twice the water quality criteria and 27.2 miles are considered marginal, (i.e., water quality criteria is exceeded by less than two times the water quality criteria). TMDLs have been drafted for the following four AUs and are expected to be submitted to EPA for final approval in 2008:

- Unnamed Brook - to Cobbetts Ponds, Windham, 1.5 miles, Severe,
- Unnamed Brook to Western Embayment , Windham, 0.5 mile, Marginal,
- Beaver Brook, Shields Brook, Ayers Brook, Londonderry, 4.86 miles, Marginal, and
- Policy Brook, Salem, 10.55 miles, Severe.

The other 20 documented riverine chloride impairments are located on,

- Wildcat Brook, Jackson, 0.53 miles, Severe,
- Wheelwright Creek, Stratham, 3.43 miles, Marginal,
- College Brook, Durham, 1.9 miles, Marginal,
- Reservoir Brook, Durham, 1.35 miles, Severe,
- Pickering Brook, Portsmouth, 4.27 miles, Marginal,
- Hodgsons Brook, Portsmouth, 1 mile, Marginal,
- Lower Newfields Brook (Upper Hodgson Br), Portsmouth, 0.5 mile, Marginal,
- Pauls brook, Portsmouth, 0.5 mile, Severe,
- Borthwick Ave Brook, Portsmouth, 1.45 miles, Marginal,
- Newfields ditch, Portsmouth, 1.15 miles, Marginal,
- Catamount Brook, Goffstown, 2.38 miles, Severe,

- Unnamed Brook - from Goldfish Pond to Dorrs Pond, Manchester, 0.33 mile, Marginal,
- Baker Brook, Manchester, 1.07 miles, Marginal,
- Little Cohas Brook, Londonderry, 3.05 miles, Severe,
- South Perimeter Brook, Londonderry, 1 mile, Severe,
- McQuade Brook, Bedford, 5.99 miles, Marginal,
- Policy Brook, Salem, 0.86 mile, Severe,
- Beaver Brook, West Running Brook, Derry, 8.45 miles, Severe,
- Beaver Brook, Londonderry, 5.7 miles, Severe, and
- Unnamed Brook - to Herrick Cove Sunapee Lake, New London, 0.75 mile, Marginal.

Listed sources for the chloride impairments include, Commercial Districts (Shopping/Office Complexes), Highway/Road/Bridge Runoff (Non-construction Related), Impervious Surfaces/Parking Lot Runoff, Industrial/Commercial Site Stormwater Discharge (Permitted), Municipal (Urbanized High Density Area), Salt Storage Sites, and Unknown Source.

Foam/Flocs/Scum/Oil Slicks cause impairment in two AUs (5.4 miles). Unpermitted Discharge (Industrial/commercial Wastes) and Unpermitted Discharge (Industrial/commercial Wastes) impact one, 2.4 mile AU known as Catamount Brook in Goffstown where a pig farm is the main source of pollution. As mentioned above, DES staff are investigating and working with the landowner to remedy the situation. Probable sources of violations in Little Cohas Brook in Londonderry (3.1 mile) are Industrial/Commercial Site Stormwater Discharges (Permitted) which include stormwater discharges from the Manchester Boston Regional Airport. A suspect stormwater outfall pipe to the brook was recently rerouted to discharge directly to the Merrimack River. Investigations continue to determine if additional work is necessary to meet water quality standards.

Degraded habitat as determined from Habitat Assessment (Streams) is the cause of impairment in 18 AUs (81.1 miles). For all but one AU, the source of impairment is listed as unknown. However, for Gues Meadow Brook in Loudon (1.3 miles) probable sources of impairment are listed as Impervious Surface/Parking Lot Runoff, Habitat Modification - other than Hydromodification, and Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO) all of which are associated with activities at a major car racing facility (speedway).

The invasive algae *Didymosphenia geminate* (a.k.a. 'rock-snot) has resulted in the impairment of five AUs (47.4 miles) of the Connecticut River from Stewartstown to Northumberland.

Non-Native Aquatic Plants are present in nine AUs (34.9 miles). Although species like variable milfoil is predominantly seen in the slow and backwater sections of river segments it has also been seen in velocities over one foot per second. With that said, all of the more severe infestations are in slow velocity segments and the marginal infestations are in high velocity segments. Section C.2.7 describes the Exotic Species Control Program administered by the department.

Low-flow alterations due to water diversion impairs one AU (2.4 miles) of Berrys River in Barrington. This is being addressed through the DES 401 Water Quality Certification program (see section C.2.5).

Other flow regime alterations impair 12 AUs (37.8 miles). Five AUs are impaired due to Impacts from Hydrostructure Flow Regulation/Modification and include the dewatered bypass reaches of the Mad River in Campton and the North Branch of the Contoocook River in Hillsborough. On the Merrimack River the Garvins Falls Bypass, Hooksett Dam Bypass, and Amoskeag Dam Bypass, in Concord, Manchester, and Manchester respectively are impaired due to decreased or dewatered conditions. Through the 401 program (section C.2.5) minimum flow requirements have been established for these AUs. Once it is confirmed that the minimum flows are being implemented, it is expected that these AUs will be removed from the impaired waters list.

One AU on the Swift River in Albany (3.1 miles) is impaired due to geomorphic alterations resulting from the channelization effect of an undersized railroad bridge.

Two AUs (13.7 miles) are impaired on the Suncook River in Epsom due to floods in 2007 which caused the river to change course and leave 1.5 miles of river dry.

Four AUs (14.2 miles) are impaired due to streambank modification/destabilization. These impairments are the direct result of human activity and include segments of the Pemigewasset River in Woodstock, Mill Brook in Thornton, Baker River in Warren, and Cold River in Acworth. The DES Watershed Assistance Section (319) (section C.2.3) is working with partners at each site to restore these river segments.

Hueber Brook in Belmont (0.5 mile) is impaired by sedimentation/siltation as well a turbidity resulting from roadway construction. Compliance actions are underway to remedy this issue.

Taste and Odor impairs one AU (3.1 miles) located on Little Cohas Brook in Londonderry which receives discharge from the Industrial/Commercial Site Stormwater Discharges (Permitted). This includes stormwater discharges from the the Manchester Boston Regional Airport. As previously discussed a suspect stormwater outfall pipe to the brook was recently rerouted to discharge directly to the Merrimack River. Investigations continue to determine if additional work is necessary to meet water quality standards.

D.3.9 WETLANDS

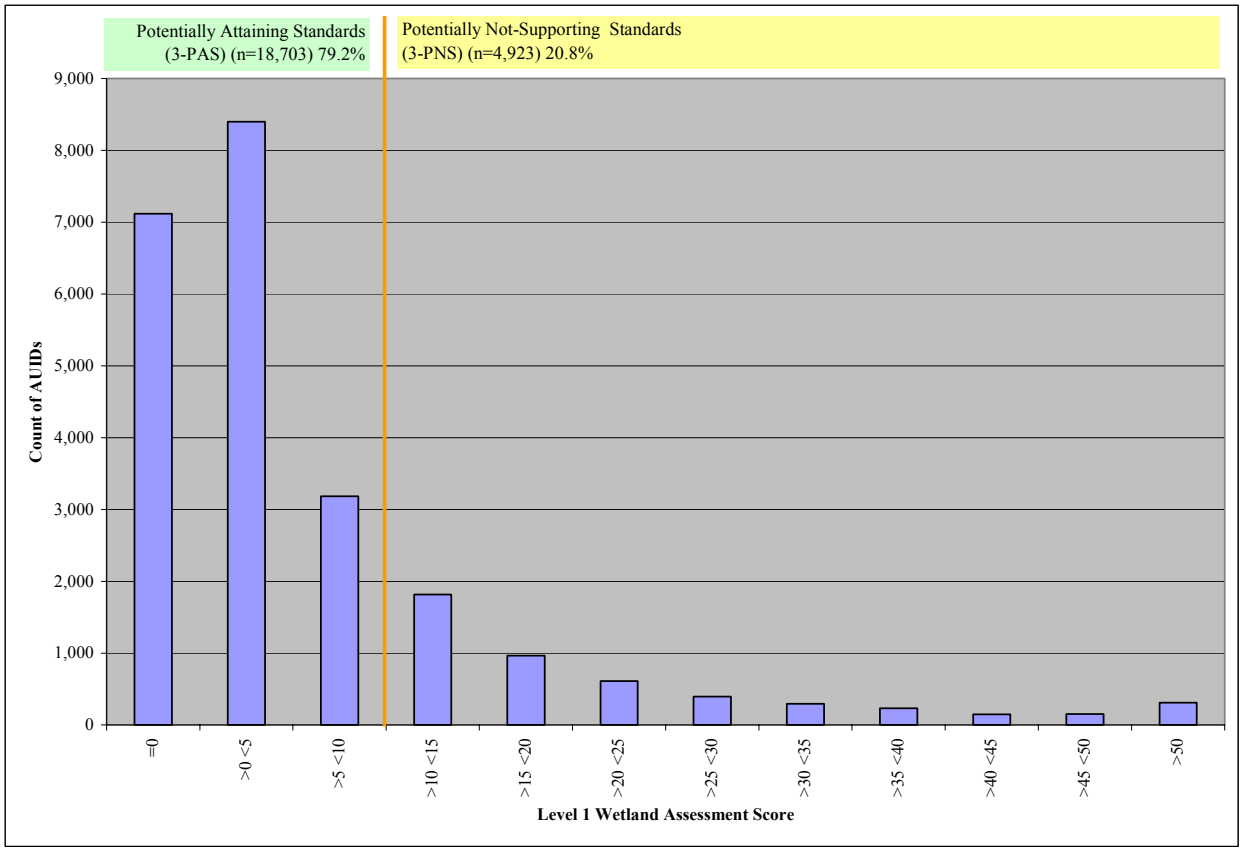
As previously reported, DES added wetlands to the Assessment Database in 2008. In all, 23,626 wetland assessment units covering 286,906 acres were added. This does not include wetlands in open water to avoid overlap with existing AUs in other waterbody types. As discussed in section C.2.16, DES developed GIS-based criteria using the characteristics of adjacent land uses. This information was used to conduct preliminary or Level 1 assessments of wetlands. Although none of the wetlands were assessed as fully supporting or not supporting this cycle, this represents a significant first step to ultimately being able to assess and report on wetland water quality.

The landscape level wetland assessment is based upon the aquatic life designated use and is intended to identify those wetlands that are likely or unlikely to provide suitable conditions for supporting a balanced, integrated and adaptive community of aquatic flora and fauna. The assessment is based on the idea that the condition of a wetlands buffer will be a major driver of the condition of the wetland. Further, we can systematically estimate the condition of the buffer based on landcover types within that buffer. Due to the inherent roughness of a landscape level analysis and that no in-wetland measurements were conducted no definitive support categories

were made. Based upon the results of the analysis the use support category "insufficient information - potentially supporting" or "insufficient information - potentially not supporting" were assigned to each assessment unit.

Figure 27 shows the distribution of the resulting scores from the Level 1 assessment. No wetlands were assessed as fully support or not supporting. A total of 18,909 (80.0%) wetland assessment units were assessed as insufficient information - potentially supporting and 4,717 (20.0%) as insufficient information - potentially not supporting. The methodology used to create the wetland assessment units and conduct the Level 1 assessment are detailed in Appendix 36: Level 1 Landscape Level Wetlands Assessment. The Level 1 assessment is a huge first step towards ultimately being able to develop criteria and a methodology for definitively assessing wetlands as fully supporting or not supporting.

Figure 27: Distribution of Level 1 Wetland Assessment Scores.



D.4 PROBABILISTIC ASSESSMENT SUMMARIES

D.4.1 OVERVIEW

One of the goals of Section 305(b) of the CWA is to assess the water quality status of all surface waters. To assess a large population such as surface waters, there are two generally accepted data collection schemes. The first is a census which requires examination of every unit in the population (i.e., site specific assessments or SSA). This, however, is usually very

expensive and often impractical. The assessment results presented in section D.3, are based on SSAs.

A more practical and economic approach is to conduct a sample survey which involves sampling a portion of the population through probability (or random) sampling. Random sampling ensures that no particular portion of the population being sampled is favored (or biased) over another. Results of sample surveys can be used to make statistically based inferences (i.e., probabilistic assessments) about the condition of the population as a whole. For example, if a sample survey was conducted on lakes and 30 percent of the random samples indicated aquatic life use impairment, it could be stated that 30 percent of the all lakes were impaired for aquatic life. Another benefit of sample surveys is that statistical analyses can then be conducted to determine the margin of error or confidence limits in the assessment.

Probabilistic assessments are most useful for Section 305(b) reporting purposes because they can provide a general overall idea of the condition of an entire waterbody type (i.e., all rivers or lakes) which might otherwise be impossible to do using the census approach. General rules for conducting and using probabilistic assessments for surface water quality assessments in New Hampshire, include the following.

- Probability assessments shall be conducted in accordance with accepted statistical practices.
- Sampling shall be based on a random sampling design.
- Sample surveys should be designed to produce an estimate of the percent of the resource (e.g., all lakes) in any use support category (e.g., fully supporting, not supporting, etc.) that are no more than +/- 20 percent at the 95 percent confidence limits.
- Criteria for determining use support shall be in accordance with the Consolidated Assessment and Listing Methodology (DES, 2008) with the exception of the minimum number of samples required. That is, when conducting probabilistic assessments, each random sample can, by itself, be used to make a discrete use support decision.
- The percentage of discrete random samples meeting each use support category can be used as an estimate of the percentage of the resource meeting each use support category. For example, if 20 percent of the discrete random samples taken in lakes indicate full support of aquatic life, then it can be reported that 20 percent of the lakes fully support aquatic life.

Probabilistic assessment results have no bearing on the Section 303(d) List other than the fact that samples collected for the probabilistic assessment can be combined with other samples within an assessment unit (AU) and assessed in accordance with the Consolidated Assessment and Listing Methodology (including the minimum sample size) to determine if the assessment unit should be included on the Section 303(d) List.

D.4.2 OVERALL PROBABILISTIC USE SUPPORT SUMMARY

New Hampshire conducted its first probabilistic assessment (PA) in 2004 for the uses of Aquatic Life and Primary and Secondary Contact Recreation in estuaries. Results and details of that assessment may be found in NHDES, 2004. Probabilistic assessments for Aquatic Life and

Primary and Secondary Contact Recreation were once again conducted for the estuaries for the 2008 assessment cycle (Appendix 23). Wadeable streams (4th order or less) were assessed for the 2006 (Appendix 24). PA results for estuaries are presented in Table 34, Figure 28, and Figure 29. PA summaries for wadeable rivers / streams are presented in Table 35, Figure 30, and Figure 31 . Further information and statistics regarding these probabilistic assessments may be found in Appendix 23 and Appendix 24 for estuaries and river/streams respectively. Figure 28 and Figure 30 compare the percent of waters assessed using site specific and probabilistic assessment methods. Before proceeding, it should be noted that while similar, the methodologies for assessments by the site specific approach and probabilistic approach is fundamentally different in terms of the data required to make support and non-support determinations. For example, under the probabilistic approach, a single dissolved oxygen grab sample can add to the total area of waters in full support or non-support. Under the site specific approach, a minimum of ten samples with no more than one sample showing an exceedance would be required to make a full support determination and at least two exceedences are needed for to assess a water as not supporting. Additionally, comparisons for rivers and streams are approximate as the two assessment methods are based on slightly different populations. That is, the percent assessed for the SSA is based on all rivers and streams (9628 miles) whereas the percent assessed for the PA is based on rivers and streams of 4th order or less (9050 miles). Though different, the river/stream miles used in the PA represent 94 percent of the total miles used in the SSA. Consequently, direct comparison of the two methods provides a reasonable estimate of the differences between the two assessment methods even though the populations are a little different.

As expected, Figure 28 and Figure 30 show that a higher percentage of surface waters can be reported as assessed using PAs as compared to SSAs. For example, Figure 28 indicates that approximately 88.3 percent of the estuaries were assessed for Aquatic Life as compared to 82.8 percent using site specific assessments. The difference is even more pronounced for the rivers/streams where approximately 52.2 percent are reported as assessed for Aquatic Life using PA compared to only 26.8 percent for the SSA method.

Comparisons of use support using the two methods are provided in Figure 29 and Figure 31 for estuaries and rivers/streams respectively. For the assessed uses, both figures show that PAs generally result in a higher percentage of waters that are fully supporting as compared to SSAs. This is not surprising as SSAs are usually based on water samples taken at locations and times when water quality violations are most likely to occur. Consequently SSAs are often biased towards impaired waters. By definition, PAs must be based on random samples and therefore samples are not necessarily collected under critical conditions. This removes some of the bias associated with SSAs but does not guarantee that a certain percentage of waters will meet water quality standards under the critical conditions. As a result PAs may provide a more accurate representation of the overall quality of the surface waters than SSAs (assuming there are insufficient resources to sample every surface water). For estuaries the most pronounced difference is for aquatic life where approximately 4.0 and 84.5 percent of the assessed surface waters are fully supporting based on SSA and PA methods respectively. For rivers/streams the largest difference also occurs for aquatic life with approximately 1.1 and 37.9 percent reported as fully supporting based on SSA and PA respectively.

PAs are based on statistical principles; as such, an estimate of error can be computed. The error associated with the estuary and river/ stream PAs is estimated to be less than

approximately 8 and 13 percent respectively (see Appendix 23 and Appendix 24). Even with the error, the PAs still suggest that a higher percentage of waters are fully supporting, as compared to SSA results, for most of the uses that were assessed.

Table 34: Estuaries: Comparison of Individual Use Support based on Site Specific (SSA) and Probabilistic Assessments (PA)

Designated Use	Total in State	Total Assessed	Fully Supporting (FS) = Attaining WQ Standards			Not Supporting (NS) = Not Attaining WQ Standards = Impaired			Threatened	Insufficient Data and Information
			FS - Good	FS - Marginal	FS - Total	NS - Marginal	NS - Poor	NS - Total		
Aquatic Life (SSA)										
Square Miles	17.8	14.8	0.0	0.7	0.7	1.0	13.1	14.0	6.7	3.1
% of Total	100.0%	82.8%	0.0%	4.0%	4.0%	5.3%	73.4%	78.7%	37.4%	17.2%
% of Assessed		100.0%	0.0%	4.9%	4.9%	6.5%	88.7%	95.1%	45.2%	
Aquatic Life (PA)										
Square Miles	17.8	15.8	15.1	0.0	15.1	0.7	0.0	0.7	0.0	2.1
% of Total	100.0%	88.3%	84.5%	0.0%	84.5%	3.8%	0.0%	3.8%	0.0%	11.7%
% of Assessed		100.0%	95.7%	0.0%	95.7%	4.3%	0.0%	4.3%	0.0%	
Primary Contact Recreation (SSA)										
Square Miles	17.8	15.1	3.2	0.3	3.4	0.1	11.5	11.7	0.0	2.7
% of Total	100.0%	84.8%	17.9%	1.4%	19.3%	0.8%	64.7%	65.5%	0.0%	15.2%
% of Assessed		100.0%	21.1%	1.7%	22.7%	0.9%	76.3%	77.3%	0.0%	
Primary Contact Recreation (PA)										
Square Miles	17.8	15.7	15.5	0.0	15.5	0.3	0.0	0.3	0.0	2.1
% of Total	100.0%	88.2%	86.7%	0.0%	86.7%	1.6%	0.0%	1.6%	0.0%	11.8%
% of Assessed		100.0%	98.2%	0.0%	98.2%	1.8%	0.0%	1.8%	0.0%	
Secondary Contact Recreation (SSA)										
Square Miles	17.8	14.8	10.2	0.0	10.2	1.9	2.7	4.6	0.0	3.0
% of Total	100.0%	83.0%	57.1%	0.0%	57.1%	10.7%	15.2%	25.9%	0.0%	17.0%
% of Assessed		100.0%	68.8%	0.0%	68.8%	12.9%	18.3%	31.2%	0.0%	
Secondary Contact Recreation (PA)										
Square Miles	17.8	17.0	17.0	0.0	17.0	0.0	0.0	0.0	0.0	0.9
% of Total	100.0%	95.0%	95.0%	0.0%	95.0%	0.0%	0.0%	0.0%	0.0%	5.0%
% of Assessed		100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	

Figure 28: Estuaries: Percent Assessed using Site Specific and Probabilistic Assessments

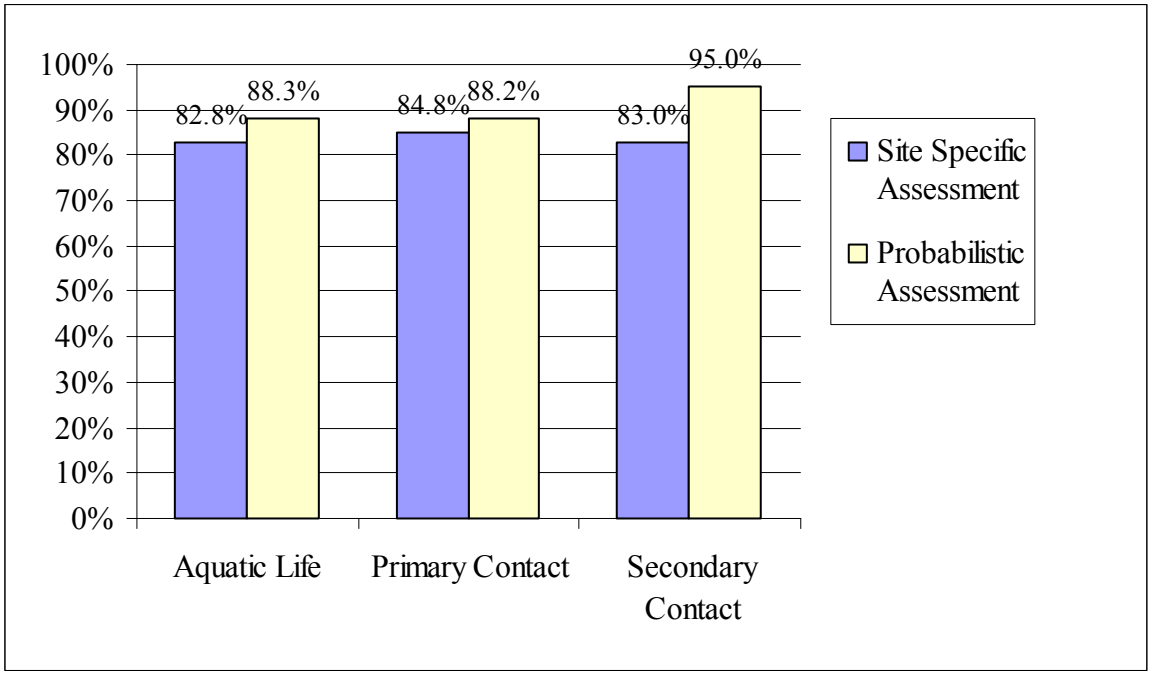


Figure 29: Estuaries: Comparison of Site Specific (SSA) to Probabilistic Assessments (PA) based on Percent Assessed

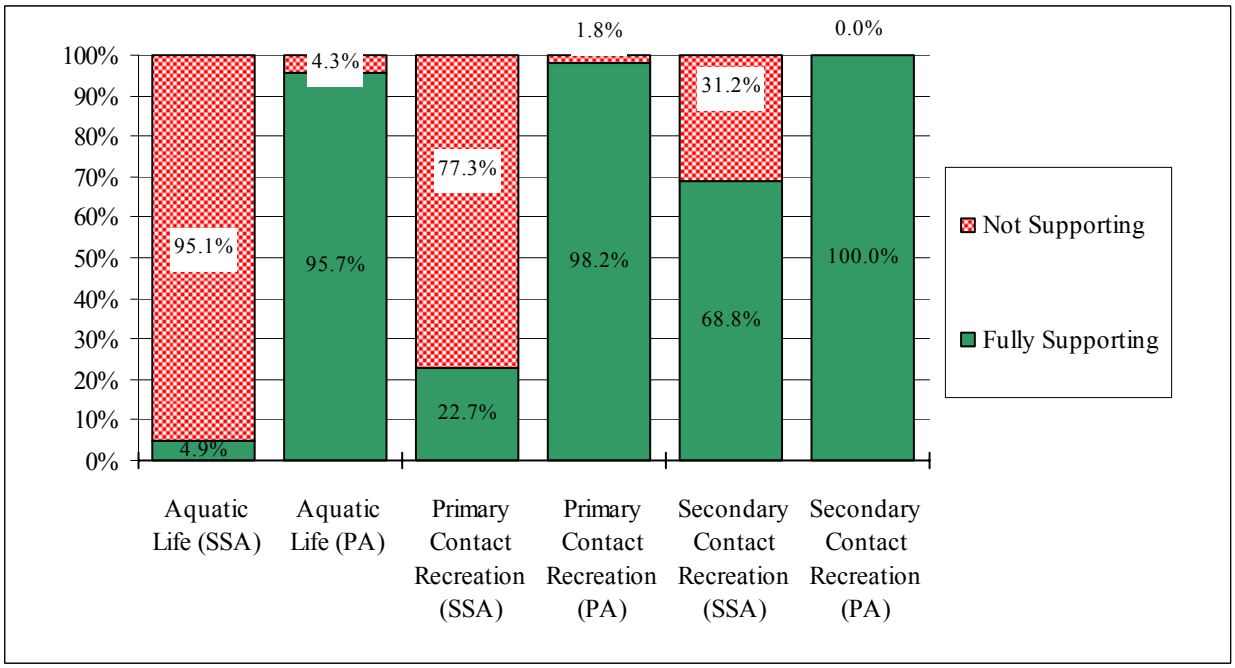
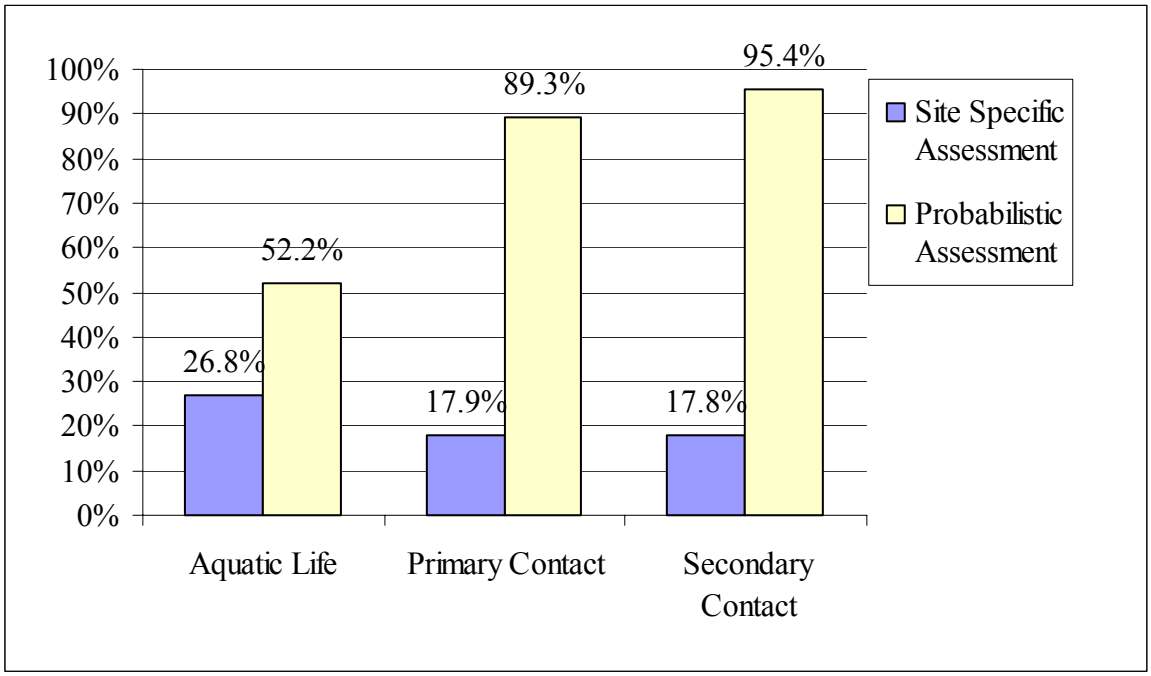


Table 35: Rivers / Streams: Comparison of Individual Use Support based on Site Specific (SSA) and Probabilistic Assessments (PA)

Designated Use	Total in State	Total Assessed	Fully Supporting (FS) = Attaining WQ Standards			Not Supporting (NS) = Not Attaining WQ Standards = Impaired			Threatened	Insufficient Data and Information
			FS - Good	FS - Marginal	FS - Total	NS - Marginal	NS - Poor	NS - Total		
Aquatic Life (SSA)										
Miles	9,658.5	2,585.5	62.0	43.3	105.2	1,245.1	1,235.2	2,480.3	38.0	7,073.0
% of Total	100.0%	26.8%	0.6%	0.4%	1.1%	12.9%	12.8%	25.7%	0.4%	73.2%
% of Assessed		100.0%	2.4%	1.7%	4.1%	48.2%	47.8%	95.9%	1.5%	
Aquatic Life (PA)										
Miles	9,050.0	4,727.0	3,429.0	0.0	3,429.0	1,298.0	0.0	1,298.0	0.0	4,323.0
% of Total	100.0%	52.2%	37.9%	0.0%	37.9%	14.3%	0.0%	14.3%	0.0%	47.8%
% of Assessed		100.0%	72.5%	0.0%	72.5%	27.5%	0.0%	27.5%		
Primary Contact Recreation (SSA)										
Miles	9,658.5	1,732.4	459.3	375.3	834.6	306.5	591.3	897.8	21.0	7,926.1
% of Total	100.0%	17.9%	4.8%	3.9%	8.6%	3.2%	6.1%	9.3%	0.2%	82.1%
% of Assessed		100.0%	26.5%	21.7%	48.2%	17.7%	34.1%	51.8%	1.2%	
Primary Contact Recreation (PA)										
Miles	9,050.0	8,083.0	7,527.0	0.0	7,527.0	556.0	0.0	556.0	0.0	967.0
% of Total	100.0%	89.3%	83.2%	0.0%	83.2%	6.1%	0.0%	6.1%	0.0%	10.7%
% of Assessed		100.0%	93.1	0.0%	93.1	6.9%	0.0%	6.9%		
Secondary Contact Recreation (SSA)										
Miles	9,658.5	1,719.2	1,027.9	573.8	1,601.7	52.1	65.4	117.5	0.0	7,939.3
% of Total	100.0%	17.8%	10.6%	5.9%	16.6%	0.5%	0.7%	1.2%	0.0%	82.2%
% of Assessed		100.0%	59.8%	33.4%	93.2%	3.0%	3.8%	6.8%		
Secondary Contact Recreation (PA)										
Miles	9,050.0	8,637.0	8,637.0	0.0	8,637.0	0.0	0.0	0.0	0.0	413.0
% of Total	100.0%	95.4%	95.4%	0.0%	95.4%	0.0%	0.0%	0.0%	0.0%	4.6%
% of Assessed		100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%		

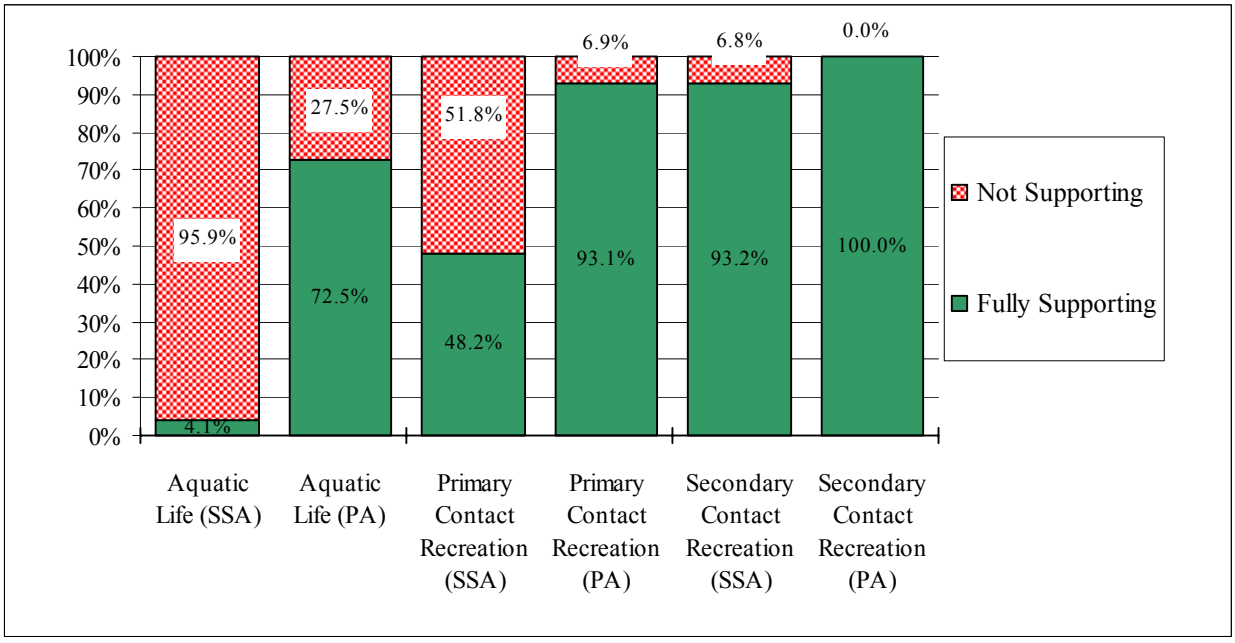
Note: Site Specific Assessment (SSA) values are based on all rivers and streams (9,658.5 total miles). Probabilistic Assessment (PA) values are based on rivers / streams that are 4th order or less (9,050 total miles).

Figure 30: Rivers / Streams: Percent Assessed using Site Specific and Probabilistic Assessments



Note: Site Specific Assessment (SSA) values are based on all rivers and streams (9628 total miles). Probabilistic Assessment (PA) values are based on rivers / streams that are 4th order or less (9050 total miles).

Figure 31: Rivers / Streams: Comparison of Site Specific (SSA) to Probabilistic Assessments (PA) based on Percent Assessed



D.5 TREND ANALYSES FOR SURFACE WATERS

A summary of trend analysis studies completed by DES for estuaries, lakes and rivers is provided in the following sections. A copy of the studies are provided Appendix 25 unless they are available on the Internet, in which case a website is provided.

D.5.1 TRENDS IN ESTUARIES

DES prepared three indicator reports for the New Hampshire Estuaries Project. These reports summarized the most recent trends in water quality, critical habitats and shellfish populations in New Hampshire's estuaries. The trends provided in these reports will be included in the state of the Estuaries Report. Information about the New Hampshire Estuaries Project is available from www.nhep.unh.edu. Major findings from each report are provided below.

Water Quality Indicators Report (NHEP, 2006a)

- Shellfish harvesting opportunities are still restricted due to bacteria concentrations in the estuary, particularly after rain storms. Dry-weather bacteria concentrations have decreased over the past 17 years. However, the concentrations have remained relatively constant for the past decade. Trend data are only available for a handful of stations during dry weather and, therefore, should not be considered representative of all areas of the estuary.
- The number of advisories at tidal and freshwater beaches in the coastal watershed is increasing. Several more years of data are needed to determine if the increasing trends are the result of new protocols adopted by the DES Beach Program in 2002. In contrast, a probabilistic survey of non-beach tidal waters does not indicate significant violations of the enterococci water quality standard in the estuary.
- The number of advisories issued for freshwater bathing beaches in the coastal watershed continues to increase. Local bacteria sources, including bathers themselves, are presumed to be the cause of the impairments.
- Available data on shellfish tissue (mussels, clams, oysters) show that the concentrations of toxic contaminants in the tissue are below FDA guidance values. All of the statistically significant trends for toxic contaminants in shellfish tissue are decreasing. However, there were no new data available for toxic contaminants in the edible tissues of finfish and lobster. Therefore, the DES fish consumption advisories for ocean finfish and lobster tomalley due to mercury, PCB and dioxin contamination (http://des.nh.gov/organization/divisions/air/pehb/ehs/hrap/index.htm) remain in effect.
- A small percentage (12 percent) of the sediments of the estuary contains toxic contaminants at concentrations that might affect the benthic community; however, impacts to the benthos have been observed in only 0.3 percent of the estuary.
- Comparisons to historical data show that dissolved inorganic nitrogen concentrations have increased in Great Bay by 59 percent in the past 25 years. During the same period, suspended solids concentrations increased by 81 percent, although there are some questions about the appropriateness of the comparison. Trends over the past 15 years since the current monitoring program began are difficult to interpret, with increasing trends evident at only a few stations for a few parameters. Any increase in nitrogen concentrations has apparently not resulted in increased phytoplankton blooms. The only increasing trend for chlorophyll-a was observed at a station with very low concentrations

already. Moreover, a probabilistic survey of the estuary in 2002-2003 found only 1.6 percent of the estuary to have chlorophyll-a concentrations greater than 20 ug/L. The total nitrogen load to the estuary in 2002-2004 was determined to be between 1,005 and 1,097 tons/year. This estimate is 30 percent lower than modeled values from the USGS SPARROW model.

- Dissolved oxygen concentrations consistently fail to meet the state water quality standards in the tidal tributaries but not in the larger embayments.
- The biological oxygen demand loading from several coastal wastewater treatment plants is increasing. However, without a water quality model, it is not possible to determine the effect of the increased BOD loads on dissolved oxygen concentrations in the estuary.

Critical Habitats and Species Indicator Report (NHEP, 2006b)

- The extent of salt marsh mapped in 2004 (5,554 ac) was lower than the NHEP goal (6,200 ac) and the estimated extent in 1990-1992 (6,452 ac). However, without further study it is not possible to know whether these differences are due to real changes in salt marsh area or different mapping methods. The discrepancies between the two datasets should be investigated in detail. Phragmites covered 133 acres of salt marsh area in 2004. There were 351 individual phragmites stands with an average size of 0.4 acres.
- Eelgrass coverage in the Great Bay has been declining since 1996 except for one good year in 2001. The cause of the decline in uncertain. Water clarity, disease, and nuisance macroalgae are all possible factors. More research is needed to understand the reasons for the decline.
- Unfragmented forest blocks greater than 250 acres constituted 51 percent of the land area in NH's coastal watershed in 2001. Only four blocks greater than 5,000 acres remained as of 2001.
- The populations of critical species of juvenile finfish, anadromous fish, lobster and waterfowl remain similar to previous observations. The NHEP has not set management goals for these populations.
- Habitat restoration is proceeding at an uneven pace. Excellent progress is being made toward the goal of restoring 300 acres of salt marsh by 2010. The NH Coastal Program has managed 279 acres of salt marsh restorations since 2000 (93 percent of goal). Oyster and eelgrass restorations are proceeding more slowly. UNH has completed five oyster bed restoration projects totaling 3.18 acres (16 percent of the goal). UNH has also completed 1.75 acres of successful eelgrass restorations (3.5 percent of the goal), along with a 5.5 acre eelgrass transplant for mitigation.

Shellfish Indicator Report (NHEP, 2005)

- Both the oyster and clam populations are at or are approaching their lowest values in the historical record. Harvestable oyster standing stock in 2004 was only 11 percent of the NHEP goal of 50,000 bushels and 5 percent of the maximum observed standing stock in 1993. Moreover, historical records indicate that much of the oyster fishery had already been lost before 1993 (Jackson, 1944). Harvestable clam standing stock in 2003 was close to the historical lows observed during crashes of the fishery in 1978 and 1987. Trends over time indicate that the clam populations have followed a cyclical pattern of boom and bust. In contrast, the oyster populations appear to be experiencing a slow decline.

- Oyster and clam populations are plagued by persistent diseases and predation. Between 4 and 20 percent of the oysters in Great Bay and clams in Hampton Harbor are heavily infected by protozoan pathogens or sarcomatous neoplasia (a form of leukemia), respectively. Green crab populations in Hampton Harbor, which prey on juvenile clams, have fluctuated over the past 27 years but no long-term trend is evident. The green crab is an invasive species which was introduced from Europe and currently exists along the Atlantic coast from Nova Scotia to Delaware.
- The number of people taking part in recreational shellfishing activity is decreasing. Oyster and clam harvesting license sales have steadily fallen since the 1980s. The current number of license holders is approximately 12 percent of the number from license holders in 1981.

D.5.2 TRENDS IN LAKES

Acid rain related trends and trophic trends for lakes and ponds are presented in section D.3.6.3. In addition DES has completed three other reports related to trend analysis in lakes (see Appendix 25). The primary purpose of the reports was to evaluate the statistical power for trend detection with the existing sampling design. In some of the reports, the trends in water sampling data were evaluated to confirm the power analysis results. The main conclusions and recommendations from these reports are listed below.

<u>Power Analysis for the Acid Lake Outlet Monitoring Program (7/17/03)</u>

- Using the existing sampling scheme of collecting two samples each year, pH, conductivity, calcium, and sulfate have sufficient power to detect "important trends" with 10 years of data and alkalinity can detect important trends with 20 years of data (maybe in as few as 15 years).
- Lakes that are sampled once per year will have sufficient power to detect "important trends" after 20 years.
- None of the parameters have sufficient power to detect trends after 5 years.
- Increasing the sample size to three samples per year does not add enough statistical power to justify the additional laboratory and personnel costs.
- Trend analysis on the 20 year datasets for 20 lakes identified significant trends for all parameters. In general:
  - Most lakes do not have a significant trend for pH, but the majority of those that do have increasing trends.
  - Alkalinity is increasing in most lakes and decreasing only in Granite Lake.
  - An equal number of lakes have increasing and decreasing trends for conductivity. Several lakes have strongly increasing trends.
  - Most lakes do not have a significant trend for calcium, but the majority of those that do have increasing trends.
  - Almost all of the lakes have decreasing trends for sulfate, but sulfate is increasing in Granite Lake.

<u>Power Analysis for the Volunteer Lake Assessment Program (6/30/04)</u>

- The current sampling design is only capable of detecting trends of chlorophyll-a and phosphorus if the concentrations have doubled over a decade. Monitoring these parameters five times per year instead of three would allow for managers to detect trends on the order of 50 percent increase over ten years.

- Conversely, alkalinity, Secchi depth, pH, and specific conductivity could be monitored for trend detection as effectively with one sample per year instead of three per year. However, multiple samples per year may be needed for these parameters for §305(b) assessment purposes or lake studies.

Power Analysis for the Fish Mercury Trend Monitoring Program (7/29/03)

- After the next five years of sampling, it will be possible to test for changes over time at the individual lakes. The experimental design has sufficient power to detect changes as small as 10 percent change over 5 years.

D.5.3 TRENDS IN RIVERS AND STREAMS

DES has completed two reports related to trend analysis in rivers (see Appendix 25). The primary purpose of the reports was to evaluate the statistical power for trend detection with the existing sampling design. In some of the reports, the trends in water sampling data were evaluated to confirm the power analysis results. The main conclusions and recommendations from these reports are listed below.

Power Analysis for the Ambient Rivers Monitoring Program (6/30/03)

- The ARMP should consider recording flow at the time of each sample collected. Flow has been shown by the USGS to be a significant covariate for concentration in river samples. If the variability caused by changes in flow were removed, the ARMP monitoring would have more power to detect trends.
- Using the existing sampling scheme of collecting three samples each summer season, only dissolved oxygen, hardness, temperature, total solids, and turbidity have sufficient power to detect the "important trend" with 10 years of data. None of the parameters have sufficient power to detect trends over 5 years with the existing sampling scheme.
- If it is important to be able to detect trends after 5 years, the existing sampling scheme will have to be changed to monthly sampling throughout the year. However, this sampling design will not provide sufficient power for trend detection in all the parameters. Monthly sampling throughout the year could also mask trends that only occur in the summer. For each parameter, the ARMP should decide whether summertime trends or year-round trends are the most important indicators of water quality.

Power Analysis for the Ambient Rivers Monitoring Program (8/4/04)

- There are statistically significant linear relationships between flow and 10 of the 20 ARMP parameters.
- For parameters that experience decreasing concentrations with increasing flow due to dilution, the variability in the concentrations can reduced by approximately 45 percent if changes in stream flow are taken into account.
- The existing sampling design for ARMP (3 summer samples per year) has sufficient power for detecting important trends for 5 parameters using raw concentrations. Using flow-adjusted concentrations, the program would have sufficient power for two more parameters (plus two others that are close). Therefore, on balance, stream flow coincident with ARMP trend station sampling should be measured or extrapolated from existing stream gages. The effort to gather these data for the 17 trend stations for 1990 to present

is worth the effort because it will make it possible to detect trends for some of the parameters at these stations at least 5 years earlier than they would be otherwise.

- Alkalinity and hardness could be measured less frequently while still retaining sufficient power for trend detection. Only one sample per year is needed for these parameters so long as the concentrations are adjusted for flow. Hardness samples should be collected at the same frequency as metals samples. If metals are not being measured, there is no need to measure hardness.
- A longer list of metals should be monitored if low detection limits can be achieved through clean techniques. The current list of metals misses mercury which is a Gulf of Maine priority pollutant. The RCRA 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) would provide better coverage of the toxic metals. The increased cost of monitoring the additional metals could be offset by reducing the sampling frequency for metals to once per year. In addition, total organic carbon and important ions such as chlorides, calcium, magnesium, and sulfate should be considered for the ARMP in order to better understand the effects acid rain and roadway salt application.
- At station 01-SAC, the only trends that were apparent in the 1990-2003 dataset were increasing dissolved oxygen saturation, specific conductivity, and temperature, and decreasing turbidity and zinc. The trends were apparent in both the raw and flow-adjusted concentrations.

D.6 PUBLIC HEALTH ISSUES

D.6.1 WATERS AFFECTED BY DRINKING WATER RESTRICTIONS

In 2006 and 2007, two boil orders were issued in the city of Somersworth due to unique record setting storms and associated flooding. In 2007, a boil order was also issued in the town of Andover. This was due to a water main break and was issued for precautionary reasons; the boil order was not based on bacteria sampling. Boil orders are usually not issued because of deteriorating source water quality. Most, if not all, surface waters contain bacteria in concentrations that exceed the stringent Safe Drinking Water Act (SDWA) standards. Rather, inadequate disinfection of the source water or the distribution system due either to mechanical or operator failure or unique occurrences such as major flooding, are usually the reason why bacteria is occasionally detected and why boil orders have to be occasionally issued.

D.6.2 WATERS AFFECTED BY BATHING BEACH ADVISORIES

Each year, the DES Public Beach Inspection Program inspects an estimated 165 freshwater and 16 tidal beaches for sanitary facilities, safety violations and water quality. Two to three bacteria samples are collected from each beach to assess bacteria levels for public health. Freshwater beaches are monitored for cyanobacteria and samples are collected when floating scums or colored waters are observed. If bacteria levels exceed state standards, a beach advisory is posted informing the public that the beach may not be safe for swimming due to elevated bacteria levels. The beach is re-sampled until bacteria counts meet acceptable state standards for designated beaches at which time the beach advisory is removed. A beach is closed at the discretion of the owner.

In the 2004 Section 305(b)/303(d) Report, beaches were assessed for primary contact recreation based on the issuance of beach advisories. For the 2006 cycle, beaches were assessed based on the exceedance of both the single sample maximum and geometric mean bacteria criteria. Beaches were also assessed based on the presence of a potentially toxic cyanobacteria scum.

In 2006, there were 604 freshwater beach inspections resulting in 124 *E. coli* violations of the single sample maximum criteria, six confirmed cyanobacteria exceedences and 18 preemptive violations resulting in 67 beach advisories posted. There were 299 coastal beach inspections resulting in 16 Enterococci violations of the single sample maximum criteria resulting in six coastal beach advisories.

In 2007, there were 577 freshwater beach inspections resulting in 112 E. coli violations of the single sample maximum criteria and 39 beach advisories posted. Eleven confirmed Cyanobacteria exceedences resulted in 11 freshwater beach advisories. In most cases, E. coli advisories lasted from one to three days or until a re-sample could be analyzed, while many Cyanobacteria advisories lasted several weeks. The coastal beaches were inspected 341 times and the single sample maximum criterion was violated 13 times. Only one coastal beach advisory was posted. In most cases, exceedences were caused by unknown sources; however geese and agriculture attributed to multiple advisories in 2007 at two beaches. A list of all impaired beaches including those where advisories were posted is included in Appendix 32.

D.6.3 WATERS AFFECTED BY FISH / SHELLFISH ADVISORIES DUE TO TOXICS

Surface waters identified as having aquatic life and/or public health impacts due to fish consumption advisories are presented in Table 36. In New Hampshire, fish consumption advisories are issued by the Environmental Health Program (EHP) within the New Hampshire Department of Environmental Services. A copy of a pamphlet entitled "How Safe is the Fish We Eat" is provided in Appendix 27 and is available on the web at http://des.nh.gov/organization/commissioner/p2au/pps/ms/mrpptp/index.htm. It provides a good general overview of the fish advisories, the benefits of eating fish and how individuals can reduce their health risk by following the advisory's preparation guidelines. Information on the dioxin, PCB and mercury advisories is provided below.

Androscoggin River Advisory due to Dioxin

Downstream of the paper mill in Berlin, an advisory has been in effect on the Androscoggin River since 1989 due to elevated levels of dioxin found in fish tissue samples taken in 1988. The primary source of dioxin is believed to be the paper mills in Berlin. The advisory recommends that pregnant and nursing women avoid consumption of all fish species. All other consumers are advised to limit consumption of all fish species to one to two, eight ounce meals per year, prepared according to guidelines (DHHS, 1989). In 1994, the paper mill converted its bleaching process to a much cleaner, elemental chlorine free process or ECF. As a result, dioxin measurements in mill discharge have dropped below the minimum detection level.

In accordance with conditions in their federal (NPDES) and state discharge permits, the PPA has conducted numerous fish sampling efforts since 1994. The latest sampling occurred in 2004. Unfortunately the limited number of composite samples analyzed and the inclusion of stocked fish has resulted in information that is of limited usefulness. Consequently, more fish

tissue testing will need to be conducted in the future to determine if the fish advisory can be rescinded.

Tidal Waters Advisory for Bluefish and Striped Bass due to PCBs

In 1987, New Hampshire, as well as many other northeastern states, issued a health advisory regarding consumption of coastal bluefish which may contain harmful levels of polychlorinated biphenyls (PCBs). According to the current advisory, all consumers should limit consumption of bluefish and striped bass to two meals per month. There is a current effort to develop an interstate Atlantic coastal advisory for the striped bass and bluefish based on PCBs. Due to the migratory nature of these fish, it seems appropriate to consider the fish tissue data collected by other states along the migration routes. The project is being lead by the Maine Environmental and Occupational Health Program. The advisory for consumption of bluefish and striped bass may be revised based on the outcome of this work.

Great Bay Estuarine System Advisory for Lobster Tomalley due to PCBs

New Hampshire also issued an advisory in 1991 because of PCBs found in lobsters from the Great Bay Estuarine System (GBES), which is intended to cover all estuaries north and west of Rye Harbor. According to the advisory, all consumers should avoid consumption of lobster tomalley. This advisory was issued as a result of two studies. The first study (USFW, 1989) was a joint effort by the NH Division of Public Health Services and the U.S. Fish and Wildlife Service (USFW). Soft shelled clams (160 specimens), and blue mussels (300 specimens) were collected from 18 sampling locations. Lobsters (9 specimens) were collected from the Pierce Island area in the Piscataqua River. Sediment samples were taken from four locations. The shellfish samples were analyzed for heavy metals (cadmium, chromium, copper, lead, mercury, nickel and zinc) and organic compounds (PCBs and polycyclic aromatic hydrocarbons (PAHs)). The results indicated that with few exceptions the levels of contaminants detected in shellfish and sediment were within the range of contaminants found elsewhere in New England, other regions of the United States and the world. In clams and mussels however, lead was the only contaminant found to approach or exceed the National Shellfish Program alert level of 5.0 ppm. Lobsters also displayed elevated levels of PCBs and PAHs in the viscera (tomalley). The findings of this report however were not considered sufficient to support a consumption advisory because of the limited number of samples, the observation that the contaminant levels were similar to other regions in New England, and because of the many assumptions used in the risk assessment which probably overestimated the actual risks. Further monitoring was recommended.

In response, the DHHS and the U.S. Food and Drug Administration (FDA) conducted a follow up study in 1989-1991 (DHHS, 1991) to further study how GBES shellfish may impact human health. In 1989, 30 pounds of lobsters were collected from Little Bay. Lobster tissue and tomalley were analyzed for PCBs and pesticides. Results indicated that concentrations of PCBs in the tomalley were similar to those observed in the first study for lobsters taken from the Pierce Island area. Based on a risk assessment, it was concluded that there may be an increased cancer risk for individuals who consume approximately 50 lobsters (meat only) per year and that the estimated risk increases significantly for those persons who regularly consume the tomalley portion. Based on these considerations, it was decided that an advisory should be issued.

Table 36: Waterbodies Affected by Fish Consumption Advisories

Name Of Waterbody	Size Affected	Type Of Fishing Advisories				Cause(s) (Pollutants of Concern)
		Avoid Consumption		Limited Consumption		
		General Population	Sub-Population	General Population	Sub-Population	
Androscoggin River (from Berlin to the Maine border)	18.2 miles of rivers & streams, 384.1 acres of impoundments	-	Yes	Yes	-	Dioxin (All species of fish)
All Inland Freshwater Bodies	9628 miles of rivers & streams, 164,472 acres of lakes & ponds and 21,406 acres of impoundments	-	-	Yes	Yes	Mercury (All species of fish)
All Inland Freshwater Bodies		-	-	Yes	Yes	Mercury (Bass and Pickerel)
Comerford and Moore Reservoirs	4583 acres		Yes	Yes		Mercury (All species of fish)
MacIndoes Reservoir	545 acres		Yes	-	-	Mercury (Yellow Perch)
May Pond (Washington) Ashuelot Pond (Washington) Crystal Lake (Gilmanton)	149.0 acres 299.5 acres 440.9 acres	Yes	Yes	-	-	Mercury Largemouth Bass, Smallmouth Bass, Pickerel)
All tidal waters in NH	17.92 square miles of estuaries and 70.19 square miles of ocean	Yes	Yes	-	-	PCBs and Dioxins (in Lobster Tomalley)
		-	-	Yes	Yes	PCBs (in Bluefish and Striped Bass)

Name Of Waterbody	Size Affected	Type Of Fishing Advisories				Cause(s) (Pollutants of Concern)
		Avoid Consumption		Limited Consumption		
		General Population	Sub-Population	General Population	Sub-Population	
		-	Yes	Yes	-	Mercury (Swordfish, Shark, Tilefish, King Mackerel)
		-	-	-	Yes	Mercury (All other species of fish)

All Inland Freshwater Bodies Advisory due to Mercury

The latest NH fish consumption advisory, issued in 2001, is based on the mercury levels in freshwater fish collected from New Hampshire lakes and streams between 1995 and 2000. For all inland freshwater bodies in NH there is a general advisory to for pregnant and nursing women, women who may get pregnant and children under 7 to limit fish consumption to 1 meal per month and for all others to limit consumption to 4 meals per month. For bass and pickerel, the general advisory recommends limiting consumption to fish 12 inches or less. As indicated in Table 36, additional mercury consumption advisories have also been issued for May Pond, Ashuelot Pond, Crystal Lake, and the Comerford, Moore's and McIndoes Reservoirs on the Connecticut River. For details regarding these advisories see the publication mentioned above entitled "How Safe is the Fish We Catch" by the DES Environmental Health Program. Fish sampling and mercury analysis has continued since the advisory was originally issued and it is expected that the mercury advisory will be revised again in 2008.

D.6.4 WATERS AFFECTED BY SHELLFISH ADVISORIES DUE TO BACTERIA

The state's coastal and estuarine waters' suitability for shellfish harvesting is evaluated in accordance with the National Shellfish Sanitation Program (NSSP). Over the last several years much effort has been expended in examining the sanitary quality of the state's tidal waters, in order to accurately classify these areas for shellfish harvest and expand harvesting opportunities. The acreage of unclassified estuarine waters has been reduced from 6,777 acres in 2000 to 1,330 in 2007. Almost 47 percent (5,400 acres) of estuarine waters are now available harvest are now open for harvest, up from 36 percent in 2000. More recent trends in classification acreage changes (2005 to 2007) are depicted in Table 37.

Table 37: Changes in Shellfish Water Classifications, 2005-2007

Location	2005 Acres	2007 Acres	2005 Percent	2007 Percent
COASTAL				
Approved	39272.2	39354.1	93.3	93.5
Conditionally Approved	0.0	0.0	0.0	0.0
Restricted	268.4	184.6	0.6	0.4
Prohibited	0.0	0.0	0.0	0.0
Prohibited/Safety Zone	2567.3	2546.5	6.1	6.0
Prohibited/Unclassified	0.0	0.0	0.0	0.0
TOTAL	42107.9	42085.2	100	100
	2005 Acres	**2007 Acres**	**2005 Percent**	**2007 Percent**
ESTUARINE				
Approved	0.0	0.0	0.0	0.0
Conditionally Approved	5127.0	5399.0	44.2	46.6
Restricted	676.5	445.0	5.8	3.8
Prohibited	160.7	910.8	1.4	7.9
Prohibited/Safety Zone	3386.0	3503.5	29.2	30.2
Prohibited/Unclassified	2247.1	1330.2	19.4	11.5

TOTAL	11597.2	11588.5	100	100

Classification Definitions:

Approved means a classification used to identify a growing area where direct harvest and/or marketing (i.e., no additional treatment processes such as relay and depuration) is allowed.

Conditionally Approved means a classification used to identify a growing area which meets the criteria for the approved classification except under certain conditions described in a management plan.

Restricted means a classification used to identify a growing area subject to pollution conditions that would make direct harvest and marketing inappropriate. Regulated commercial harvesting can be allowed by special license provided shellstock is subjected to a suitable and effective post-harvest treatment process, such as through relaying and/or depuration.

Prohibited means a classification used to identify a growing area where the harvest of shellstock for any purpose, except depletion or gathering of seed for aquaculture, is not permitted because a sanitary survey indicates the presence of public health risks that require further study and evaluation.

Prohibited/Safety Zone means a classification used to identify a growing area where the harvest of shellstock for any purpose, except depletion or gathering of seed for aquaculture, is not permitted because of proximity to a significant source of pollution such as a wastewater treatment facility or a marina.

Prohibited/Unclassified means a classification used to identify a growing area where the harvest of shellstock for any purpose, except depletion or gathering of seed for aquaculture, is not permitted because a sanitary survey of the area has not been completed.

Although gains in estuarine acreage available for harvest have been realized, most areas open for harvest continue to be subject to temporary harvesting closures, primarily due to risk of sewage contamination. Most of these temporary closures are related to contamination following rainfall events, although other issues such as risk of sewage contamination during boating season also accounts for some closures.

The DES Shellfish Program measures the degree to which estuarine waters are actually available for harvest by tracking "acre-days," which is the product of the acres of shellfish growing waters and the number of days that these waters are open for harvest. The acre-days indicator is reported as the percentage of the total possible acre-days of harvesting for which the shellfish waters are actually open, and is a good integrative measure of the degree to which a harvesting area meets standards for shellfish harvesting.

The acre-day statistic shows a net increase in harvesting opportunities between 2005 and 2007 (44 percent to 48 percent) for estuarine waters. The attached table shows that the greatest gains were made in the Hampton/Seabrook estuary, where the combination of new acreage open and a less-restrictive rainfall closure criterion led to a doubling of harvest opportunities.

Table 38: Changes in Shellfishing Days and % Acre-Days Open (2005 – 2007)

Location	2005 Days Open*	2005 % Acre-Days Open	2007 Days Open*	2007 % Acre-Days Open	Comments
COASTAL (Atlantic Ocean)	170 of 365 days open	43.4	295 of 365 days open	75.6	Unusually severe "red tide" event in

Location	2005 Days Open*	2005 % Acre-Days Open	2007 Days Open*	2007 % Acre-Days Open	Comments
					2005 accounts for most of the closures
ESTUARY (all areas)	variable	44.0	variable	48.0	
Rye Harbor	0 of 40 days open	0.0	0 of 38 days open	0.0	Area is not classified, and therefore closed to harvest
Little Harbor	15 of 40 days open	8.2	22 of 38 days open	12.9	Rainfall closure threshold raised from 0.50 inches to 1 inch for the Nov-May harvest season. Area closed June-October.
Bellamy River	0 of 303 days open	0.0	139 of 303 days open	29.0	
Great Bay	253 of 303 days open	56.4	263 of 303 days open	58.6	
Little Bay	27 of 40 days open	60.0	22-26 of 38 days open	45.4	
Hampton/Seabrook	15 of 40 days open	15.7	22 of 38 days open	35.3	Rainfall closure threshold raised from 0.50 inches to 1 inch for the Nov-May harvest season; ~275 acres reopened in 2007. Area closed June-October.
Lower Piscataqua River	0 of 40 days open	0.0	0 of 38 days open	0.0	Area is not classified, and therefore closed to harvest

*Where oysters are the primary shellfish resource, the number of possible days open is 303 days (areas are closed for harvest in July and August for resource conservation reasons). Where softshell clams are the primary shellfish resource, the number of possible days open is 38-40 (for resource conservation reasons, harvesting is only allowed on Saturdays during the September-May harvesting season).

PART E. GROUND WATER MONITORING AND ASSESSMENT

E.1 NH GROUNDWATER PROTECTION PROGRAMS

Table 39 provides a summary of the myriad of state and Federal groundwater protection programs that are currently in place in New Hampshire. New Hampshire was one of the first four States in the Nation to receive EPA's endorsement of its comprehensive approach to groundwater protection. This endorsement is an acknowledgment that the state has an array of local, state and federal groundwater protection programs in place which are sufficiently coordinated to effectively protect groundwater. The state routinely engages all stakeholders in a process to identify and jointly address groundwater issues of concern.

Wellhead protection continues to be a major focus of groundwater protection efforts, with more than 80 percent of the Public Water Systems in New Hampshire having implemented wellhead protection measures to ensure high quality drinking water. Groundwater availability issues are of increasing concern. This concern has led to the passage of statutes and the development of regulations that require any adverse impact to surrounding water resources from a large groundwater withdrawal be assessed and mitigated. The state has also recently adopted laws and regulations that establish water conservation standards for the state.

Table 39: Summary of state Groundwater Protection Programs

Programs or Activities	Check (✓) (1)	Implementation Status (2)	Responsible state Agency (3)
Active SARA Title III Program	√	Fully Established	OEM
Ambient groundwater monitoring system	√	Under Development	NHDES
Aquifer vulnerability assessment	Not Applicable	Not Applicable	Not Applicable
Aquifer mapping	√	Fully Established	USGS, NHDES
Aquifer characterization	√	Fully Established	USGS, NHDES
Comprehensive data management system	√	Continuing Efforts	NHDES, GRANIT
EPA-endorsed Core Comprehensive state Groundwater Protection Program (CSGWPP)	√	Fully Established	NHDES*
Groundwater discharge permits	√	Fully Established	NHDES
Groundwater Best Management Practices	√	Fully Established	NHDES

Programs or Activities	Check (✓) (1)	Implementation Status (2)	Responsible state Agency (3)
Groundwater legislation	√	Fully Established	NHDES
Groundwater classification	√	Fully Established	NHDES
Groundwater quality standards	√	Fully Established	NHDES
Interagency coordination for groundwater protection initiatives	√	Fully Established	NHDES
Nonpoint source controls	√	Fully Established	NHDES
Pesticide state Management Plan	√	Fully Established	NHDES
Pollution Prevention Program	√	Continuing Efforts	NHDES
Resource Conservation and Recovery Act (RCRA) Primacy	√	Fully Established	NHDES
state Superfund	√	Fully Established	NHDES
state RCRA Program incorporating more stringent requirements than RCRA Primacy	√	Fully Established	NHDES
state septic system regulations	√	Fully Established	NHDES
Underground storage tank installation requirements	√	Fully Established	NHDES
Underground Storage Tank Remediation Fund	√	Fully Established	NHDES
Underground Storage Tank Permit Program	√	Fully Established	NHDES
Underground Injection Control Program	√	Fully Established	NHDES
Vulnerability assessment for drinking water/wellhead protection	√	Fully Established	NHDES
Well abandonment regulations	√	Fully Established	NHDES
Wellhead Protection Program (EPA-approved)	√	Fully Established	NHDES
Well installation regulations	√	Fully Established	NHDES

E.2 SUMMARY OF GROUNDWATER QUALITY

Natural groundwater quality is generally good. The predominant crystalline rock formations produce groundwater of low mineral content, hardness and alkalinity. Although the majority of groundwater can be used as a drinking water source, most groundwater is highly corrosive to water supply distribution systems. Ambient groundwater quality from stratified drift aquifers can be impacted by such aesthetic concerns as iron, manganese, taste and odor. Bedrock well water quality is sometimes impacted by naturally occurring contaminants including fluoride,

arsenic, mineral radioactivity and radon gas. Elevated concentrations of radon gas occur frequently in bedrock wells.

In addition to naturally occurring contaminants, there are many areas of localized contamination due primarily to releases of petroleum and volatile organic compounds from petroleum facilities, commercial and industrial operations and landfills. Due to widespread winter application of road salt, sodium is also a contaminant of concern in New Hampshire groundwater.

The five highest priority sources of groundwater contamination are:

1. Inappropriate land uses in close proximity to water supply wells;
2. Chemical use and storage;
3. Highways and railroads;
4. Urban stormwater; and
5. Septic systems and sewer lines.

Table 40 summarizes available aquifer monitoring data for New Hampshire. A copy of the Ambient Groundwater Quality Standards for New Hampshire (Env-Ws 1500 & Env-Wq 402) is available at http://des.nh.gov/organization/commissioner/legal/rules/index.htm.

Table 40: Aquifer Monitoring Data

Aquifer Description (1) state of New Hampshire County(ies) (optional) (2) _____
Aquifer Setting (1) Fractured Bedrock, Stratified Drift and Glacial Till Longitude/Latitude (optional) (3) _____
Data Reporting Period (4) 2006-2007

Monitoring Data Type	Total No. of Wells Used in the Assessment (5)	Parameter Groups Number	Number of Wells								
			No detections of parameters above MDLs or background levels		No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l. *(INA)*		Parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs (10) *(INA)*	Parameters are detected at concentrations exceeding the MCLs (11)	Removed from service (12)	Special Treatment (13)	Background parameters exceed MCLs (14) *(INA)*
			ND (6)	Number of wells in sensitive or vulnerable areas (Optional) (7)	ND/ Nitrate≤ 5 mg/l (8)	Number of wells in sensitive or vulnerable areas (optional) (9)					
Ambient Monitoring Network (Optional) *(INA)*		VOC									
		SOC									
		NO3									
		Other (15)									
Raw Water Quality Data from Public Water Supply Wells		VOC									
		SOC									
		NO3									
		Other(15)									
Finished Water Quality Data from Public Water Supply Wells *(INA)*	1493	VOC	920	All	INA		42	1	10		
	704	SOC	441	All	INA		11	6			
	2240	NO3	1762	All	2890	All	608	0			
		Other (15)	256								

Table 40 (continued)

Monitoring Data Type	Total No. of Wells Used in the Assessment (5)	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		No detections of any parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l. *(INA)*		Parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/L (10) *(INA)*	Parameters are detected at concentrations exceeding the MCLs (11)	Removed from service (12)	Special Treatment (13)	Background parameters exceed MCLs (14)
			ND (6)	Number of wells in sensitive or vulnerable areas (optional) (7)	ND/ Nitrate≤ 5 mg/l (8)	Number of wells in sensitive or vulnerable areas (optional) (9)					
Raw Water Quality Data from Private or Unregulated Wells (optional)		VOC									
		SOC									
		NO3									
		Other (15)									
Other Sources (optional)		VOC									
		SOC									
		NO3									
		Other (15)									

Major uses of the aquifer or hydrologic unit (optional) (16)	_√_ Public water supply _√_ Private water supply	____ Irrigation ____ Thermoelectric	_√__ Commercial ____ Livestock	____ Mining √__ Industrial	____ Baseflow ____ Maintenance
Uses affected by water quality problems (optional) (16)	__√ Public water supply __√ Private water supply	____ Irrigation ____ Thermoelectric	____ Commercial ____ Livestock	____ Mining ____ Industrial	____ Baseflow ____ Maintenance

1. Only includes wells with nitrate and VOC data available.
2. Only includes wells with nitrate and SOC data available

PART F. PUBLIC PARTICIPATION

F.1 PUBLIC PARTICIPATION - REQUEST FOR DATA

DES constantly solicits data from within and outside of DES. In 2003, DES created the Environmental Monitoring Database (EMD), the purpose of which is to serve as a warehouse for all types of environmental data. Whenever DES is aware of monitoring being conducted, it attempts to obtain the data and preferably in a form which can be automatically uploaded into the EMD. Any data in the EMD or submitted to the DES water quality assessment coordinator by January 23, 2008 was considered in the 2008 assessment process. Examples of the more than 100 distinct data sources used in the 2008 cycle are provided in the below:

Table 41: Examples of Data Sources Used in 2008 Assessment

Organization Type	Organization Name	Program Name	Number of Projects
PRIVATE INDUSTRY	SEABROOK STATION	SEABROOK STATION ENVIRONMENTAL MONITORING PROGRAM	1
PRIVATE NON-INDUSTRIAL	LOON MOUNTAIN RECREATION CORPORATION	LOON MOUNTAIN RECREATION CORP MONITORING PROGRAM	1
PUBLIC UNIVERSITY/ COLLEGE	N.H. ESTUARIES PROJECT	NHEP MONITORING PROGRAMS	2
	UNIVERSITY OF NEW HAMPSHIRE	GREAT BAY ESTUARINE RESTORATION COMPENDIUM (GBERC)	1
		UNH NATURAL RESOURCES DEPARTMENT	1
		UNH TIDAL WATER QUALITY MONITORING PROGRAM	3
		UNIVERSITY OF NEW HAMPSHIRE CENTER FOR FRESHWATER BIOLOGY	1
US GOVERNMENT/ FEDERAL	U.S. ARMY CORP OF ENGINEERS, NEW ENGLAND DISTRICT	MERRIMACK RIVER WATERSHED ASSESSMENT STUDY	1
	UNITED STATES GEOLOGICAL SURVEY	USGS WATER QUALITY SAMPLING PROGRAM	2
US GOVERNMENT/ LOCAL	CITY OF MANCHESTER	MANCHESTER HEALTH DEPARTMENT WATER QUALITY PROGRAM	1
	TOWN OF EXETER	EXETER RIVER STUDY	1
	TOWN OF SALEM	TOTAL MAXIMUM DAILY LOAD PROGRAM (TMDL)	10
US GOVERNMENT/ STATE	GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE	SYSTEM WIDE MONITORING PROGRAM	3
	NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES	401 WATER QUALITY CERTIFICATION PROGRAM	5

Organization Type	Organization Name	Program Name	Number of Projects
		AMBIENT RIVER MONITORING PROGRAM (ARMP)	1
		BEACH MONTORING PROGRAM	3
		BIOMONITORING PROGRAM	1
		CLEAN LAKES PROGRAM	6
		COMPLAINT INVESTIGATIONS	1
		CONTAMINATED SITE REMEDIATION AND STATE SITES	1
		FEDERAL REMEDIATION SITES	1
		LAKE PROGRAMS	7
		NATIONAL COASTAL ASSESSMENT	4
		NPDES COMPLIANCE SAMPLING PROGRAM (NPDESCSP)	1
		RIVER NUTRIENT CRITIERIA DEVELOPMENT	1
		RIVERS MANAGEMENT AND PROTECTION	1
		SHELLFISH PROGRAM	16
		TOTAL MAXIMUM DAILY LOAD PROGRAM (TMDL)	10
		VOLUNTEER RIVER ASSESSMENT PROGRAM (VRAP)	1
		WATERSHED APPROACH PILOT PROGRAM	1
		WATERSHED ASSISTANCE	4
		WATERSHED BUREAU EMERGENCY RESPONSE	2
VOLUNTEER	GREAT BAY COAST WATCH	WATER QUALITY MONITORING PROGRAM	1
	GREEN MOUNTAIN CONSERVATION GROUP	SACO & OSSIPEE WATERSHED WATER QUALITY MONITORING PROGRAM	2
	PENNICHUCK WATER WORKS	PENNICHUCK WATER WORKS PRE VRAP VOLUNTEER MONITORING PROGRAM	1
	SOUHEGAN WATERSHED ASSOCIATION	SOUHEGAN AND MERRIMACK RIVERS WATER MONITORING PROGRAM	1
	UPPER MERRIMACK RIVER LOCAL ADVISORY COMMITTEE	UPPER MERRIMACK MONITORING PROGRAM	1

F.2 PUBLIC PARTICIPATION - CALM

On May 29, 2007, the New Hampshire Department of Environmental Services (DES) requested comments on the 2006 Consolidated Assessment and Listing Methodology (CALM) which served as a draft of the CALM for the 2008 Section 305(b) and 303(d) Surface Water Quality Report (i.e., the 2008 CALM). The request for comments was accompanied by a list and description of possible revisions being considered by DES at the time. Downloadable copies of the 2006 CALM and list of possible revisions were made available on the DES website for review (http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm). The following organizations/agencies were also notified by email:

- Appalachian Mountain Club
- Audubon Society
- Connecticut River Joint Commissions
- Conservation Law Foundation
- County Conservation Districts
- Designated River Local Advisory Committees
- Lake and River Local Management Advisory Committees
- Maine Department of Environmental Protection
- Manchester Conservation Commission
- Massachusetts Department of Environmental Protection
- Merrimack River Watershed Council
- National Park Service
- New England Interstate Water Pollution Control Commission
- NH Department of Health and Human Services
- NH Coastal Program
- NH Rivers Council
- North Country Council
- Regional Planning Commissions
- Society for the Protection of National Forests
- Natural Resources Conservation Service
- The Nature Conservancy
- US Environmental Protection Agency
- US Geological Survey
- US Fish and Wildlife Service
- US Forest Service
- University of New Hampshire
- Vermont Department of Environmental Conservation
- Volunteer Lakes Assessment Program
- Volunteer Rivers Assessment Program
- Water Quality Standards Advisory Committee

The public comment period ended on June 28, 2007. A copy of the request and guidance for submitting comments is provided in Appendix 29

Appendix 30 includes a summary of comments received on the draft CALM and the DES's response to the comments. This document is also available on the DES website (http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm).

F.3 PUBLIC PARTICIPATION - 303(D) LIST

On February 23, 2008, the New Hampshire Department of Environmental Services (DES) released the draft Section 303(d) List of impaired waters for public comment. Downloadable copies of the draft list were made available on the DES website for review (http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm). In addition, the following organizations/agencies were notified by email:

- Appalachian Mountain Club
- Audubon Society
- Connecticut River Joint Commissions
- Conservation Law Foundation
- County Conservation Districts
- Designated River Local Advisory Committees
- Lake and River Local Management Advisory Committees
- Maine Department of Environmental Protection
- Manchester Conservation Commission
- Massachusetts Department of Environmental Protection
- Merrimack River Watershed Council
- National Park Service
- New England Interstate Water Pollution Control Commission
- NH Department of Health and Human Services
- NH Coastal Program
- NH Rivers Council
- North Country Council
- Regional Planning Commissions
- Society for the Protection of National Forests
- Natural Resources Conservation Service
- The Nature Conservancy
- US Environmental Protection Agency
- US Geological Survey
- US Fish and Wildlife Service
- US Forest Service
- University of New Hampshire
- Vermont Department of Environmental Conservation
- Volunteer Lakes Assessment Program
- Volunteer Rivers Assessment Program
- Water Quality Standards Advisory Committee

The public comment period ended on March 23, 2008, however comments were accepted through Monday, March 24, 2008 since March 23rd was a Sunday. A copy of the request and

guidance for submitting comments is provided in Appendix 31. The comments received are provided in Appendix 32 and the department's response to comments are in Appendix 33.

As a result of comments received on the February 23, 2008 Draft 303(d), the New Hampshire Department of Environmental Services (DES) developed an assessment methodology for determining compliance with water quality standards for biological integrity (Env-Wq 1703.19) using eelgrass (*Zostera marina*) cover in the Great Bay Estuary as an indicator. After going through a thorough peer-review process, this new methodology is now considered part of the CALM. The new methodology, as well as all comments on the methodology, and the department's response to those comments are provided in Appendix 5: Methodology and Assessment Results related to Eelgrass and Nitrogen in the Great Bay Estuary.

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Appendix 33: 303(d) – DES Response to Public Comments

Appendix 34: Benthic Index of Biological Integrity

Appendix 35: Cold Water Fish Index of Biotic Integrity

Appendix 36: Level 1 Landscape Level Wetlands Assessment