** PUBLIC COMMENT DRAFT **

Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH:

Beaver Brook in Derry and Londonderry, NH

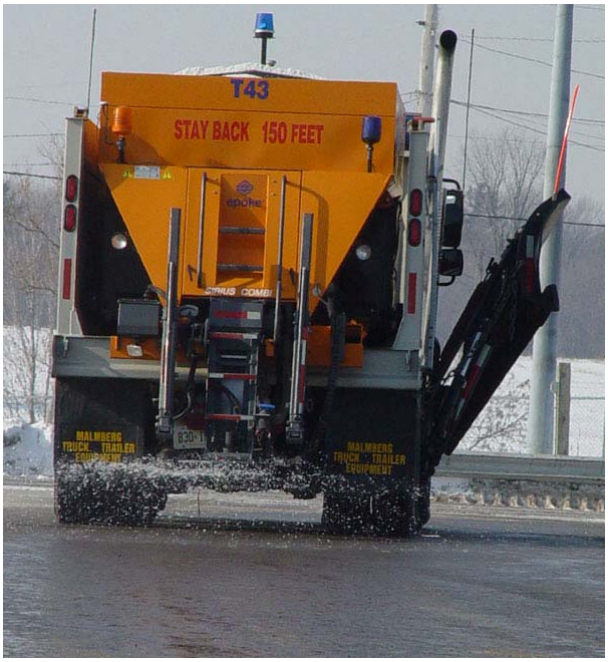

Photo Credit: Environment Canada

December 2007

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

NHDES-R-WD-07-46

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Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH:

Beaver Brook in Derry and Londonderry, NH

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December 31, 2007

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1. Introduction

Section 303(d) of the Clean Water Act (CWA) and the Environmental Protection Agency's Water Quality Planning Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for water quality limited segments that are not meeting designated uses under technology-based controls for pollution. The TMDL process establishes the allowable loadings of pollutants for a waterbody based on the relationship between pollutant sources and instream water quality conditions, so that states can establish water quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources.

The purpose of this study is to develop a TMDL for chloride in the Beaver Brook watershed located in Derry, Londonderry, Chester, and Auburn, N.H. The goal is to reduce chloride loads so that water quality standards for all the designated uses affected by chloride pollution are met in all areas of the Beaver Brook watershed.

2. Problem Statement

a. Waterbody Description

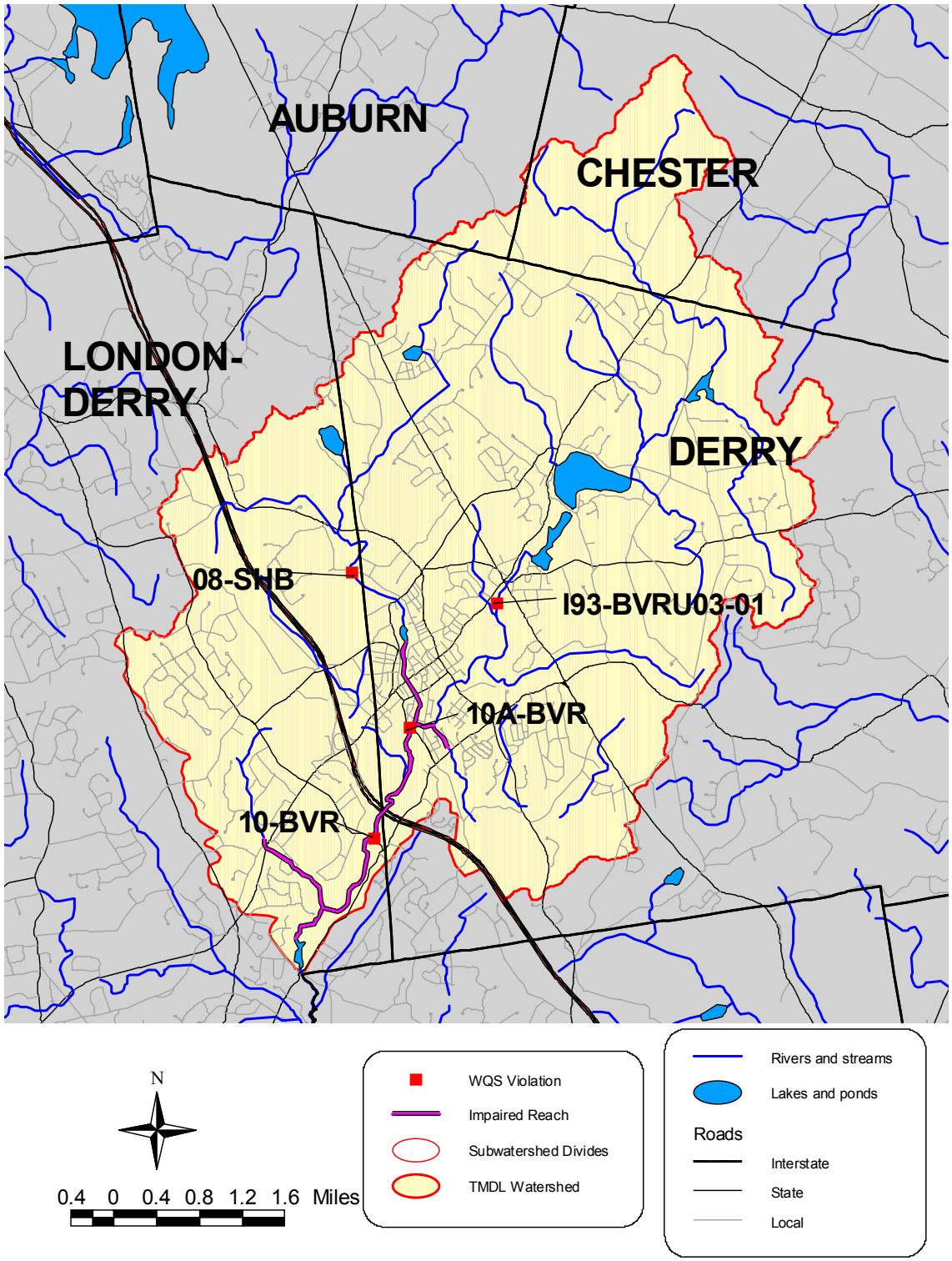
The assessment unit for this TMDL is Beaver Brook (NHRIV700061203-16). It is a stream segment of 4.86 miles located in Derry and Londonderry, N.H. The watershed for this assessment unit is 30.33 square miles (Figure 1) with the upper reaches of the watershed stretching into Chester and Auburn. Land use characteristics of the watershed are listed in Table 1.

Table 1: Land use in the Beaver Brook watershed

Land Use and Demographics	Beaver Brook Watershed	Units
Agriculture	5.91	% of area
Cleared	22.27	% of area
Developed	6.87	% of area
Forested	48.1	% of area
Transportation	11.23	% of area
Wetland	5.62	% of area
Drainage Area	30.33	Square miles
Population	29,895	People
Housing Units	11,525	Number
Population Density	986	People/sq.mi.
"Urbanized Area" Classification	66.0%	% of area

Data Source: DES (2007b)

Figure 1: Impaired Assessment Units and Water Quality Violations in the Beaver Brook Watershed



b. Applicable Water Quality Standards and Water Quality Numeric Targets

Water Quality Standards determine the baseline water quality that all surface waters of the State must meet in order to protect their intended (designated) uses. They are the "yardstick" for identifying where water quality violations exist and for determining the effectiveness of regulatory pollution control and prevention programs. The standards are composed of three parts; designated uses, criteria, and antidegradation regulations.

In New Hampshire, all state surface waters are either classified as Class A or Class B, with the majority of waters being Class B. A general description of designated uses for each classification may be found in state statute RSA 485-A. According to New Hampshire's Consolidated Assessment and Listing Methodology (CALM; DES, 2005) designated uses for New Hampshire surface waters include those shown in Table 2.

The second major component of water quality standards is the "criteria." These are numeric or narrative criteria which define the water quality requirements for Class A or Class B waters. Criteria assigned to each classification are designed to protect the designated uses for each classification. 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 [www.gencourt.state.nh.us/rsa/html/L/485-A/485-A-8.htm] and in the State of New Hampshire Surface Water Quality Regulations (Env-Ws 1700) [www.des.nh.gov/rules/env-ws1700.pdf].
The CALM (DES, 2005) describes the methodologies for comparing water quality data with the criteria to assess designated use support.

The third component of water quality standards are antidegradation provisions which are designed to preserve and protect the existing beneficial uses of the State's surface waters and to limit the degradation allowed in receiving waters. Antidegradation regulations are included in Part Env-Ws 1708 of the New Hampshire Surface Water Quality Regulations. Antidegradation is not a consideration for this TMDL study.

Beaver Brook is a Class B waterbody. According to Env-Ws 1703.21, the water quality criteria for chloride in nontidal Class B waterbodies to protect aquatic life is that concentrations should not exceed 860 mg/L for acute exposures or 230 mg/L for chronic exposures. Acute aquatic life criteria are based on an average concentration over a one-hour period and chronic criteria are based on an average concentration over a period of four days (EPA, 1991) The frequency of violations for either acute or chronic criteria should not be more than once every three years, on average (EPA, 1991).

Table 2: Designated Uses for New Hampshire Surface Waters

Designated Use	DES Definition	Applicability
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	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

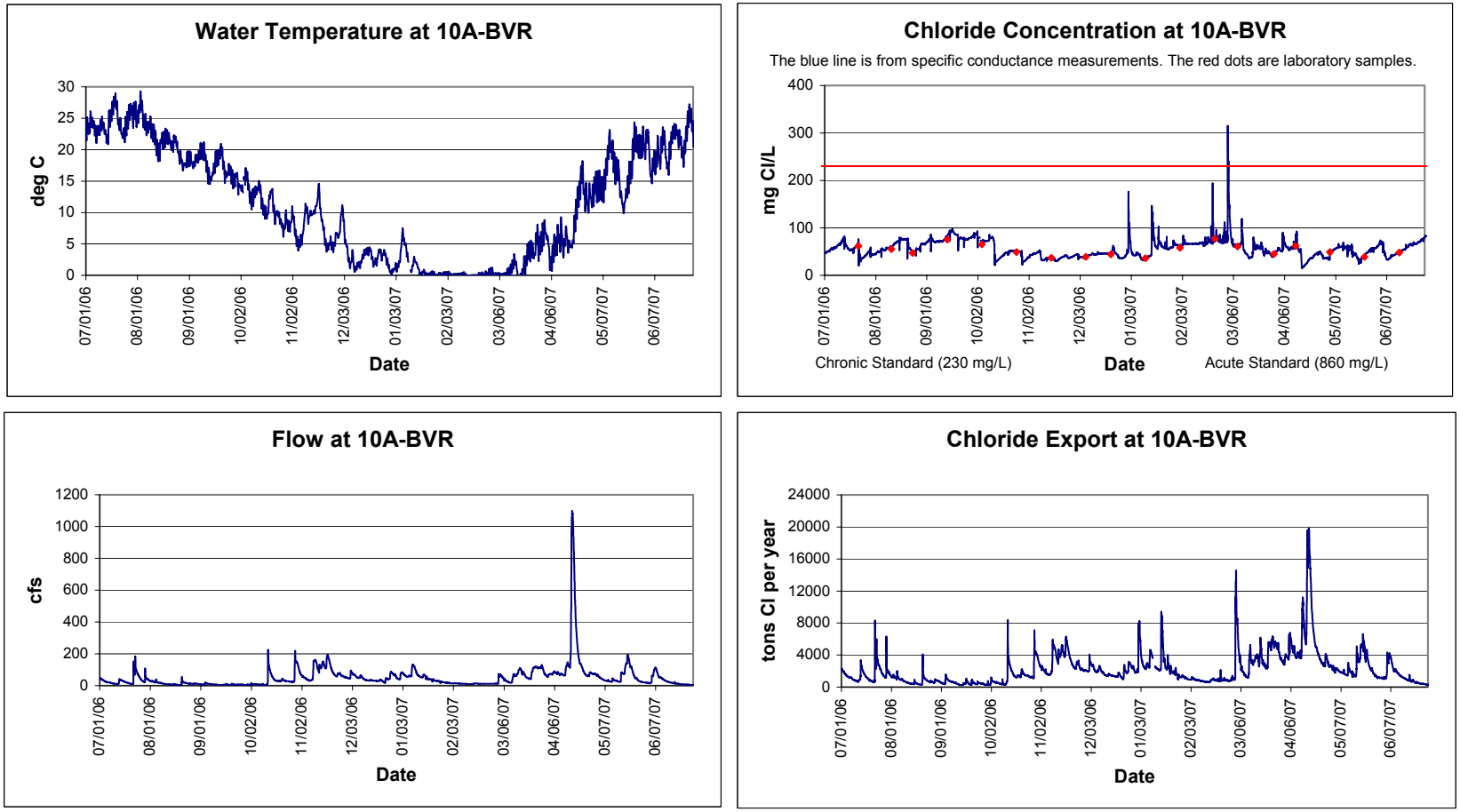
3. Beaver Brook Receiving Water Quality Characterization

In the winters ending in 2003, 2004, 2005 and 2006, the New Hampshire Department of Environmental Services (DES), the US Environmental Protection Agency (EPA), and the New Hampshire Department of Transportation (DOT) monitored chloride in watersheds in the vicinity of I-93 in southern New Hampshire. Chloride concentrations were primarily measured in winter with near continuous specific conductance readings by data loggers. DES placed the assessment unit NHRIV700061203-16 on New Hampshire's 2006 Section 303(d) list because measurements of chloride concentrations through 2005 demonstrated exceedences of State surface water quality standards. The assessment unit, along with all rivers and lakes in the state, is also listed as impaired for the fish consumption designated use due to the state-wide fish consumption advisory for mercury. Water quality impairments for iron and pH also have been documented in this assessment unit.

The assessment unit was placed on the 2006 Section 303(d) list for chloride because of violations of the chronic water quality standard for chloride in 2004 and 2005. For the period between February 3 and February 9, 2004, water quality violations were detected at stations 10-BVR and 10A-BVR. The durations of the violations were 5.5 to 5.9 days, respectively (approximately 1.5 percent of the year) (DES, 2007b). Another violation of the chronic standard was detected at station 10A-BVR between January 20 and January 25, 2005. The period of violation was 4.6 days (1.2 percent of the year) (DES, 2007b).

For this TMDL study, DES, EPA and DOT developed a monitoring program to collect a comprehensive and standardized dataset for chloride, stream flow, and chloride imports to and exports from the watershed (DES, 2006). The monitoring plan was implemented between July 1, 2006 and June 30, 2007. The data from this monitoring program have been summarized in a Data Quality Audit (DES 2007a) and a Data Report (DES 2007b). The difference between the TMDL monitoring and the previous efforts is that data were collected at the same time at all stations to allow comparison between stations under similar conditions. Stream flow data were collected so that chloride flow duration curves and export calculations could be made. Figure 2 shows the near continuous measurements of temperature, chloride, stream flow, and chloride export (product of chloride concentration and stream flow) at station 10A-BVR between July 1, 2006, and June 30, 2007. The average values for these parameters over the year were 11.33 ^{o}C, 55.86 mg Cl/L, 51.07 cfs, and 2,181.99 tons Cl/yr, respectively. For perspective, typical concentrations of chloride in New Hampshire rivers in 1920, before salt was used as a deicer, were 1.3 mg Cl/L (Hall, 1975).

Figure 2: Time Series of Temperature, Chloride, Stream Flow and Chloride Export at Station 10A-BVR

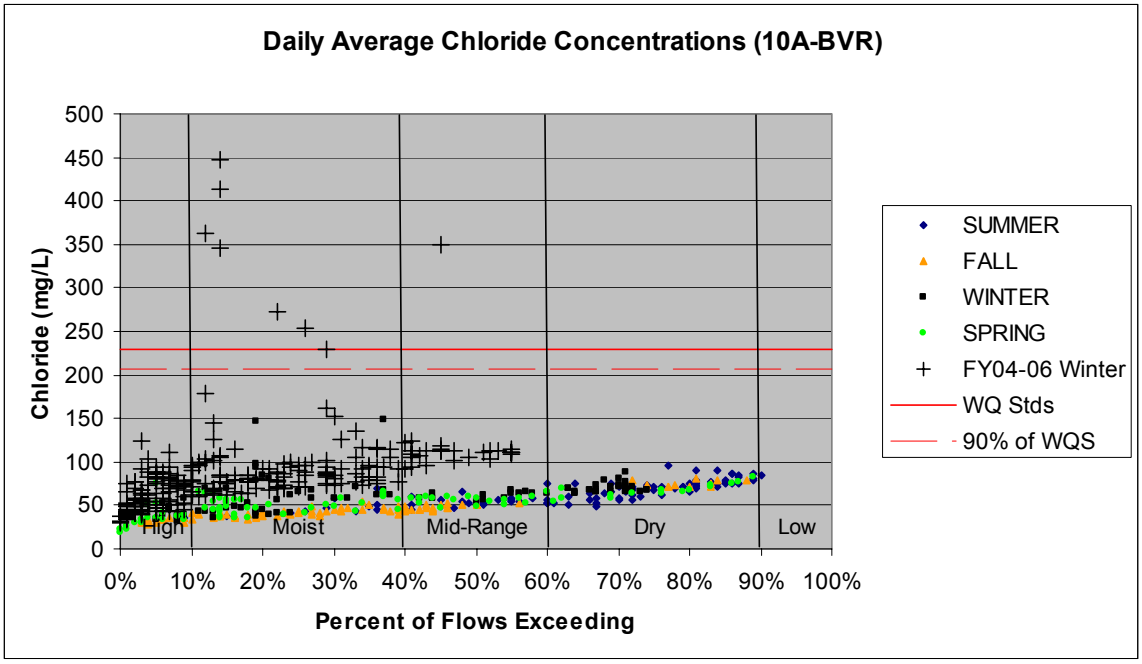


Data Source: DES (2007b)

The monitoring for the TMDL study detected violations of the acute water quality standard at two stations in the Beaver Brook watershed. At station 08-SHB, the chloride concentration spiked to an average concentration of 1,191 mg/L between 12:00 and 15:30 on March 2, 2007. Likewise, at station I93-BVRU03-01, between 06:30 and 07:45 on January 1, 2007, the chloride concentration reached a maximum value of 1,130 mg/L. No violations of the chronic standard were detected at any stations in FY06 or FY07. All of the locations in the watershed where violations of water quality standards have been detected are shown in Figure 1. The violations on this figure are from a compilation of all relevant data from 2002-2007 (DES, 2007b). The number of violations and the exact dates when these violations occurred are summarized in DES (2007b).

Concentration-flow duration curves were used to document how the chloride concentration changed with stream flow (DES, 2007b). For these plots, the measured stream flow on a date was converted to the percent of the time when that flow level is exceeded. The methods for the historical flow duration calculations are provided in DES (2007b). The concentration-flow duration plot for station 10A-BVR is shown in Figure 3. Both the full year of data from FY07 and the winter data collected in FY04-FY06 are shown on this plot. Stream flow at 10A-BVR in FY04-FY06 were estimated from the USGS Beaver Brook gage and a watershed area transposition technique. This figure indicates that, in general, chloride concentrations increase as stream flow decreases. However, the violations that were observed in FY04-FY06 occurred during apparent runoff or melt events in the winter season. Summer data for these years were not collected.

Figure 3: Concentration-Flow Duration Plot for Station 10A-BVR



Data Source: DES (2007b)

In addition to the near-continuous monitoring conducted by DES, EPA and DOT, the Town of Derry has collected 63 chloride samples with concentrations ranging from 39 to 150 mg/L from stations located between 10A-BVR and 10-BVR. The samples were collected between June 1995 and April 2007 (2 samples per year at 3 stations). The concentrations in the grab samples were all less than the chronic and acute water quality standards (230 and 860 mg/L, respectively).

4. Source Characterization

Chloride in the form of salt is imported to the study watersheds from several major sources: Roadway deicing, food waste, water softeners, atmospheric deposition, and roadway salt pile runoff. DES estimated the mass of salt imported from each source. Details on how these estimates were made are provided in DES (2007b). For the TMDL, groundwater was considered a pathway for chlorides, not an independent source.

All of the chloride imported to the watershed is eventually delivered to the impaired reach through stormwater runoff and groundwater flow. Stormwater flow through municipal storm sewer systems (MS4) covered by the Phase II stormwater program regulations will be considered a point source for this TMDL (EPA, 2002). The balance of the stormwater runoff will be considered a non-point source. Sixty-six percent of the watershed is covered by the MS4 Phase II program (Table 1); therefore, 66% of the chloride load will be considered a point source.

The salt imports for FY04, FY05, FY06 and FY07 (FY is July 1 to June 30) are listed by source in Table 3. The values for FY07 were determined using the methods in DES (2007b). For FY04, FY05, and FY06, DES used salt application rates provided by DOT and municipalities plus the following assumptions:

- Imports from atmospheric deposition, food waste, water softeners, and salt piles in FY04-FY06 were the same as for FY07.
- Roadway lane miles and parking lot areas were the same for all years.
- The salt application rate for private roads was the average of the municipal rates.
- The salt application rate for parking lots in FY04, FY05, and FY06 was the value for FY07 (6.4 tons/ac/yr) multiplied by the ratio of the overall average roadway application rate for the year and the overall average for FY07.

The values for roadway and parking lot application rates that were used in the calculations are shown in Table 4.

Salt imports into the watershed varied; the highest value was in FY05 and the lowest value was in FY07. A total of 10,432 tons of salt was imported to the watershed in FY05 at an average rate of 417 tons of salt per square mile of drainage area. In FY07, 6,380 tons of salt were imported, which is equivalent to 210 tons of salt per square mile of drainage area. The contribution of each source to the total load in FY05 is shown in Figure 4. Deicing of roadways and parking lots accounted for 96 percent of the imports, with parking lots being the single largest source (44 percent). Salt piles, water softeners, food waste, and atmospheric deposition were minor components.

The year to year variation in salt imports is primarily due to differences in the severity of the winters. The winter severity index is a climate indicator used by DOT, which is based on daily average temperature and precipitation between November 1 and March 31 for each winter. The index values for FY04 through FY07 are shown at the bottom of Table 4. The highest salt import rate occurred in FY05 when the winter severity index

was the lowest. Conversely, the salt import rate was low in FY07 when the index was high. The winter severity index and salt imports were similar in FY04 and FY06.

Table 3: Sources of Salt to the Beaver Brook Watershed

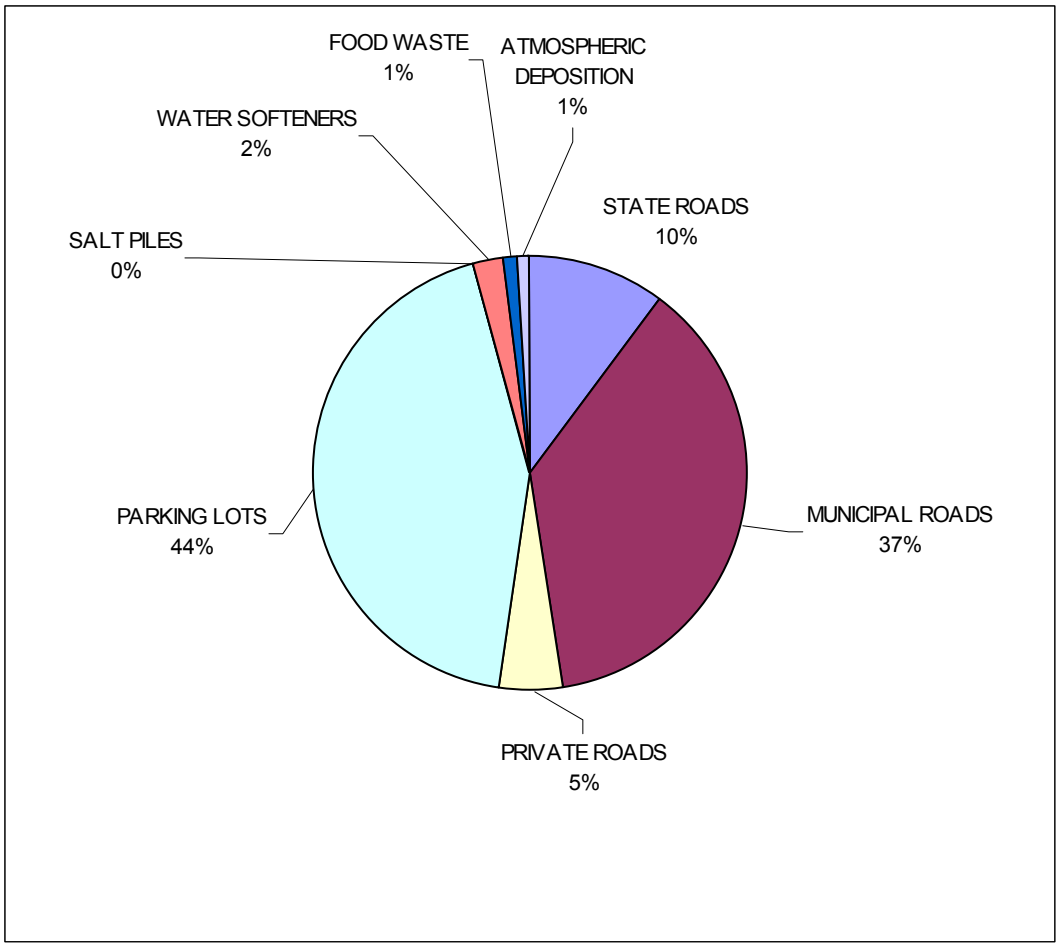
Source	Salt Imports (tons salt/yr)			
	FY04	FY05	FY06	FY07
State Roads	834.56	1,290.00	746.27	668.72
Municipal Roads	4,123.02	4,703.18	4,587.15	1,901.08
Private Roads	559.04	623.25	566.34	336.04
Parking Lots	4,048.77	5,505.90	4,013.98	2,956.02
Salt Piles	1.54	1.54	1.54	1.54
Water Softeners	272.28	272.28	272.28	272.28
Food Waste	149.48	149.48	149.48	149.48
Atmospheric Deposition	95.13	95.13	95.13	95.13
Total	10,083.81	12,640.75	10,432.18	6,380.30

Table 4: Salt Application Rates for Roadways and Parking Lots in the Beaver Brook Watershed in FY04, FY05, FY06, and FY07

Town or State PS	Salt Application Rates (tons salt/lane-mile/year)			
	FY04	FY05	FY06	FY07
Auburn	12.00	12.00	12.00	12.00
Chester	12.36	12.36	12.36	12.36
Derry	11.68	14.88	17.19	6.84
Londonderry	20.35	19.06	11.17	4.82
Salem	21.55	31.55	29.24	12.30
Windham	9.29	7.43	6.43	4.11
State PS 508	14.03	22.97	15.47	15.24
State PS 512	8.37	15.23	8.02	9.16
State PS 513	17.91	28.94	17.47	15.71
State PS 514	14.72	29.58	15.88	13.03
State PS 528	21.48	28.66	17.10	13.99
Average of Municipal Rates	14.54	16.21	14.73	8.74*
Average of State Rates	15.30	25.08	14.79	13.43
Overall Average	14.89	20.24	14.76	10.87
Ratio of Overall Average to Overall Average in FY07	1.37	1.86	1.36	1.00
Estimated Parking Lot Application Rate (tons salt/acre/year)	8.8	11.9	8.7	6.4
Winter Severity Index	-16.61	-26.10	-17.67	-11.11

* The average municipal rate for FY07 (8.74 tons salt/lane-mile/year) is slightly higher than the value used in DES (2007b) (8.28 tons salt/lane-mile/year). DES (2007b) calculated the average value with a pivot table which weighted the value based on the number of watersheds associated with each source. The value in this report is an unweighted average.

Figure 4: Relative Contribution of Each Source to the Total Salt Imports to the Watershed in FY05



5. TMDL and Allocations

a. Definition of a TMDL

According to the 40 CFR Part 130.2, the total maximum daily load (TMDL) for a waterbody is equal to the sum of the individual loads from point sources (i.e., waste load allocations or WLAs), and load allocations (LAs) from nonpoint sources (including natural background conditions). Section 303(d) of the CWA also states that the TMDL must be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety (MOS), which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. In equation form, a TMDL may be expressed as follows:

$$TMDL = WLA + LA + MOS$$

where:
WLA = Waste Load Allocation (i.e. loadings from point sources)
LA = Load Allocation (i.e., loadings from nonpoint sources including natural background)
MOS = Margin of Safety

TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure (40 CFR, Part 130.2 (i)). The Beaver Brook TMDL will be expressed as a load duration curve following guidance from EPA (2007). The MOS can be either explicit or implicit. If an explicit MOS is used, a portion of the total allowable loading is actually allocated to the MOS. If the MOS is implicit, a specific value is not assigned to the MOS. Use of an implicit MOS is appropriate when assumptions used to develop the TMDL are believed to be so conservative that they are sufficient to account for the MOS.

b. Determination of TMDL

i. Seasonal Considerations/Critical Conditions

Section 303(d) of the CWA states that the TMDL must be established at a level necessary to attain the applicable water quality standards with seasonal variations. In Table 5, the factors which can influence chloride concentrations have been listed, along with how those factors will be manipulated to ensure that the TMDL will result in attainment of water quality standards during critical conditions.

Table 5: Factors for Determining Critical Conditions

Factor	Effect on Chloride Concentration	Selection of Critical Condition
Season	Figure 3 shows that most violations occurred during the winter season during periods of "moist" stream flow. However, summer season data were not collected in FY04-FY06.	The TMDL will be expressed as a load duration curve to set limits for "moist" flow periods during the winter season.
Stream Flow	Figure 3 shows that chloride concentrations increase as stream flows decrease.	The TMDL will be expressed as a load duration curve to accurately describe the acceptable load at each stream flow.
Location	The proximity of salt sources can affect the chloride concentration in the waterbody.	Data from the year round station with the highest chloride yield (tons Cl/mi2/yr), 09-BVR, will be the basis for the TMDL.
Water Quality Standard	Either the acute or chronic water quality standard must be chosen to set the target for the TMDL.	The chronic standard will be the basis for the TMDL target because most of the violations in the watershed were of the chronic standard. The chronic standard is also lower than the acute standard.

ii. Margin of Safety

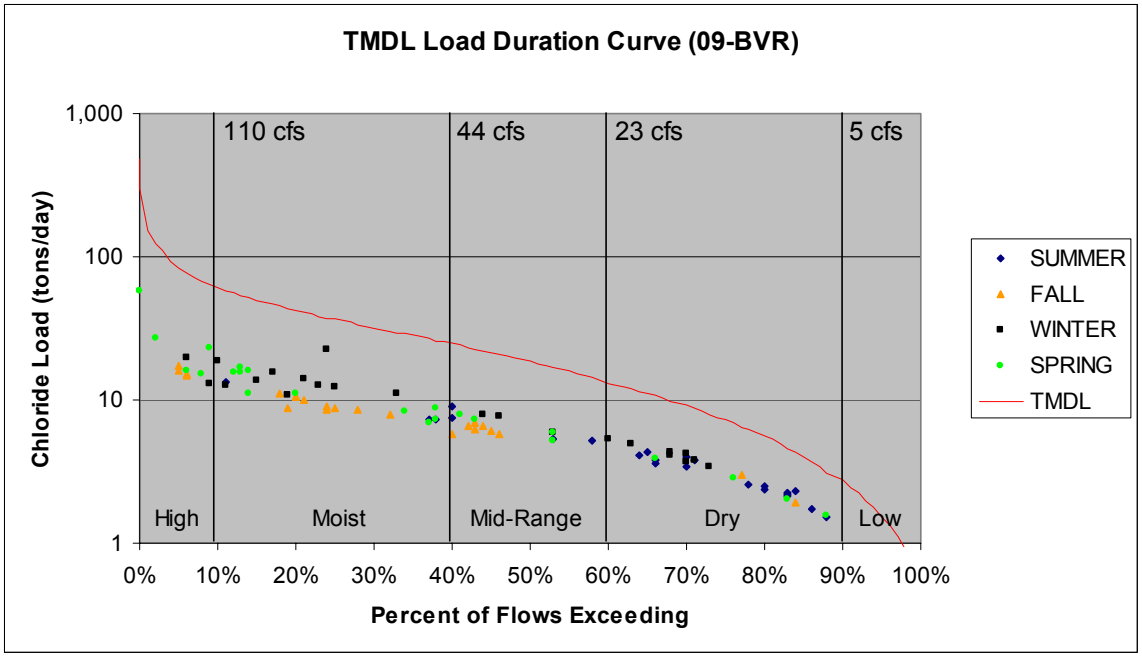
An explicit Margin of Safety (MOS) will be used in the TMDL calculation. The TMDL will be set at 90 percent of the chronic water quality standard (90%*230 mg C/L = 207 mg Cl/L). This assumption is equivalent to holding 10 percent of the loading in reserve to account for scientific uncertainty.

iii. TMDL Calculation

The TMDL will be expressed as a load duration curve following guidance from EPA (2007) and in compliance with the approved Quality Assurance Project Plan (DES, 2006). The TMDL will be 90 percent of the chronic water quality standard (207 mg Cl/L) multiplied by each stream flow in the four day average flow duration curve. The four-day average flow duration curve was used because the chronic water quality standard applies to four day average concentrations. The TMDL will be set for the outlet station of the watershed, 09-BVR, because this station had the highest chloride yield in FY07. Figure 5 shows the TMDL load duration curve and the existing loads measured at 09-BVR between July 1, 2006 and June 30, 2007 (equivalent data were not collected in FY04-FY06). The units for the TMDL are tons of chloride per day. At each point on the TMDL curve, the waste load allocation for MS4 permittees is 66 percent of the TMDL and the load allocation for non-point sources is 34 percent of the TMDL (not shown on figure).

The margin of safety is explicit. The TMDL load duration curve is not expected to change; therefore, this TMDL is relevant to all existing and future impairments due to chloride in the Beaver Brook watershed.

Figure 5: TMDL Load Duration Curve at Station 09-BVR



The TMDL can be alternatively expressed as a percent reduction goal (PRG) to guide implementation. The salt imports in FY04-FY05 (when chronic water quality violations occurred) can be compared to salt imports in FY06-FY07 (when chronic violations did not occur) to identify the salt import value at which water quality violates the chloride standard. In FY04-FY05, the salt imports ranged from 332 to 417 tons salt per square mile of drainage area. In FY06-FY07, the salt imports ranged from 210 to 344 tons salt per square mile of drainage area. Therefore, the apparent threshold for chronic water quality violations must be where these two ranges overlap: 332 to 344 tons of salt per square mile of drainage area. The lowest value in this range (332) was from FY04, a year with average annual stream flow and during which violations of the chronic chloride standard occurred. The TMDL must be set at a level for which violations will not occur. Therefore, the TMDL will be the salt loading rate from FY04 reduced by 10% (299 tons of salt per square mile of drainage area). An additional margin of safety will be applied in the load allocations to ensure that water quality standards are met under all conditions.

The Beaver Brook watershed covers 30.33 square miles. If the watershed can only assimilate 299 tons of salt per square mile of drainage area, the total salt import load to watershed must be less than 9,069 tons per year in order to attain water quality standards. In FY05, when chronic water quality violations occurred, the salt imports to the watershed, 12,641 tons per year, needed to be 28% lower in order to reach the goal. In

FY07, when chronic violations did not occur, salt imports to the watershed were already below the goal.

iv. Allocation of Loads

In 2006, DOT and DES established an interagency Salt Reduction Workgroup. The purpose of the workgroup is to advise DES and DOT on the TMDL study and implementation plan until these are complete, and to advise and then to assist with implementation of required salt load reductions. The workgroup includes representatives from: DES, DOT, EPA, the Federal Highway Administration (FHWA), the selectmen's office of each town with area in a TMDL watershed, the public works department of each town with area in a TMDL watershed, the University of New Hampshire T2 Program, private winter road and parking lot maintenance companies, motorist associations, the State Police, the Southern New Hampshire Regional Planning Commission, the Nashua Regional Planning Commission, and the Rockingham Planning Commission.

In 2008, the Salt Reduction Workgroup will determine the final load allocations by sector. However, <u>as a starting point</u>, draft allocations are presented in Table 6 based on the following assumptions:

- Ninety-six percent of the salt imports to the watershed were from deicing activities. Therefore, essentially all of the salt import reductions will need to come from reduced deicing loads. The percent reduction in salt imports will be the same for state, municipal, and private roads and parking lots.
- The allocation for salt pile runoff will be zero because all salt and salt-sand piles should be covered.
- The existing loads from water softeners, food waste, and atmospheric deposition will be used as the allocation for these sources.
- 10% of the total allocation will be reserved as a margin of safety.

Table 6: Existing Salt Imports and Load Allocations

Source	FY05 Salt Imports (tons/salt/yr)	FY07 Salt Imports (tons salt/yr)	Allocation of Loads (tons salt/yr)	Percent Reduction Relative to FY05
State Roads	1,290.0	668.7	813.6 (15.3 tons/lm/yr)	36.9%
Municipal Roads	4,703.2	1,901.1	2,966.2 (10.0 tons/lm/yr)	36.9%
Private Roads	623.3	336.0	393.1 (10.2 tons/lm/yr)	36.9%
Parking Lots	5,505.9	2,956.0	3,472.4 (7.5 tons/ac/yr)	36.9%
Salt Piles	1.5	1.5	0	100%
Water Softeners	272.3	272.3	272.3	0%
Food Waste	149.5	149.5	149.5	0%
Atm. Deposition	95.1	95.1	95.1	0%
Margin of Safety			906.9	NA
Total	12,640.8	6,380.3	9,069.0	28.3%

In the preceding table, the deicing load allocations were expressed in units of both tons per year and tons per lane-mile (or acre) per year. The latter values were calculated from the total lane miles or parking lot acres managed by each organization in 2007.

6. Implementation Plan

a. Statutory/Regulatory Requirements

Section 303(d)(1)(C) of the CWA provides that TMDLs must be established at a level necessary to implement the applicable water quality standard. The following is a description of activities that are planned to abate water quality concerns in the Beaver Brook watershed.

b. Description of Activities to Achieve the TMDL

i. Implementation Plan

To implement this TMDL, salt imports to the watershed for deicing must be limited to the allocated loads in Table 6. State law (RSA 485-A:12.II) provides that "If, after adoption of a classification of any stream, lake, pond, or tidal water, or section of such water, including those classified by RSA 485-A:11, it is found that there is a source or sources of pollution which lower the quality of the waters in question below the minimum requirements of the classification so established, the person or persons responsible for the discharging of such pollution shall be required to abate such pollution within a time to be fixed by the department."

The details of an implementation plan will be developed by the Salt Reduction Workgroup in 2008 (see section 5(b)(iv) for information on the workgroup). The plan will require that owners of property on which salt is applied track and report the amount applied. This will be compared with allocations on an annual basis to determine compliance with RSA 485-A:12 and the load allocations of Table 6. It should be noted that the load allocations in the TMDL do not include an allowance for future growth, so any future construction of additional roads or parking lots in the TMDL watersheds would necessitate additional load reductions elsewhere in the watershed beyond the allocations in Table 6.

ii. Monitoring

Pending the availability of resources, specific conductance will be monitored at 15 minute intervals with data loggers at the outlet station for the watershed, 09-BVR, and station 10A-BVR from July 1, 2007 to June 30, 2016. The data will be analyzed for violations of the acute and chronic water quality standards following the procedures used in DES (2007b). The number of violations and the salt imports to the watershed will be tracked for each year. NHDES will evaluate changes in these values using multivariate linear or logistic regression with climate variables (e.g., the DOT Winter Severity Index, flow) as covariates. A trend will be considered significant if the coefficient of the year

term in the equation is significant at the $p<0.05$ level. A minimum of five years of data (and most likely 10 years) will be needed before trend analysis can be performed.

7. Public Participation

a. Description of the Public Participation Process

EPA regulations (40 CFR 130.7 (c) (ii)) require that calculations to establish TMDLs be subject to public review.

To be completed after the public comment period has ended.

b. Public Comment and DES Response

To be completed after the public comment period has ended.

8. References

DES. 2005. Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology. NH Department of Environmental Services, Watershed Management Bureau, Concord, NH. November 2005. Available from: www.des.nh.gov/WMB/swqa/calm.html.

DES. 2006. Total Maximum Daily Loads for Chloride for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Quality Assurance Project Plan. NH Department of Environmental Services, Watershed Management Bureau, Concord, NH. June 30, 2006. Available from www.rebuildingi93.com/content/environmental/waterquality.

DES. 2007a. Total Maximum Daily Loads for Chloride for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Data Quality Audit. NHDES-R-WD-07-39. NH Department of Environmental Services, Watershed Management Bureau, Concord, NH. August 17, 2007.

DES. 2007b. Total Maximum Daily Loads for Chloride for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Data Report. NHDES-R-WD-07-40. NH Department of Environmental Services, Watershed Management Bureau, Concord, NH. September 2007.

EPA. 1991. Technical Support Document for Water Quality-based Toxics Control. EPA/505/2-90-001. US Environmental Protection Agency, Office of Water, Washington, DC. March 1991.

EPA. 2002. Establishing Total Maximum Daily Load (TMDL) Waste Load Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on those WLAs. Memorandum from Robert Wayland III, US Environmental Protection Agency, Office of Water, Office of Wetlands, Oceans, and Watersheds, Washington, DC. November 22, 2002.

EPA. 2007.An Approach for Using Load Duration Curves in the Development of TMDLs. EPA 841-B-07-006. U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, Washington, D.C. August 2007. Available from: www.epa.gov/owow/tmdl/techsupp.html.

Hall, F.J. 1975. Chloride in Natural Waters of New Hampshire: New Hampshire Agricultural Experiment Station Bulletin 504, University of New Hampshire, Durham.