APPENDIX F

NATURAL RESOURCES
WRITTEN REEVALUATION/TECHNICAL REPORT

TABLE OF CONTENTS

1.0 INTRODUCTION

In April 2004, the New Hampshire Department of Transportation (NHDOT) and the Federal Highway Administration (FHWA) issued a Final Environmental Impact Statement (FEIS) proposing the widening of I-93 to four-lanes in each direction between Salem and Manchester. On June 28, 2005, FHWA issued a Record of Decision (ROD) approving the proposed alternative (hereinafter referred to as "the Project"). The Conservation Law Foundation subsequently challenged the ROD in U.S. District Court, contending that NHDOT and FHWA violated the National Environmental Policy Act, 42 U.S.C. § 4321 *et seq.* and the Federal-Aid Highway Act, 23 U.S.C. § 101 *et seq.*

A "Memorandum and Order" was issued on August 30, 2007 by the United States District Court for the District of New Hampshire on the case of the Conservation Law Foundation v. Federal Highway Administration and New Hampshire Department of Transportation (*Case No. 06-cv-45-PB and Opinion No. 2007 DNH 106;* hereinafter referred to as "the Order"). The Order directed NHDOT and FHWA to prepare

> "…an SEIS that specifically considers how the Delphi Panel's population forecasts affect Defendants' analysis of both the effectiveness of the Four Lane Alternative as a traffic congestion reduction measure and the indirect effects of the additional population predicted by those forecasts on secondary road traffic and air quality issues." [pp. 85-86]

NHDOT and FHWA are preparing a Draft Supplemental Environmental Impact Statement (DSEIS) on the Project to address the Order, specifically, and to generally supplement the Project's FEIS consistent with the guidance of FHWA Technical Advisory, entitled, "Guidance for Preparing and Processing Environmental and Section 4(f) Documents", dated October 30, 1987 (T6640.8a), relative to changes, new information, or further developments subsequent to the FEIS.

1.1 Purpose

This Written Re-evaluation/Technical Report has been prepared to: (1) identify whether or not there have been changes, new information, or further developments relevant to the Project's natural resource effects subsequent to the FEIS as a result of the Order; and (2) using this identification, assess whether new or updated analyses of the Project's natural and biological resource effects are warranted.

1.2 Methodology and Approach

The following methodology and approach was used to evaluate if changes or updates to the analyses described for each respective environmental resource area analyzed in the 2004 FEIS will be required:

- Identify and describe previous analysis methods and criteria used to assess impacts;

- Describe current analysis methods, regulations and guidelines, industry standards, and criteria used to assess impact significance;
- Identify changes in analysis methods, regulations and guidelines, industry standards, and criteria used to assess impact significance;
- Reanalyze the effects of the proposed project using the Delphi Panel's population and employment projections as well as the latest New Hampshire Office of Energy and Planning (OEP) projections with respect to traffic and air quality. Update the results of the other resource categories as warranted when substantial changes to the impact assessment methods or protocols, industry standards or guidelines, and applicable federal, state, or local government regulations have been identified; and
- Include a summary of findings from these evaluations as part of a stand-alone technical report for each resource category. Each technical report includes a section that provides an overview of the previous analysis methods and criteria used to assess impacts, the results and mitigation recommended in the 2004 FEIS, as well as any changes to the analysis methods, regulations, guidelines, industry standards or criteria used to assess impact significance that have been identified with the updated results. The findings described in each technical report will be incorporated into the Draft SEIS (DSEIS). Refer to Sections 2, 3, 4, 5 and 6 below for specific details.

2.0 Water Resources

2.1 2004 Analysis Methods & Prevailing Regulations/Guidelines

2.1.1 Surface Water

The 2004 FEIS described and mapped lakes, ponds and streams in the vicinity of the I-93 corridor. For Canobie Lake and Cobbetts Pond, the 2004 FEIS summarized the results of sampling work conducted in 2002 as part of the NHDES Volunteer Lake Assessment Program (VLAP). The description of stream conditions incorporated the results of the December 2002 to May 2003 specific conductance monitoring and chloride sampling conducted by NHDOT in coordination with NHDES and EPA.

The surface water impact analysis consisted of three components: a stormwater pollutant loading analysis based on the area of impervious surface and proposed stormwater treatment practices, a phosphorus loading analysis for the principal lakes in the study area, and an analysis of the long-term in-stream chloride concentrations as a result of the increased deicing salt applications that would be needed to maintain the added travel lanes. The methodologies employed for each of these analyses are summarized below.

Stormwater Runoff

The 2004 FEIS conservatively assumed that stormwater runoff pollutant loadings would double from existing conditions as a result of the 2005 Selected Alternative. The analysis then took into account the effectiveness of the proposed stormwater treatment practices to derive the net change pollutant loadings. The 2004 FEIS found that in order to achieve a no net increase in pollutant contributions in comparison to existing conditions, a minimum of 80 percent of the total roadway area in watershed would have to be directed toward extended detention basins, assuming an overall removal efficiency of 60 percent for pollutants associated with particulates. If more than 80 percent of the roadway was treated by extended detention basins, this could result in a net reduction in pollutant loadings. It was determined that 50 extended detention basins and 24 vegetated swales could adequately treat all the stormwater from the project. The preliminary extended detention basin designs assumed storage of a "first flush" volume of ½ inch of rainfall for approximately 30 hours and a minimum length to width ratio of 4 to 1.

Phosphorus Loadings

Average annual in-lake phosphorus concentrations attributable to I-93 were calculated using a modified version of the Vollenweider model, as presented in the FHWA report *Pollutant Loadings and Impacts from Highway Stormwater Runoff, Volume 1: Design Procedures* (Driscoll et al., 1990). Conservative phosphorus removal efficiencies of 40 percent for extended detention basins and 20 percent for grass swales were assumed.

Deicing Salt and Chloride Concentrations

A mass balance analysis was conducted to estimate the long-term average annual concentrations of chloride in receiving streams attributable to the I-93 roadway. The analysis incorporated the results of a 2002-2003 water quality sampling study to represent upstream or background levels in streams where data was available. The analysis was based on the following assumptions:

- All of the applied road salt reaches the receiving waters within the year of application.
- None of the sodium and chloride is attenuated within the road side soils or proposed treatment measures.
- On average, road salt is applied at an annual rate of 22.8 tons per lane mile based on 10 years of road salt application data for the Manchester to Salem I-93 roadway segment.
- The average annual recharge to the area streams is equivalent to half of the average annual precipitation or roughly 21 inches, which is equivalent to 1.7 cfs per square mile of drainage area.

2.1.2 Aquatic Life

The 2004 FEIS described the types of fish present in the waterbodies along the I-93 corridor, as well as the bird species that use open-water habitats for various life history requirements. A detailed inventory of the condition of existing bridge and culvert crossings was provided, including information on the presence of fish habitat, average width, average depth, dominate substrate, average flow, culvert diameter and the specific type of culvert or bridge. The 2004 FEIS noted that the New England Fishery Management Council has designated the Merrimack River and tributaries to the Merrimack River as essential fish habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

Potential aquatic life impacts were quantified based on calculations of the difference in length between the existing and proposed culvert/bridge crossing for each perennial watercourse affected by construction.

2.1.3 Groundwater

The 2004 FEIS described the stratified-drift aquifers in the study area using reports from previous USGS studies. Public water supply wells within 2,000 feet of I-93 were identified and mapped based on information obtained from the former NHDES Water Supply Engineering Bureau (currently the Drinking Water and Groundwater Bureau). The results of sodium and chloride sampling of the public water supply wells were reported using information from the NHDES Drinking Water Source Protection Program and additional sampling conducted as part of the 2002-2003 NHDOT Road Salt Sampling Study.

The amount of I-93 roadway area transversing through stratified-drift aquifer areas was estimated using preliminary design plans. Based on the amount of roadway area within each of the stratified-drift aquifers, a general assessment of the potential effect on groundwater recharge as well as the existing or future use of the aquifer was conducted while considering the inherent

characteristics of the aquifer, the availability of an existing municipal water supply system and the existing land use within the aquifer area.

Potential sodium and chloride impacts from deicing activities from deicing salt were estimated using a mass balance approach to determine the average annual sodium and chloride concentrations accounting for the various hydrogeologic conditions. The analysis was very conservative because it assumed all the deicing salt applied to the roadway would infiltrate into groundwater. In reality, depending on the underlying soil types and drainage infrastructure, much of the applied road salt may be conveyed by surface runoff and end up in nearby surface waters. The mass balance analysis used on average deicing salt application rate of 22.8 tons per lane mile.

The 2004 FEIS calculated roadway encroachment on wellhead protection areas associated with public wells and qualitatively evaluated the results.

2.2 Results from 2004 FEIS

2.2.1 Surface Water

Stormwater Runoff

The preliminary drainage design utilized in the 2004 FEIS found that in at least 13 of the corridor watersheds, extended detention basins could treat runoff from nearly 100 percent of the new and reconstructed roadway area, meaning that pollutant loadings would be reduced in comparison to existing conditions. This included the key streams that drain to the major area lakes, such as in the northwest tributary to Cobbetts Pond and the south and north tributaries to Canobie Lake.

In five other watersheds, at least 80 percent of the new and reconstructed roadway area would be directed to extended detention basins while the remaining 20 percent would be directed to grass swales. No substantial increase in pollutant loadings would be expected in these watersheds.

In the remaining three watersheds (tributary to Porcupine Brook at Exit 1, the north tributary to Flatrock Brook, and the south tributary to Beaver Brook), approximately 65 to 75 percent of the new and reconstructed roadway area would be treated by extended detention basins, with the remaining area being treated by grass swales. In these three watersheds where less than 80 percent of the total roadway area is being proposed for treatment by extended detention basins, there is the potential for a slight increase in pollutant concentrations from highway runoff. However, the 2004 FEIS concluded that given the conservative assumptions used in the analysis, the level of increase would be expected to be minimal and not result in any measurable impact to water quality or the designated uses of the affected waterbodies.

Phosphorus Loadings

Assuming a phosphorus removal efficiency of 40 percent with extended detention basins, the 2005 Selected Alternative could increase phosphorus concentrations by 0.7 and 0.6 µg/l in

Canobie Lake and Cobbetts Pond, respectively. Even if a removal efficiency of only 20 percent were assumed (grass swales), the in-lake phosphorus concentrations would increase by only 1.5 and 1.6 µg/l, to 13.5 µg/l and 12.6 µg/l respectively. The 2004 FEIS concluded that these theoretical increases were relatively minor given the existing lake phosphorus concentrations and would not be expected to cause a discernable or measurable change in quality conditions in either lake. The total amount of new and reconstructed roadway area would represent 2.2 and 2.4 percent of the overall lake watershed area for Cobbetts Pond and Canobie Lake, respectively. Less than a third of the total predicted future phosphorus concentrations would be associated with highway runoff, meaning that the majority of the phosphorus inputs would continue to be derived from other sources.

Deicing Salt and Chloride Concentrations

The deicing salt mass-balance analysis found that future chloride concentrations could potentially exceed the chronic life criteria (230 mg/l) in four streams under the 2005 Selected Alternative:

- Tributary to Harris Brook,
- South Tributary to Canobie Lake,
- North Tributary to Canobie Lake and
- Dinsmore Brook

Also, Policy Brook had currently elevated chloride levels and a predicted future concentration that approached the chronic criteria. For tributary to Harris Brook, Policy Brook, and the North Tributary to Canobie Lake, most of the existing chloride concentrations were attributed to sources other than the I-93 roadway, given that the upstream concentrations were elevated. The elevated upstream chloride concentrations in the North Tributary to Canobie Lake were potentially linked to the water softening process at the nearby Pennichuck Water Works wells.

The 2004 FEIS concluded that Dinsmore Brook and the South Tributary to Canobie Lake could be affected the most by the 2005 Selected Alternative based on the predicted increases in average annual chloride concentrations. Dinsmore Brook and South Tributary to Canobie Lake are small waterbodies with watershed areas of about 200 acres or less. Neither stream was considered to provide regionally important aquatic habitat because of their small watershed size and limited stream lengths. The relatively large increase predicted for the South Tributary to Canobie Lake was largely due to a change in the drainage direction, where nearly 0.5 mile of the roadway that currently drains to Porcupine Brook would be diverted back to the Canobie Lake watershed. This change was made based on a request from the Salem Board of Selectmen and the Water Department officials to maximize the surface recharge of the lake.

2.2.2 Aquatic Life

The majority of the stream bed impacts of the 2005 Selected Alternative were due to culvert lengthening, typically ranging from 50 to 200 feet. Exceptions where larger areas of disturbance could occur included the realignment of 750 feet of the Tributary to Harris Brook in Salem and

the relocation of 2,400 linear feet of stream channel in the Wheeler Pond Tributary in Londonderry due to highway widening and sound wall construction.

Two tributaries to the Merrimack River, Cohas Brook in Manchester and Little Cohas Brook in Londonderry were evaluated for potential impacts on the designated EFH for Atlantic Salmon. In Cohas Brook, two concrete box culverts and one bridge would be widened or replace in-kind (Locations #5A, #3N, and #4E, see 2004 FEIS Figure 3.4-1). Degraded conditions with coarse sands exist at the box culvert locations where the stream bottom will be impacted by replacement of the structures. Since the bridge at #4E was recently replaced and both stream banks rip-rapped with stone, extending the abutments for the additional minor widening was not expected to impact the stream bottom or any natural bank. The 2005 Selected Alternative would have no direct impact on Little Cohas Brook. BMPs would be used to prevent downstream runoff impacts during construction. Coordination with NMFS and completion of the EFH Assessment Worksheet indicated that the 2005 Selected Alternative would have an "adverse effect" on EFH that is "not substantial."

2.2.3 Groundwater

The 2005 Selected Alternative would increase the area of impervious surface within the stratified-drift aquifers by 82 acres, a small percentage of the overall aquifer size (over 5,000). Given the low transmissivity and the limited overall use of the affected aquifers for water supply, the expected increase in roadway area under the 2005 Selected Alternative was not expected to result in any measurable adverse impacts to the aquifer. The sodium and chloride groundwater analysis found that even with the doubling of roadway lane miles under the 2005 Selected Alternative, average sodium and chloride concentrations in groundwater at the edge of the right-of-way were projected to be well below the 250 mg/l secondary drinking water standard for sodium and chloride.

The 2004 FEIS identified protection measures consistent with the NHDES guidelines based on the results of the wellhead protection area encroachment analysis. The sodium and chloride analysis for public wells identified four wells with greatest potential for impact—the Pennichuck Water Works wells located along the west side of Canobie Lake, the Yankee Trader (Citizens Bank) and the Plaza-93 wells that are both located along Route 111 within the Exit 3 interchange, and the Boumil Grove Condominium complex in Londonderry, just south of the Exit 4 interchange.

- The high existing chloride concentration at the Pennichuck Water Works well was attributed to the water softening system since the sodium concentration at this well was relatively low. Therefore, deicing salt from I-93 was found to be having a minimal effect on sodium and chloride concentrations in this well.
- At Exit 3, the Plaza-93 facility would be acquired under the 2005 Selected Alternative. The Yankee Trader well is not used for potable water.
- The Boumil Grove Condominiums well has experienced considerable variability in sodium and chloride concentrations both seasonally and year to year, suggesting the need for additional monitoring. The additional deicing salt loadings associated with the 2005

Selected Alternative have the potential to raise the chloride concentrations in this well to approach the state drinking water standard on a more consistent basis.

2.3 Record of Decision Commitments/Mitigation

2.3.1 Record of Decision

Surface Water Resources

The Record of Decision commits NHDOT to an adaptive management approach to maintain salt usage/chloride loadings at existing levels through incremental implementation of the project in the event that TMDL load reductions for state roads are not met. The Record of Decision also made the following specific commitments with respect to surface water resources:

- Approximately 50 different extended-detention basins and 24 grass swales will be incorporated into the project design. The design objective will be to treat runoff from the entire length of the new and reconstructed roadway, including the park-and-ride facilities and the secondary roads and ramps associated with the interchange areas. Both basins and swales will be designed for maximum treatment efficiencies. Typical grass drainage swales will also be utilized in the project to collect and convey stormwater and will provide supplemental treatment benefits.
- I-93 will be relocated toward the median in the vicinity of the Exit 3 interchange to reduce the overall footprint of the interchange and provide additional buffer area between the highway and Canobie Lake and Cobbetts Pond to enhance water quality protections and opportunities.
- The drainage design, treatment swales, and detention basins will include specific spill containment measures in the vicinity of Canobie Lake to capture and isolate any inadvertent hazardous materials spills before they can reach Canobie Lake.
- NHDOT will specify in the contract bid documents that only low phosphorus or no phosphorus fertilizers are to be used in the reestablishment of vegetation within the watershed areas of Canobie Lake and Cobbetts Pond to minimize the potential for phosphorus contributions associated with project construction.
- Opportunities to divert runoff into the watershed of Canobie Lake will be further explored during final design, as requested by the Salem Board of Selectmen, in order to maximize the surface recharge to the Lake.
- NHDOT will coordinate with regulated MS4 communities as part of its obligations in meeting the small MS4 regulations under the NPDES Phase II Program in addressing stormwater management and treatment measures, eliminating any illicit discharges within the storm drain systems, implementing spill prevention and containment measures with emergency response personnel, and general good housekeeping measures. NHDOT will prepare annual reports detailing the activities and efforts that were undertaken as part of the five-year Statewide Stormwater Management Plan under the NPDES Phase II Permit Program, and how the measurable goals were met.
- NHDOT will continue to pursue best management practices for road salt to optimize the use of material, to maximize efficiency and effectiveness of de-icer application. The project will incorporate a Road Weather Information System (RWIS) to provide

maintenance staff real time pavement temperature and moisture data that supports more effective decision-making. NHDOT will utilize the Maintenance Decision Support System (MDSS), an advanced decision support tool for winter maintenance managers currently under development, to maximize the efficiency of winter maintenance operations to reduce salt usage with precision timing of material application.

- NHDOT will standardize the use of "pre-wetting" road salt and ground-oriented spreader application of road salt to limit scatter and increase effectiveness of applied de-icing material.
- NHDOT will replace and refurbish its vehicle fleet and equipment used to maintain I-93 over approximately the next 10 years and will include equipment to increase efficiency of operations. Equipment purchases will include items such as infrared thermometers to adjust de-icer applications based on specific pavement temperature, and under body scraper plows which remove snow more effectively requiring less deicer.
- NHDOT will institute the use of salt brine, a mixture of road salt and water spray applied to roadway surface, to reduce and mitigate the amount of road salt applied to this section of I-93.
- Frequent and systematic training of maintenance personnel will be conducted for the crews maintaining I-93 on salt management reduction techniques and the environmentally sensitive areas along the corridor. Trained NHDOT personnel and equipment will be prioritized for the I-93 corridor winter maintenance over private contractors and equipment.
- Sensitive environmental areas will be indentified and marked for field crews maintaining I-93 and to raise awareness of the motoring public.
- NHDOT will continue to explore the effectiveness and practicability of alternative de-icers, through limited pilot studies and experiments throughout the State, for potential use in environmentally sensitive areas.
- During the construction phase, additional measures will be undertaken as practicable to ensure that the water quality of Canobie Lake, Cobbetts Pond, and other brooks, streams and wetlands are protected. NHDOT will ensure that Storm Water Pollution Prevention Plans (SWPP) are prepared for each construction contract per NHDES requirements and USEPA NPDES Phase II requirements and guidelines for construction activities. The goal of the SWPP(s) is to reduce or eliminate stormwater pollution from construction activity by implementing pollution control Best Management Practices (BMPs) to protect water quality, including designing and implementing erosion and sediment control measures appropriate for the project specific construction activities and resources. Prior to the commencement of work, the Contractor will submit an erosion control and stormwater management plan specific to the project that will present measures to be employed to limit the extent and duration of exposed soils, temporary stabilization measures to be used and containment measures to prevent downstream sedimentation and turbidity.
- All requirements of the Construction General Permit (CGP) will be met for each construction contract including a Notice of Intent, implementation of the SWPP, and Notice of Termination upon completion.
- NHDOT will continue to participate with NHDES and USEPA with respect to the regional issues of elevated chloride levels in area streams. NHDOT will participate in continuing water quality monitoring efforts as they relate to characteristics of I-93's

contributions and coordinate with NHDES relative to its Volunteer Lake Assessment Program (VLAP) for monitoring any future changes in chloride concentrations associated with Dinsmore Brook, Cobbetts Pond, and the tributaries to Canobie Lake. NHDOT will participate in the anticipated TMDL study and work towards implementing appropriate road salt management plans that may be developed. The NHDOT will comply with the provisions of the Section 401 Water Quality Certification.

- NHDOT will also coordinate and exchange information with local DPW officials regarding new and more efficient ways to store and apply road salt for deicing purposes through outreach and education efforts as part of the Phase II Storm Water Management Plan, discussed above. NHDOT will share its technical experiences and knowledge, provide technical assistance to communities, and investigate venues and opportunities, such as through the University of New Hampshire (UNH) Technology Transfer Center, for sharing knowledge and experience relative to road salt management and application techniques.
- NHDOT will provide funding of up to $3 million to the NHDES Drinking Water Supply Land Grant Program to be used to purchase property rights to aid in the protection of water quality around Massabesic Lake, which is used to supply drinking water to Manchester, and parts of Derry and Londonderry.

Groundwater Resources

The Record of Decision made the following commitments with respect to groundwater resources:

- The 2005 Selected Alternative will incorporate extended detention basins and grassed swales to treat roadway runoff for nearly the entire new and reconstructed roadway, including existing pavement areas. This is consistent with NHDES's *Recommendations for Groundwater Protection Measures When Siting or Improving Roadways*, and Level 2 protection measures for all new and improved roadways in Wellhead Protection Areas (WHPAs), locally designated groundwater protection areas or areas classified as GA1 areas (i.e. watersheds or recharge areas to existing or future water supplies) under the WHPA Program.
- Consistent with the NHDES (1995) recommendations, the practicability of Level 3 measures including impermeable drainage swales and detention basins, and diversion runoff will be evaluated during final design for portions of the reconstructed roadway within 1,000 feet of a community well or 500 feet of the non-community, non-transient wells. This includes specifically the Boumil Grove Condominium's well in Londonderry which is within 500 feet of the proposed roadway area. In lieu of these measures, the possibility of connecting this condominium to the nearby municipal water system may also be explored.
- With the "tight –shift" design option, the I-93 roadway in the vicinity of the Pennichuck wells will be relocated further away as part of the 2005 Selected Alternative, and will require only Level 2 protection measures.
- The same mitigation measures relative to road salt that were described for Surface Water Resources will also protect groundwater resources.

- As part of the final design, NHDOT will also identify and specify precautions to minimize potential blasting impacts during construction for all known public and private wells within 1,000 feet of the blasting area. NHDOT will also coordinate with the area utilities just prior to construction to prevent and repair any inadvertent damage to underground distribution lines.
- NHDOT will investigate and replace any wells that are subsequently found to be damaged or degraded as a result of NHDOT activities through its Well Replacement Program. In accordance with RSA 228:4, NHDOT will conduct remedial measures for any wells that are found to have been impacted by construction or maintenance activities in relation to a state highway.

2.3.2 Section 401 Water Quality Certification

The I-93 Salem to Manchester Section 401 Water Quality Certification was issued by NHDES on May 2, 2006. By issuing the Water Quality Certification NHDES has determined that any discharge associated with the project will not violate surface water quality standards, or cause additional degradation in surface waters not presently meeting water quality standards. The Water Quality Certification conditions and the actions NHDOT has taken to comply with these provisions are summarized below.

Condition E-1 is a standard condition in all water quality certifications that states that the construction and operation of the project shall not cause or contribute to a violation of surface water quality standards in waterbodies currently meeting the water quality standards.

Condition E-2 contains requirements related to inspection and maintenance plans for construction soil erosion control BMPs. To meet these requirements, NHDOT is complying with a 2/2/09 letter from Paul Currier to Charles Hood, *Subject: Amendment of the November 16, 2006 Guidance for BMP Inspection and Maintenance, and Turbidity Sampling and Analysis Plans for I-93 Expansion Project Water Quality Certification*. Proposed construction turbidity sampling locations are submitted to NHDES prior to advertising each construction contract. Condition E-2 also requires emergency response provisions for addressing erosion control issues at any time. This information is submitted to NHDES by the contractor prior to construction.

Condition E-3 states that the conditions of the NHDES Wetland Bureau permit become conditions of the water quality certification.

Condition E-4 requires that stormwater BMPs be designed, implemented and maintained as proposed in the 2004 FEIS and ROD. Condition E-4 also requires concurrence from NHDES on the design of stormwater BMPs and pollutant load estimates. To meet these requirements, NHDOT has been and continues to coordinate with the NHDES Watershed Management Bureau. NHDOT has agreed to design and analyze the proposed permanent stormwater treatment structures according to *NHDES Interim Guidance Issued on May 24, 2007* and "Simple Method Model" for Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorous (TP).

Condition E-5 requires a pre- and post-construction water quality monitoring plan for sediment, phosphorus, nitrogen and total petroleum hydrocarbons be approved by NHDES prior to

construction. NHDES approved the *I-93 Expansion BMP Efficiency Trend Monitoring Plan* on May 21, 2007 and implementation of the plan began in summer 2008.

Condition E-6 requires water quality monitoring for chloride, including monitoring in locations outside the TMDL watersheds. NHDES approved the *I-93 Expansion Chloride Surveillance Monitoring Plan* on October 19, 2006 and implementation of the plan began in summer 2007.

Conditions E-7 through E-11 are requirements related to chloride TMDL studies and implementation. To meet these requirements, NHDOT has entered into a Memorandum of Agreement (MOA) with NHDES on May 16th 2006 to provide $560,000 to conduct four TMDL studies in watersheds impaired for chloride. The MOA states that NHDES and NHDOT will coordinate to conduct the TMDL studies for chlorides on Policy Brook, Unnamed Tributary to the Western Embayment of Canobie Lake (also known as the North Tributary to Canobie Lake), Dinsmore Brook, and Beaver Brook. NHDES has completed the TMDL studies, which are awaiting EPA approval. NHDOT also funds and participates in the Salt Reduction Work Group to facilitate TMDL outreach, public education and technical support. The workgroup has produced two documents: *Results of the Workgroup Interviews* and *Potential Solutions for Reducing Road Salt Use in New Hampshire*.

2.4 2008 Update Evaluations

2.4.1 Changes in Regulations/Guidelines

On May 24, 2007, NHDES issued a document entitled *Interim Guidance for the Structural Design of Stormwater Best Management Practices Needed to Achieve Results of Pollutant Loading Analyses*. Among other changes, the interim guidance requires the design of stormwater treatment measures to treat a volume of runoff equivalent to the first one inch of rainfall, instead of the ½ inch of rainfall assumed in the preliminary extended detention basin designs in the 2004 FEIS,.

2.4.2 Changes in Analysis Methods

NHDOT agreed to strive to design and analyze the permanent stormwater treatment BMPs for the I-93 project in accordance with the interim guidance described in Section 2.4.1. Key changes to the water resources impact analysis assumptions since the 2004 FEIS as a result of the new guidance include:

1. The runoff or Water Quality Volume that needs to be treated increased from the first half-inch to a full inch.
2. The analysis needed to include Total Nitrogen (TN) and Total Phosphorus (TP), as specified in the Water Quality Certificate.
3. Restrictions on placing the Stormwater Treatment Structures in wetlands

The interim guidance substantially changed the design of the project stormwater treatment BMPs. The number of basins proposed has increased from 50 to approximately 100, and the predominant type of basins has been changed from dry extended detention basins to wet

extended detention basins and gravel wetlands to maximize removal efficiencies for TN and TP. NHDOT has been and will continue to coordinate with NHDES regarding the project stormwater treatment BMPs, including NHDES review of design plans and pollutant loading analysis for these structures. While the design of the project stormwater treatment BMPs was ongoing at the time of the preparation of the SEIS, it is anticipated that sufficient treatment capacity will be provided to meet or exceed the 2004 FEIS and ROD commitments with respect to highway runoff. Where feasible and consistent with other environmental and design considerations, NHDOT will continue to strive to design the stormwater treatment structures in accordance with the NHDES interim guidance.

2.4.3 Changes in Existing Conditions

Since the 2004 FEIS there has been a substantial increase in the amount of data available to characterize chloride concentrations and loadings in the I-93 corridor as a result of post-FEIS monitoring by NHDOT, NHDES and EPA, TMDL studies for four corridor waterbodies, and chloride surveillance monitoring of streams outside the TMDL watersheds. Updated information on phosphorus concentrations in Canobie Lake and Cobbetts Pond is available from VLAP.

Chloride Total Maximum Daily Load (TMDL) Studies

Section 303(d) of the Clean Water Act (CWA) and EPA'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. In New Hampshire, NHDES is the agency responsible for conducting TMDL studies and establishing TMDLs. The TMDL process studies existing loadings, identifies responsible parties and establishes the allowable loadings of pollutants for a waterbody based on the relationship between pollutant sources and instream water quality conditions. The States establish water quality based controls to reduce pollution from the identified sources and restore water quality.

Prior to beginning chloride TMDL studies, NHDES, NHDOT, EPA and USGS developed and agreed to roles and responsibilities, technical tasks, and detailed analysis procedures for all TMDL studies. These procedures are documented in the report entitled *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* (NHDES, 2006). The TMDL study included the collection of road salt loading information from the State and Municipalities, estimates of road salt loading for private entities, and in-stream chloride concentration, specific conductance, water temperature and stream flow data for the four chloride impaired waterbodies from 7/1/06 to 6/30/07. The data obtained through the study is analyzed and presented in a document entitled *Data Report for the Total Maximum Daily Loads for Chloride For Waterbodies in the Vicinity of the I-93 Corridor From Massachusetts to Manchester, NH: Policy-Porcupine Brook Beaver Brook Dinsmore Brook North Tributary to Canobie Lake* (NHDES, 2007). All of the chloride TMDL related documents referenced in this section are available on the I-93 project website (http://www.rebuildingi93.com/).

Following an opportunity for public comment on Draft TMDL reports for Beaver Brook, Dinsmore Brook, the north tributary to Canobie Lake, and Policy Brook in 2007, Final TMDL reports were submitted by NHDES to EPA for approval in April 2008. On January 22, 2009, EPA issued a letter to NHDES approving the TMDL reports as meeting the requirements of Section 303(d) of the Clean Water Act and EPA's regulations (40 CFR 130).

While EPA approves the TMDL reports establishing the total reduction in chloride loadings needed to achieve water quality standards, NHDES is responsible for the implementation of the TMDLs. For the chloride impaired waterbodies in the I-93 corridor, NHDES will prepare an Implementation Plan containing chloride load allocations. The load allocations will be distributed among the various entities responsible for chloride loadings (e.g. NHDOT for roads maintained by the State, individual municipalities for municipal roads, etc.). The individual chloride source entities are allowed to develop their own proposed implementation plans for submission to NHDES, but the load allocations will ultimately be determined by the NHDES Implementation Plan. There will be an opportunity for public comment on the NHDES TMDL Implementation Plan.

Beaver Brook[1]

The Beaver Brook watershed assessed in the TMDL study is 30.33 square miles in size, covering portions of Derry and Londonderry, Auburn and Chester. The waterbody was placed on the 303(d) list in 2006 based on violations of the chronic water quality standard (230 mg/l) in 2004 and 2005. During the 2006-2007 TMDL study data collection, no violations of the chronic water quality standard were recorded; as such, NHDES used data from previous years to establish a load reduction.. Table 2-1 shows the TMDL study estimates of salt loadings by source in the Beaver Brook watershed. Based on this data, NHDES estimated that the major sources of chloride loadings in the watershed were parking lots (44 percent or 5,506 tons) and municipal roads (37 percent or 4,703 tons). State roads were estimated to contribute 10 percent (1,290 tons) of total loadings to Beaver Brook. The chloride TMDL for Beaver Brook (using the percent reduction goal method[2]) was set at 9,069 tons of salt per year. In the 2006-2007 season, when chronic violations did not occur, salt imports to the watershed were already below the goal (6,380 tons/year) (although violations of the acute standard (860 mg/l) were recorded during the 2006-2007 TMDL study at two monitoring stations located upstream from I-93 (08-SHB, and I93-BVRU03-01)).

[1] 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 (NHDES, 2008).

[2] The percent reduction goal calculation was based on the reduction in loadings needed to achieve the standards during the "dry" hydrologic condition (e.g.). For detailed technical information on how the percent reduction goal calculations were performed, refer to the Quality Assurance Project Plan (NHDES,2006.

Table 2-1
Beaver Brook Salt Loadings by Source, 2003-2007

Source	Agency/Town	Salt Imports (tons salt/yr)			
		FY04	FY05	FY06	FY07
State Roads	NHDOT PS 508	53.2	87.2	58.7	57.8
	NHDOT PS 512	137.9	250.9	132.1	150.9
	NHDOT PS 513	66.7	107.8	65.1	58.5
	NHDOT PS 514	110.6	222.2	119.3	97.9
	NHDOT PS 528	466.2	622.0	371.1	303.6
Municipal Roads	Auburn	12.0	12.0	12.0	12.0
	Chester	67.6	67.6	67.6	67.6
	Derry	2,479.4	3,158.7	3,649.1	1,451.3
	Londonderry	1,564.0	1,464.9	858.5	370.2
Private Roads	Chester	25.7	28.6	26.0	15.4
	Derry	375.3	418.4	380.2	225.6
	Londonderry	158.0	176.2	160.1	95.0
Parking Lots	Derry	2,585.9	3,516.6	2,563.7	1,888.0
	Londonderry	1,462.8	1,989.3	1,450.3	1,068.0
Salt Piles	Derry	0.3	0.3	0.3	0.3
	Londonderry	1.3	1.3	1.3	1.3
Water Softeners	NA	272.3	272.3	272.3	272.3
Food Waste	NA	149.5	149.5	149.5	149.5
Atm. Deposition	NA	95.1	95.1	95.1	95.1
Total		10,083.8	12,640.8	10,432.2	6,380.3

Dinsmore Brook[3]

The Dinsmore Brook watershed is located within the Town of Windham and is 0.55 square miles in size. The waterbody was placed on the 303(d) list in 2006 based on violations of the chronic water quality standard (230 mg/l) through 2005. During the 2006-2007 TMDL study data collection, the chronic standard was exceeded for 68.5 days of the year (18.8 percent) at the monitoring location downstream of I-93 before the Dinsmore Brook empties into Cobbetts Pond (I93-DIN-01), primarily during the period between July and the end of September. Table 2-2 shows the TMDL study estimates of salt loadings by source in the Dinsmore Brook watershed for the 2006-2007 season. The TMDL study estimated that state roads were the largest source of chloride loadings to Dinsmore Brook at 50 percent (81.7 tons), followed by parking lots (26 percent or 43.4 tons) and private roads (21 percent or 34.3 tons). This result is not surprising given the small size of the watershed and that I-93 Exit 3 interchange is located in the watershed. The chloride TMDL for Dinsmore Brook using the percent reduction goal method was set at 126 tons of salt per year, or 24.3 percent less than the 166.5 tons applied in the watershed in the 2006-2007 season.

[3] Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Dinsmore Brook in Windham, NH (NHDES, 2008).

Table 2-2
Dinsmore Brook Salt Loadings by Source, 2006-2007

Source	Agency/Town	Salt Imports (tons salt/yr)
State Roads	NHDOT PS 514	24.7
	NHDOT PS 528	57.0
Municipal Roads	Windham	4.0
Private Roads	Windham	34.3
Parking Lots	Windham	43.4
Salt Piles	Windham	0.0
Water Softeners	NA	0.7
Food Waste	NA	0.5
Atmospheric Deposition	NA	1.7
Total		166.5

North Tributary to Canobie Lake[4]

The North Tributary to Canobie Lake is located in the Town of Windham and has a watershed area of 0.2 square miles. The North Tributary to Canobie Lake is a sub-watershed of Policy Brook and one implementation plan will be established for both of these watersheds. The waterbody was placed on the 303(d) list in 2006 based on violations of the chronic water quality standard (230 mg/l) in 2003 through 2005. During the 2006-2007 TMDL study data collection, the chronic standard was exceeded for 68.1 days of the year (18.7 percent) at a sampling location (I93-NTC-01) located downstream of I-93 prior to this waterbody empting into Canobie Lake. Table 2-3 shows the TMDL study estimates of salt loadings by source in the North Tributary to Canobie Lake watershed for the 2006-2007 season. State roads, including I-93 were estimated to contribute 84 percent (38.8 tons) of the chloride loadings. However, this figure may be misleading because a water softener was formerly the largest source of salt to the watershed (approximately 55 tons per year) resulting from the discharge of brine from a community water supply well field directly into a wetland. The brine discharges stopped in September 2005, but it is likely that large quantities of chloride from past discharges reside in the groundwater. The chloride TMDL for North Tributary to Canobie Lake using the percent reduction goal method was set at 28.1 tons of salt per year, or 39.6 percent less than the 46.5 tons imported in the watershed in the 2006-2007 season.

[4] Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: North Tributary to Canobie Lake in Windham, NH (NHDES, 2008).

Table 2-3
North Tributary to Canobie Lake Salt Loadings by Source, 2006-2007

Source	Agency/Town	Salt Imports (tons salt/yr)
State Roads	NHDOT PS 514	7.2
	NHDOT PS 528	31.6
Municipal Roads	Windham	4.2
Private Roads	Windham	0.0
Parking Lots	Windham	2.3
Salt Piles	Windham	0.0
Water Softeners	NA	0.4
Food Waste	NA	0.2
Atmospheric Deposition	NA	0.6
Total		46.5

Policy-Porcupine Brook[5]

The Policy-Porcupine Brook watershed is located in the Towns of Salem and Windham and is 10.8 square miles in size. The waterbody was placed on the 303(d) list in 2006 based on violations of the chronic water quality standard (230 mg/l) in 2003 through 2005. During the 2006-2007 TMDL study, the chronic chloride standard was exceeded for 87.7 days of the year (24 percent) at the outlet station for the Policy-Porcupine Brook watershed (Station I93-POL-01V). At station I93-POL-04X, which is upstream of I-93, 66 days were in violation of the chronic standard (18 percent), along with three violations of the acute standard. Table 2-4 shows the TMDL study estimates of salt loadings by source in the Policy-Porcupine Brook watershed for FY07. The TMDL study estimated that the major sources of chloride loadings in the watershed were parking lots (50 percent or 2,426 tons) and municipal roads (27 percent or 1,305 tons). State roads were estimated to contribute nine percent (456 tons) of total loadings to Policy-Porcupine Brook. The chloride TMDL for Policy-Porcupine Brook using the percent reduction goal method was set at 3,635 tons of salt per year, or 24.5 percent less than the 4,814 tons applied in the watershed in the 2006-2007 season.

[5] Total Maximum Daily Load (TMDL) Study For Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Policy-Porcupine Brook in Salem and Windham, NH (NHDES, 2008).

Table 2-4
Policy-Porcupine Brook Salt Loadings by Source, 2006-2007

Source	Agency/Town	Salt Imports (tons salt/yr)
State Roads	NHDOT PS 514	160.5
	NHDOT PS 528	295.6
Municipal Roads	Salem	1,247.9
	Windham	57.8
Private Roads	Salem	119.6
	Windham	5.4
Parking Lots	Salem	2,379.1
	Windham	47.3
Salt Piles	Salem	315.2
Water Softeners	NA	101.8
Food Waste	NA	52.3
Atmospheric Deposition	NA	31.9
Total		4,814.3

NHDOT TMDL Implementation Plan

In May 2009, NHDOT submitted a TMDL implementation plan specific to State highways to NHDES.[6] The objective of the NHDOT implementation plan is to continue to provide reasonably safe highway conditions during winter weather, while addressing the need to reduce salt use in the TMDL watersheds. The NHDOT implementation plan also takes into account the salt loadings from the proposed widening of I-93 to four lanes in each direction, provides an estimated timeline for the implementation of various deicing BMPs, and outlines monitoring procedures to assess NHDOT salt use in comparison to objectives of the plan. The salt load allocations proposed in the NHDOT implementation plan include salt loading savings resulting from a 20% improvement in application efficiency over past practices. In addition, the current and future salt loads were compared to an independent variable, vehicle usage (e.g. traffic volumes and vehicle lane miles). The vehicle usage comparison allowed NHDOT to assess the efficiency (how many vehicles are served by the application of salt), by sector (State, Municipal and Private applicators). The NHDOT TMDL implementation plan report is available on the project website (http://www.rebuildingi93.com/).

[6] Implementation Plan to Increase the Efficiency and Effectiveness of Road Salt Use To Meet Total Maximum Daily Load For Chloride In Water Bodies Along the I-93 Corridor From Salem to Manchester, NH: Beaver Brook, Dinsmore Brook, North Tributary to Canobie Lake and Porcupine-Policy Brook (NHDOT, 2009).

Chloride Surveillance Monitoring

On October 19, 2006 NHDOT and NHDES published the *I-93 Expansion Chloride Surveillance Monitoring Plan*. The purpose of the plan was to establish the sampling and analysis procedures for meeting the Section 401 Water Quality Certificate condition (E-6) requiring chloride monitoring outside of the TMDL watersheds. Chloride monitoring involves eight rounds of sampling per year at the following locations:

- NH Route 28 Bypass / Cohas Brook
- Symmes Drive / Little Cohas Brook
- Parmenter Road / Nesenkeag Brook
- Island Pond Road / Taylor Brook
- NH Route 28 / Flatrock Brook
- Church Road / Golden Brook

Since sampling began in June 2007, no violations of the chronic or acute chloride standards have been recorded at any of the chloride surveillance sites. Table 2-5 summarizes the range of chloride concentrations and specific conductance measurements recorded in the first year of chloride surveillance monitoring.

Table 2-5
2007-2008 Chloride Surveillance Monitoring Results

	Chloride (mg/l)	Specific Conductance (µs/cm)
Cohas Brook	19-32	80-125
Little Cohas Brook	61-130	205-430
Nesenkeag Brook	25-120	102-325
Taylor Brook	27-43	139-253
Flatrock Brook	33-48	178-273
Golden Brook	44-68	239-380

Volunteer Lake Assessment Program (VLAP)

The 2004 FEIS reported VLAP data for Canobie Lake and Cobbetts Pond through 2002. Updated information taking into account VLAP data through 2008 is summarized below.

In Canobie Lake, chlorophyll-a levels and lake transparency have remained relatively constant since 2002. There is no apparent change in total phosphorus concentrations in Canobie Lake since 2002. Although there has been variation from year to year, the epilimnion (upper layer) phosphorus concentration in 2008 (7.2 µg/l) was nearly identical to 2002 concentration (7.0 µg/l). Hypolimnion (lower layer) phosphorus concentrations appear to have decreased since 2002, from 19 µg/l to 13 µg/l in 2008.

In Cobbetts Pond, chlorophyll-a levels have varied considerably from year to year since 2002. High levels of chlorophyll-a were recorded in 2004 and 2005, but in 2006 declined to the 2002 levels. Lake transparency was lower than 2002 levels in 2003, 2004, and 2005, but substantially higher than 2002 levels in 2006, in contrast to the long term trend. Phosphorus concentrations have decreased in the hypolimnion at both sampling locations on Cobbetts Pond. Phosphorus

concentrations have increased slightly in the epilimnion at station 2 (southern section), but remained approximately the same at station 1 (northern section).

- Epilimnion Station 1: 11.5 µg/l in 2002 to 12 µg/l in 2008
- Hypolimnion Station 1: 40 µg/l in 2002 to 15 µg/l in 2008

- Epilimnion Station 2: 7 µg/l in 2002 to 13 µg/l in 2008
- Hypolimnion Station 2: 31 µg/l in 2002 to 26 µg/l in 2006

Since the 2004 FEIS, NHDES has classified Cobbetts Pond as eutrophic based on the available water quality monitoring data. Phosphorus sources contributing to the eutrophication of Cobbetts Pond include increased impervious surface cover, lawn fertilizers, malfunctioning septic systems, and the construction of sandy beaches (June 28, 2007 letter from NHDES to Derek Monson, Cobbetts Pond Improvement Association).

Cobbetts Pond Watershed Restoration Plan

NHDES and the Cobbetts Pond Improvement Association, with the assistance of a federal grant, are funding the development of a watershed restoration plan for the Cobbetts Pond watershed. The plan will include the identification of pollutant loading sources and necessary reductions in loadings needed to achieve the water quality goals of the plan. The development of the watershed restoration plan will include the following tasks:

- comprehensive review of historic lake data;
- six months of lake and tributary water quality monitoring (scheduled for spring-fall 2009);
- hydrologic and pollutant load modeling;
- development of a prioritized list of potential stormwater improvements in the Cobbetts Pond watershed;
- engineering, permitting and construction of several high priority watershed restoration sites; and
- collaboration with watershed stakeholders through a series of public forums and educational workshops.

The watershed restoration plan is expected to be completed by fall 2009.

2.4.4 Changes in Future No Build and Build Conditions

There are no changes to the No Build condition for water resources as described in the 2004 FEIS, other than the updated existing conditions information presented in Section 3.4.3.

The water quality commitments from the 2004 FEIS and ROD remain valid. Any changes in pollutant loadings as a result of the changes in the proposed stormwater treatment practices described in Section 2.4.2 are being done in cooperation with and with concurrence from NHDES. NHDOT will continue to coordinate with NHDES with respect to stormwater management and to ensure the conditions of the Section 401 Water Quality Certification are met.

The number of roadway lanes proposed as part of the 2005 Selected Alternative (four in each direction) has not changed; therefore the 2004 FEIS analysis and conclusions regarding deicing salt loadings have not changed. For chloride loadings related to deicing salt applications, NHDOT has been implementing the management practices outlined in the Record of Decision and MOA.

2.4.5 Mitigation

NHDES guidance addressing the requirements of the Water Quality Certificate has substantially increased the number of stormwater treatment structures included in the project. The adoption of this guidance has essentially doubled the number of these structures from the total number detailed in the 2004 FEIS. The guidance also added a requirement to treat nutrients (nitrogen and phosphorous) contained in stormwater. Innovative detention basins, such as gravel wetlands, have been incorporated into the design of I-93 to strive to achieve the goals of the guidance. In cooperation with NHDES, NHDOT is implementing the water resources commitments made in the Record of Decision, Water Quality Certification, and NHDOT/NHDES MOA. With respect to chlorides, some of the mitigation commitments NHDOT have made are summarized below:

- Provided $560,000 in funding for and participation in four TMDL studies. As part of this effort, a Salt Reduction Workgroup has been established to advise NHDES on the TMDL study and NHDES's Implementation Plan, and to advise and assist with the implementation of required salt load reductions. The workgroup includes representatives from the following organizations: NHDES; NHDOT; EPA; 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 Technology Transfer (T2) Center; 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. Representatives from pertinent watershed organizations and state-wide environmental organizations were invited to join the workgroup in 2008. A professional facilitator retained by the Steering Committee and funded by NHDOT leads the Salt Reduction Workgroup meetings. The Salt Reduction Workgroup has published two reports: *Results of the Workgroup Interviews for the I-93 Salt Reduction Workgroup* (Jeffrey H. Taylor & Associates and Center for the Environment, Plymouth State University, 2007) and *Potential Solutions for Reducing Road Salt Use in New Hampshire* (Jeffrey H. Taylor & Associates and Center for the Environment, Plymouth State University, 2008)

- Dedicated $2.5 million to I-93 corridor municipalities to fund salt reduction.

- Committed $700,000 to fund regional salt reduction, including plow driver training (state, local and private), public education and salt use tracking.

- NHDOT has purchased equipment to improve the efficiency of deicing salt applications, including two ground oriented pre-wetting spreaders, four brine trucks, two Road Weather Information System (RWIS) stations and established a Maintenance Decision Support System (MDSS), which is a plow and salting forecasting software system.

2.5 Conclusion

Any changes in pollutant loadings as a result of the changes in the design of the proposed stormwater treatment practices are being done in cooperation with and with concurrence from NHDES. NHDOT will continue to coordinate with NHDES with respect to stormwater management and to ensure that the conditions of the Section 401 Water Quality Certification are met. The number of roadway lanes proposed as part of the 2005 Selected Alternative (four in each direction) has not changed; therefore the 2004 FEIS analysis and conclusions regarding deicing salt loadings have not changed. With the exception of the design changes in the stormwater treatment practices (doubling the number of detention basins), water resources commitments in the Record of Decision, Water Quality Certification, and NHDOT/NHDES MOA remain valid.

3.0 Floodplains

3.1 2004 Analysis Methods & Prevailing Regulations/Guidelines

The 2004 FEIS identified and described floodplains and floodways that may be encroached upon by the project based on FEMA's 1998 Flood Insurance Rate Maps (FIRM). Floodplain and floodway impacts in acre-feet were identified through an overlay analysis for nine watercourses. Due to the importance of Policy Brook and the Spicket River floodway and floodplain areas in the Town of Salem, an additional detailed analysis was completed using the Army Corps of Engineers Hydraulic Engineering Center's River Analysis Software (HEC-RAS) computer program to create an "existing conditions" hydraulic model of the study area using actual ground survey cross sections that approximates the 100-year flood event. The study looked at a 1.3 mile section of Policy Brook between Kelly Road and its confluence with the Spicket River; and a 1.5 mile section of the Spicket River from its confluence with Policy Brook to just below its confluence with Harris Brook in Massachusetts. A "proposed conditions" hydraulic model was created by modifying the existing cross sections to reflect the roadway improvements associated with the 2005 Selected Alternative.

3.2 Results from 2004 FEIS

Total floodplain impacts calculated for the 2005 Selected Alternative 43.4 acre-feet (across eight waterbodies) plus floodway impacts of 6.3 acre-feet (across five waterbodies), for a total impact of 49.7 acre-feet. The detailed hydraulic analysis of Policy Brook and Spicket River in Salem concluded that the 100-year flood elevation would experience minor, if any, change as a result of the proposed highway improvements. As such, the 2005 Selected Alternative was expected have a negligible impact on these watercourses' ability to convey floodwaters.

Taking into account the proposed mitigation measures (See Section 3.3), the 2004 FEIS made a floodplain finding in accordance with Executive Order 11988 *Floodplain Management*, and 23 CFR 650A *Location and Hydraulic Design of Encroachments on Floodplains*, that there was no practicable alternative to the proposed construction in floodplains and that the 2005 Selected Alternative includes all practicable measures to minimize harm to floodplains.

3.3 Record of Decision Commitments/Mitigation

The Record of Decision made the following commitments with respect to floodplains:

- Direct impacts to the 100-year floodplain and floodways will be minimized during final design, by steepening highway embankments and/or utilizing retaining walls where appropriate. Such locations include the areas adjacent to the Spicket River, Policy Brook, and Porcupine Brook in Salem; Beaver Brook in Derry and Londonderry, Wheeler Pond in Londonderry, and Cohas Brook in Manchester.

- A series of up to 14 basins will be constructed at locations immediately adjacent to impacted floodplains or where natural valley storage is being lost.

- Additional flood storage compensation will be created at locations adjacent to flood-susceptible brooks and rivers, or locations upgradient from flood-prone areas. Detention basins are being proposed for stormwater treatment and floodwater storage at a number of locations along the widened highway. These basins are typically designed to store up to a 50-year storm event before discharging to nearby watercourses.

- The design of the wetland creation sites will include the goal of providing both floodflow alteration and compensatory flood storage. These sites include the Pelham Road Mitigation Site, Waste Water Treatment Plant Site, and Baggett Site in Salem, Highway Median Site in Windham; and South Road Mitigation Site in Londonderry.

- The 2004 FEIS estimated that 155-161 acre-feet of flood storage would be provided by the proposed mitigation measures.

3.4 2008 Update Evaluations

3.4.1 Changes in Regulations/Guidelines

There have been no changes in the regulations and guidance pertaining to the analysis of floodplain and floodway impacts since the 2004 FEIS. Changes in the FEMA mapping of floodplains and floodways since the 2004 FEIS is described in Section 3.4.2.

3.4.2 Changes in Analysis Methods

On May 17, 2005, FEMA issued a Digital Flood Insurance Rate Map (DFIRM) for Rockingham County, New Hampshire. The DFIRM data is made available to the public through the New

Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT). The 2005 DFIRM replaces the previous paper FIRMs.

As part of the final design process, NHDOT has conducted an update of the I-93 widening floodplain impacts, including the use of the 2005 DFIRM for Rockingham County. It should be noted that mapped FEMA floodplain boundaries typically do not accurately reflect site-specific topography in many locations. Often times the floodplain boundary presented on a FEMA map will cross contours in a manner that is obviously impossible given the estimated flood elevation compared to actual ground elevations. For this reason, NHDOT prepared a "corrected floodplain" boundary for the updated floodplain impact analysis. The corrected floodplain map was developed by incorporating the 2005 DFIRM data with the topographic and roadway data included in project plans. This enabled the identification of areas where the DFIRM flood boundary clearly did not reflect or was inconsistent with the existing topography information. The floodplain boundary was then modified to reflect topographic conditions and the resultant floodplain data was developed into a CAD file containing the digital 100-year floodplain and floodway mapping. The corrected floodplain mapping is a more accurate representation of the estimated 100-year floodplain for the project corridor than the unaltered DFIRM data.

3.4.3 Changes in the Existing Conditions

The waterbodies with floodplains and floodways delineated have not changed since the 2004 FEIS. However, the exact boundaries of the floodplains and floodways have been corrected based on detailed topographic information for the project corridor, as described previously in Section 3.4.2. The corrected floodplain boundary does not change the flood elevations reported on the DFIRM, which are generally the same of the previous paper FIRM flood elevations. The corrected floodplain mapping reduces the size of the floodplain in areas affected by 2005 Selected Alternative, as described in Section 3.4.4, below.

3.4.4 Changes in the Future No Build and Build Conditions

Other than the floodplain mapping changes noted above in Section 3.4.2 and 3.4.3, there are no changes to the No Build condition for floodplains as described in the 2004 FEIS.

Table 3-1 presents the updated 100-year floodplain impact analysis results using the 2004 FEIS floodplain mapping (1998 FIRM), 2005 DFIRM, and the corrected floodplain mapping. At 19.8 acre-feet, the floodplain impact calculated using the corrected floodplain boundaries is substantially less than the impacts calculated using the uncorrected DFIRM (49.7 acre-feet). The total floodplain impact using the uncorrected DFIRM data (50.0 acre-feet) is similar to the estimated impact using the 2004 FEIS data. As discussed previously, the corrected floodplain impact calculation is the most accurate estimate of floodplain boundaries available, accounting for site specific topography.

In addition to reductions in 100-year floodplain impacts, updated design information indicates a reduction in floodway impacts for the 2005 Selected Alternative. Through avoidance and minimization measures in final design, floodway impacts reported in the 2004 FEIS have been eliminated for the Spicket River, Tributary to Wheeler Pond, and Cohas Brook/Long Pond

Brook. The two remaining floodway impacts estimated for the 2005 Selected Alternative are at Beaver Brook (1.9 acre-feet) and Wheeler Pond (0.01 acre-feet). These floodway impacts are less than the floodway impacts predicted for these waterbodies in the 2004 FEIS (2.4 acre-feet for Beaver Brook and 0.05 acre-feet for Wheeler Pond).

Table 3-1
Updated 100-Year Floodplain Impacts

Resource	Municipality	Floodplain Data Source		
		2004 FEIS (1998 FIRM) (acre-feet)	2005 Uncorrected DFIRM (acre-feet)	Corrected Floodplain (acre-feet)
Spicket River	Salem	2.4	0	0
Harris Brook Tributary	Salem	6.2	16.8	3.1
Porcupine Brook	Salem	12.5	4.2	0.7
Policy Brook -1	Salem	15.0	1.5	4.2
Policy Brook- 2	Salem	0.5	0.3	1.0
Golden Brook	Windham	1.5	15.6	2.2
Beaver Brook	Derry	4.7	4.7	4.4
Wheeler Pond	Londonderry	1.6	1.6	1.0
Tributary to Wheeler Pond	Londonderry	2.5	2.5	2.2
Cohas/Long Pond Brooks	Manchester	2.8	2.8	1.0
Total		49.7	50.0	19.8

3.4.5 Mitigation

As a result of the substantially reduced floodplain impacts ensuing from corrected floodplain mapping and design changes since the 2004 FEIS, NHDOT and FHWA are eliminating the proposed valley storage mitigation areas. Many of these previously identified valley storage areas consist of undeveloped and naturally vegetated areas. Creation of flood storage at these locations would result in wildlife habitat impacts from the extensive tree removal and earthwork required. The impacts associated with constructing the valley storage areas, which were deemed be acceptable in the 2004 FEIS, are no longer prudent due to the substantial reduction in floodplain impacts and consistent with FHWA's mitigation regulations which require that the "proposed mitigation represents a reasonable public expenditure after considering the impacts of the action and the benefits of the proposed mitigation measures" (23 CFR 771.105(d)). During the December 17, 2008 natural resource agency meeting, agreement was obtained from ACOE, NHDES and the other resource agencies to eliminate these valley storage areas from the mitigation package.

Another change in floodplains mitigation involves the Salem Waste Water Treatment Plant Site (Salem WWTP), which was proposed as a wetland mitigation site and compensatory flood storage area in the 2004 FEIS. NHDOT has determined that the extent of soil and groundwater contamination on the Salem WWTP site is greater than was known at the time of the 2004 FEIS. Due to the uncertainties associated with the site clean up, remediation costs for the 32 acre Salem WWTP could range from $3.5 million up to $16.5 million. Portions of the proposed 7.0-acre floodplain creation area have been determined to be located in an area with some of the greatest

groundwater contamination located within the mitigation site. Shifting the proposed floodplain mitigation to avoid the most contaminated area would require impacting an area of undeveloped wooded wetland and upland. Concerns have also been expressed by the NHDES' Waste Management and Water Divisions that the potential would still exist that the existing groundwater contamination could be exposed by any excavation and could potentially migrate through the created area from changes in groundwater flows or by seeping into surface waters. During the December 17, 2008 natural resource agency meeting, agreement was obtained from ACOE, NHDES and the other resource agencies to eliminate the Salem WWTP site from the mitigation package.[7]

NHDOT is investigating alternative sites for the creation of flood storage to replace the Salem WWTP site. One of the locations under consideration is Haigh Avenue in Salem, a residential street located on the east side of I-93 just north of the of New Hampshire/Massachusetts border. The residences on Haigh Avenue have experienced severe flooding in the past from Policy Brook and the Spicket River. The Haigh Avenue residents are willing to relocate and requested that the Town of Salem apply for a residential buyout grant from FEMA. Although a previous request was denied, the Town of Salem has resubmitted a request for funding for residential buyout program. If a residential buyout program was initiated in the future with or without FEMA involvement, the Haigh Avenue site could be effective as a compensatory flood storage area. The Haigh Avenue site could provide up to 27.7 acre-feet of flood storage, greater than the 22.1 acre-feet of storage than would have been provided at the Salem WWTP site. The Haigh Avenue site is also adjacent to the Policy Brook floodplain that will be impacted by the 2005 Selected Alternative. Additional benefits associated with the Haigh Avenue site would include the conversion of previously developed areas and the removal of impervious surfaces, including driveways, road surfaces, and rooftops. The use of the Haigh Avenue site would also eliminate the need for 1,500 feet of noise barrier and associated fill, and provides a location for the potential enhancement and restoration of Policy Brook.

A second potential replacement site for the Salem WWTP site is the Cluff Crossing site, located south of Rockingham Park Boulevard in Salem. The Cluff Crossing site is presently the location of a 27 acre mitigation site (Site ID #30) with 21 acres in preserved in its natural state and 6 acres accommodating Town of Salem recreational fields. Preliminary estimates indicate that approximately 12.5 acre-feet of flood storage could be created on these 6 acres adjacent to Policy Brook.

Additional investigations of the suitability of the Haigh Avenue and Cluff Crossing sites for floodplain mitigation will be conducted as necessary. Proposed changes to the project floodplain mitigation commitments have been and will continue to be coordinated with the resource agencies.

[7] Meeting summary available at:
http://www.nh.gov/dot/org/projectdevelopment/environment/units/projectdevelopment/nracrmeetings.htm

3.5 Conclusion

Since the 2004 FEIS, 100-year floodplain impacts have been substantially reduced from 49.7 acre-feet to 19.8 acre-feet as a result of design modifications and updated floodplain mapping, which includes floodway impacts having been reduced from 6 acre-feet to 2 acre-feet. The reductions in estimated floodplain and floodway impacts indicate that reductions in the floodplain mitigation commitments would be appropriate. In addition, NHDOT has identified new potential compensatory flood storage areas at Haigh Avenue and Cluff Crossing in Salem that could replace the previously proposed Salem Waste Water Treatment Plant site, which requires extensive hazardous materials remediation. Proposed changes to the floodplains mitigation commitments have been and will continue to be coordinated with the resource agencies.

4.0 Wetland Resources

4.1 2004 Analysis Methods & Prevailing Regulations/Guidelines

4.1.1 Wetlands

There were several wetland delineation, assessment and field review activities conducted in the I-93 corridor that contributed to the mapping and characterization of wetlands in the 2004 FEIS. In 1989 a wetland delineation and general assessment was performed in and around I-93 from Salem to Manchester. A detailed delineation of wetlands for the area within the median of I-93 was conducted, and a more cursory delineation was completed for the areas outside of, but adjacent to the northbound and southbound barrels of I-93. Wetland systems were delineated on 1"= 50' scale topographic maps. The delineations were based on the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*, the required basis for wetland delineations between 1989 and 1991. The 1989 Federal Manual uses more conservative delineation parameters resulting in more conservative (more wetland area) boundaries than the 1987 *Corps of Engineers Wetland Delineation Manual* which is the current standard for wetland delineation in New England.

The results of the 1989 wetland delineations were combined with the National Wetlands Inventory (NWI) maps to produce wetland boundaries. In July 1998, the wetlands in the I-93 corridor were field reviewed. Using the 1987 *Corps of Engineers Wetland Delineation Manual*, the previous wetland delineations were revised and updated. Preliminary wetland delineation was extended to the first major intersection beyond the immediate interchange areas for Exit 1 to Exit 5.

Using the U.S. Army Corps of Engineers 1999 *Highway Methodology Workbook Supplement*, function and value assessments were performed in April and May of 2002 for the 27 wetland systems within the I-93 project corridor. The function and value assessments were performed in 56 locations in the vicinity of potential impacts. One wetland function and value box was prepared for each wetland system, representing a composite of the individual assessments performed within each of the 27 systems.

4.1.2 Vernal Pools

In 1996, 2001 and 2002, the I-93 corridor from Salem to Manchester was investigated to determine the location and extent of vernal pools. Using New Hampshire Fish and Game Department guidelines, visual inspections of the pool's water column, substrate, vegetation, and surrounding upland habitat were performed. Species identification and counts of aquatic invertebrates and amphibian egg masses, juveniles and adults were made. Physical characteristics such as pool dimension, maximum and average water depth, and water temperature were also noted. The presence or absence of vernal pool indicator species (fair shrimp, wood frog, spotted salamander, blue-spotted salamander, Jefferson salamander, and marbled salamander) determined whether an area was classified as a vernal pool or not.

4.2 Results from 2004 FEIS

4.2.1 Wetlands

The 2004 FEIS identified 77 acres of wetland impacts for the 2005 Selected Alternative by comparing cut and fill requirements to the wetland mapping described in Section 4.1.1. The majority of the wetland impacts were located along the edge of wetland systems that have already been impacted by highway construction. The 2004 FEIS concluded that in most cases, these "edge impacts" represent only a small percentage of the total wetland acreage within the system and, while representing an incremental loss of wetland area, will not eliminate the functions and values performed by the remaining wetland. Based on consideration of the extent and type of wetland impacts, and of the proposed wetlands mitigation plan, FHWA made a wetlands finding pursuant to Executive Order 11990 that there was no practicable alternative to the proposed construction in wetlands and that the proposed action includes all practicable measures to minimize harm to wetlands that may results from such use.

4.2.2 Vernal Pools

The 2004 FEIS found that the 2005 Selected Alternative would impact three vernal pools. North of Exit 3, the 2005 Selected Alternative would impact vernal pool #13, which is located within the highway median. The functioning of this pool would likely be eliminated as 1,350 square feet or 90 percent of the areal extent of the pool would be filled. Vernal pool #13 has limited use by breeding amphibians, probably due to inadequate upland habitat around the pool and water quality degradation.

The 2005 Selected Alternative would impact portions of vernal pools #21 and #22, located on the east side of I-93 north of Exit 4. The 2005 Selected Alternative would impact the western edges (that currently exhibit signs of habitat degradation, i.e. filamentous algae, trash) of the pools amounting to approximately 3,000 square feet, or 30 percent of vernal pool #20 and 3,000 square feet or 15 percent of vernal pool #21 being filled.

4.3 Record of Decision Commitments/Mitigation

4.3.1 Record of Decision

The Record of Decision made the following commitments with respect to wetlands:

Compensation for unavoidable losses of wetlands and project impacts will include a combination of creation, restoration/enhancement, and preservation of the following project mitigation/enhancement package, involving protection of approximately 1,000 acres at 16 sites throughout the study corridor. The recommended mitigation sites are summarized as follows:

Salem
Total mitigation provided by four sites in Salem will amount to 90 acres (including creation, preservation, and flood storage replacement elements). These sites are:

- Cluff Crossing Road (Site #30), 27 acre parcel
- Pelham Road Mitigation Site (Site #31), 25 acre parcel
- Salem Wastewater Treatment Plant Site (Site #32), 32 acre site
- Baggett Property (Site #38) about six acres in size

Windham
Total mitigation provided by three sites in Windham will amount to nearly 318 acres (creation, preservation, and flood storage replacement). Each of the sites is described below.

- Highway Median Site (Site # 24), 17 acre parcel
- Armstrong Property (Site #49), 11 acre parcel
- Southeast Lands Area (Site #45), approximately 290 acres

Derry
Total mitigation provided by the site in Derry would amount to nearly 200 acres (preservation). The proposed mitigation site is described below.

- Sybiak Farm Property (Site #16)

Londonderry
Total mitigation provided by four sites will amount to approximately 290 acres, including preservation, creation, and flood storage replacement. Each of these sites is discussed below.

- South Road Mitigation Site (Site #14 and 15), 75 acre parcel
- Norwood Site (Site #63), 37 acre parcel
- Musquash Brook Parcels (Site #61), 110 acres
- Scobie Pond Area Properties (Site #58), 70 acres

Manchester
Total mitigation provided by the five Crystal Lake area sites in Manchester will amount to about 120 acres (preservation). The sites are described below.

- Filip Farm Site, Filip Glen Phase 2 (Site #3), 16 acres
- Giovagnoli Farm Property (Site #44), 20 acres
- Podsadowski Property - The Hill (527 Corning Road Realty) (Site 46), 34 acres

- Greek Picnic Grounds (Potomac Glen) (Site 47), 40 acres
- Demers Property (Site 53), 10 acres

The Record of Decision committed $3 million in funding to the NHDES Drinking Water Supply Land Grant Program to protect the watershed surrounding Massabesic Lake. This land and water protection effort, in combination with the commitment to provide funding to communities for planning technical assistance, will provide future protection of wetland, as well as upland, resources in the I-93 region.

The Record of Decision noted that attempts will be made to further minimize wetland impacts during final design by steepening slope embankments, where appropriate.

4.3.2 Wetland Permit Conditions

The Clean Water Act Section 404 permit for the 2005 Selected Alternative was issued by the U.S. Army Corps of Engineers on March 29, 2007 (permit number NAE-2004-233). In May 2006, NHDES issued the state wetland permit for the I-93 Improvements project, with conditions (permit number 2002-02033). The Section 404 permit and NHDES permit conditions include standard provisions related to the restoration of disturbed areas, sedimentation and erosion control practices, and the requirement to comply with the conditions of the Section 401 Water Quality Certification. The permit conditions include the completion of the wetlands compensatory mitigation package as described in the 2004 FEIS and ROD, and adherence to the Memorandum of Agreement on historic properties between NHDOT, FHWA and the State Historic Preservation Officer signed August 8, 2002.

The permit also indicates a specific additional requirement related to condition E-10 of the Water Quality Certificate issued by the NHDES. Condition E-10 of the Water Quality Certificate states "The activity shall not contribute additional chloride loads, beyond those based on existing road salt management practices, to chloride-impaired surface waters. To this end, the Applicant shall implement the elements of adaptive management approach to salt management practices contained in Section 1.3 of the ROD." To demonstrate compliance with condition E-10 of the water quality certificate, special condition 7 of the Section 404 permit requires NHDOT to record the amount of road salt used on I-93 between the Massachusetts border and Exit 6, and report this information to the ACOE, EPA and NHDES on a quarterly basis. The quarterly report is required to describe the adaptive management strategies being implemented to maximize salt application efficiency.

4.4 2008 Update Evaluations

4.4.1 Changes in Regulations/Guidelines

On January 12, 2007 the ACOE New England District issued a *Mitigation Plan Checklist* and *Mitigation Plan Checklist Guidance*. The guidance provides required contents for compensatory mitigation plans. On December 18, 2007, the ACOE New England District issued an *Addendum to New England District Compensatory Mitigation Guidance: Compensation for Impacted Aquatic Resource Functions*, which established recommended mitigation ratios for various types

of wetland impacts and mitigation measures. These documents do not apply to the I-93 widening because a permit application and mitigation plan was submitted before the guidance was issued.

On June 5, 2007, the USACOE and EPA issued a guidance memorandum entitled *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States*. The guidance addresses the conditions under which ACOE and EPA will and will not assert jurisdiction in response to the Supreme Court's interpretation of the term "waters of the United States" in the Clean Water Act. This guidance does not apply to the I-93 widening because a Section 404 permit has been granted prior to the ruling.

On April 10, 2008, the USACOE and EPA issued a final rule on compensatory mitigation for aquatic resource impacts. The rule amends the USACOE regulations (33 CFR Parts 325 and 332) and EPA regulations (40 CFR Part 230). The rule is intended to improve compensatory mitigation by emphasizing a watershed approach in selecting compensatory mitigation project locations, requiring measurable, enforceable ecological performance standards and regular monitoring for all types of compensation and specifying the components of a complete compensatory mitigation plan, including assurances of long-term protection of compensation sites, financial assurances, and identification of the parties responsible for specific project tasks. The rule establishes a preference hierarchy for mitigation options, with mitigation bank credits being the preferred, followed by in-lieu fee program credits, and lastly permitee-responsible mitigation. The rule does not apply to the I-93 widening because a Section 404 permit application had already been submitted and a permit granted prior to the effective date of the rule (June 9, 2008).

In conclusion, there have been no changes in the regulations and guidance relevant to wetlands that require reexamination of the 2004 FEIS results or conclusions.

4.4.2 Changes in Analysis Methods

In 2006 the I-93 corridor wetland boundaries were verified and delineated to just beyond the proposed toe-of-slope or the proposed edge of right-of-way, which ever was furthest. The delineation was based on the three parameter approach, which considers plants, soils and hydrology in the determination of the wetland/upland boundaries, as detailed in the 1987 *Corps of Engineers Wetland Delineation Manual* (ACOE, 1987) and utilized GPS units and field sketches to create revised wetland boundary information on updated base maps.

The 2004 FEIS wetland impact calculations were based on preliminary design information and did not include impacts related to drainage structures since those structures had not yet been designed. As the final design has progressed on the first eight construction contracts (10418I, 10418G, 10418N, 13933C, 13933F, 13933G, 13933K and 14633E), updated wetlands impacts have been calculated. The updated impact calculations incorporate the results of the 2006 wetland delineations. The first eight construction contracts cover approximately one third of the corridor and are representative of the types of changes that have occurred since the 2004 FEIS. These changes include an increased area of wetlands as a result of updated mapping, changes in stormwater treatment requirements which increased the size of some BMPs, and other changes in final design to accommodate unanticipated problems. For the purposes of the SEIS update

analysis, the change in wetland impacts for the first eight construction projects was extrapolated to estimate the change in impacts that could occur for the entire project.

4.4.3 Changes in the Existing Conditions

The 2006 wetland verification and delineation resulted in an increase in the area of wetlands in comparison to the 2004 FEIS wetland boundaries.

4.4.4 Changes in the Future No Build and Build Conditions

There are no changes to the No Build condition for wetlands as described in the 2004 FEIS.

For the first eight construction contracts, final design wetland impacts of the 2005 Selected Alternative total about 27.4 acres versus 24.6 acres estimated in the 2004 FEIS and Section 404 permit application. This represents an increase of about 11 percent for this portion of the project due to a revised delineation of wetlands along the corridor, design refinements, increases in the number/size of stormwater treatment areas and more accurate mapping. Extrapolating these results to the entire project would mean total wetland impacts of approximately 85 acres, or about 8 acres more than estimated in the 2004 FEIS and Section 404 permit application. While the acreage of impacts has increased slightly since the 2004 FEIS, the type of impacts and the conclusions of the wetlands impact analysis have not changed. The wetland impacts occur on the edges of the corridor wetland systems and represent only a small percentage of the total wetland acreage within the system and, while representing an incremental loss of wetland area, will not eliminate the functions and values performed by the remaining wetland.

4.4.5 Mitigation

Table 4-1 provides the current status of the project wetland mitigation sites, which total 956 acres of wetland and upland preservation plus 24 acres of wetland creation.

NHDOT has been and will continue to coordinate with the ACOE, NHDES and other natural resource agencies regarding the increase in the total acreage of wetland impacts. As is typical for projects of this scope, the regulatory agencies understand that wetland impacts will change as the project progresses and have therefore made provisions for updating permits to reflect the actual impacts.

As discussed in Section 3.4.5, NHDOT is evaluating replacing the Salem WWTP mitigation site with a new mitigation site in Salem.

4.5 Conclusion

Based on the first eight construction contracts, the total wetland impacts of the 2005 Selected Alternative are estimated to have increased by about eight acres since the 2004 FEIS, to a total of 85 acres due to a revised delineation of wetlands along the corridor, design refinements, increases in the number/size of stormwater treatment areas and more accurate mapping. However, the type of impacts (generally edge impacts) and 2004 FEIS conclusions regarding the

wetland impacts has not changed—the impacts are a small proportion of the total area of the affected wetland systems and the functions and values of the remaining wetland area will not be eliminated. NHDOT has been and will continue to coordinate with resource agencies regarding the increase in the total acreage of wetland impacts.

Table 4-1
Wetland Mitigation Site Status

Site ID #	Site Name	Town	Owned by	Tax Map-Lots	Easement/ Deed Restriction	Approximate Total Size (acres)	Creation (acres)	Preservation (acres)	Notable Site Features
30	Cluff Crossing	Salem	DOT	117-7885, 117-8876, 127-8877 & 117-8878	Restrictions in Process	27		27	Public recreational fields and undeveloped wooded area adjacent to and including prime wetland area. Transfer to town with conservation easement.
	Pelham Road								25 acres total
31	Pelham Road Mitigation Site	Salem	DOT	105-7779	Restrictions 08/07	20	4	16	Advance Mitigation Site. Created wetlands completed in 2002. Abuts Porcupine Brook prime wetland.
31	Pelham Road Mitigation Site	Salem	DOT	105-10093 & 105-10094	Restrictions 08/07	5		5	
32	Salem Wastewater Treatment Plant	Salem	Town	143-9475	Potential Future Easement	32	7	25	Abandoned buildings and WWTP plant components and second-growth areas. Flood storage compensation and hazardous waste remediation. Town owned, conservation easement by DOT.
38	Baggett Property	Salem	DOT	116-8761	Restrictions 10/07	6	2	4	Forested area adjacent to prime wetland. Wetland/flood storage creation and preservation (wildlife habitat).
24	Highway Median	Windham	DOT		Restrictions in Process	13	3	10	Located within highway median. Potential for small amount of wetland creation and restoration.
24	Highway Median	Windham	Private	17-G-83	Restrictions 08/08	4		4	Retain existing easement on Parcel W-106
49	Armstrong Property (Cobbetts Pond Site)	Windham	DOT	17-I-2	Restrictions 08/07	11		11	Adjacent to existing NHDOT wetland creation/preservation site. Wellhead Watershed Protection District located on site.

Site ID #	Site Name	Town	Owned by	Tax Map-Lots	Easement/ Deed Restriction	Approximate Total Size (acres)	Creation (acres)	Preservation (acres)	Notable Site Features
45	Southeast Lands (Mesiti - Dark School House Development)	Windham	DOT	25-R-1000A, 25-R-1300 and 25 - R- 1100	Restrictions 11/07	274		274	Large, undisturbed, contiguous forested areas adjacent to Porcupine Brook and Golden Brook containing diversity of species and habitat. Some areas under development threat. Contains identified Heritage Site (NE Basin Swamp). Adjacent to Town Conservation
	Sybiak Farm								229 acres total
16	Tuckernuck Development, LLC	Derry	DOT	108-265-2, 108-267 & 108-266	Restrictions 08/07	59		59	Wide variety of wildlife habitat including upland forest, abandoned farm field/orchards and prime wetlands. Adjacent to existing recreational path.
16	Windham Road Holdings, LLC	Derry	DOT		Restrictions 08/07	139		139	
16	Serge R. & Cheryl S. Beaulieu	Derry	DOT		Restrictions 08/07	30		30	
16	Edwin Sybiak	Derry	DOT		Restrictions 08/07	0.5		0.5	
	South Road								75 acres total
14, 15	South Road Mitigation Site (Garabedian)	Londonderry	DOT	7-111, 7-113 & 7-114	Restrictions 08/07	24	8	16	Advanced Mitigation Site. Abuts Beaver Brook. Created wetlands and wildlife habitat restoration in design. Adjacent to town conservation lands.
	Garabedian	Londonderry	DOT		Restrictions 08/07	38		38	
15	Garabedian	Londonderry	DOT		Restrictions 08/07	13		13	
63	Norwood Group Parcel (Golden Londonderry)	Londonderry	DOT	7-112	Restrictions 08/07	28		28	Diverse wetlands (PFO, PSS, PEM), adjacent to a perennial tributary to Beaver Brook, make up 80% of the site. Lies adjacent to South Road Mitigation Site and town conservation land.
58	Scobie Pond (Weigler)	Londonderry	Private	16-99 & 16-100	Potential Future Easement	67		67	Entirely forested with oak, pine and mixed deciduous stands on ledgy hillsides. Some red maple swamp in central portions of site. Site is largely intact, and is greater than 90% upland. Abuts Scobie Pond area, and is apparently heavily used for recreation.

Site ID #	Site Name	Town	Owned by	Tax Map-Lots	Easement/ Deed Restriction	Approximate Total Size (acres)	Creation (acres)	Preservation (acres)	Notable Site Features
61	Musquash Expansion (Cooper Financial)	Londonderry	DOT	11-42, 11-43 and 11-44	Restrictions 08/07	82		82	Two tracts of diverse forest directly adjacent to a larger protected system. Mainly forested upland, with recent logging in some portions. Abuts Musquash Swamp preserve.
	Crystal Lake Area								108 Acres Total
3	Filip Farm Site, Filip Glen Phase 2 (City of Manchester)	Manchester	City	682-19 to 26 & 682-29 to 32	Easement held by City of Manchester	16		16	Portion of Filip's Glen development deeded to Crystal Lake Preservation Association. Open field and wetlands that abut Mosquito Brook and other Crystal Lake area parcels.
44	Giovagnoli Farm Property	Manchester	Private	850-7	Potential Future Easement	19		19	Conservation easement on an agricultural field that lies adjacent to Cohas Brook and connects to Great Cohas Swamp, located to the west.
46	Podsadowski Property - The Hill (527 Corning Road Realty)	Manchester	DOT	805-1	Restrictions 08/07	31		31	Forested, hillside parcel provides important connection to other undeveloped and protected land areas. Source of groundwater recharge for Crystal Lake.
47	Greek Picnic Grounds (Potomac Glen)	Manchester	DOT	807-1 & 807-2	Restrictions 08/07	36		36	Hill top parcel that connects Crystal Lake area parcels to existing conservation lands.
53	Demers Property Easement	Manchester	Private	504-2	Potential Future Easement	6		6	Conservation easement on undeveloped land to widen ecological corridor along Mosquito Brook.
Total						**980**	**24**	**956**	

5.0 Wildlife Resources

5.1 2004 Analysis Methods & Prevailing Regulations/Guidelines

For the 2004 FEIS, USFWS, NHF&GD, New Hampshire Heritage Inventory (NHNHI), Audubon Society, Southern New Hampshire Regional Planning Commission, Rockingham Planning Commission, and the Conservation Commissions of Manchester, Londonderry, Derry, Windham, and Salem were contacted about species or wildlife habitats in the study area. NHF&GD, NHNHI, Audubon, Southern New Hampshire Planning Commission, and the Conservation Commissions of Manchester and Salem responded.

Wildlife habitat types were identified through a review of published material including USGS topographic maps and National Wetlands Inventory maps, NHDOT's previous work on wetlands within the I-93 right-of-way, and windshield surveys in 1992, 1993 and 1998. During May 9-10, 2001, a spring field survey was conducted for the entire corridor to document wildlife corridors and wildlife habitat of concern as well as locating threatened or endangered plant and animal species. Wildlife observation stations were designated in relation to wetland systems in order to obtain an overall understanding of existing natural resources.

USFWS indicated that a presence/absence survey should be conducted for the New England cottontail, a candidate species for federal listing under the Endangered Species Act. In coordination with USFWS, a survey was conducted during the winter and spring of 2003 to examine the distribution and abundance of New England cottontails and their habitat within the I-93 study corridor.

5.2 Results from 2004 FEIS

5.2.1 Wildlife Resources

The 2004 FEIS described potential wildlife habitat impacts related to the construction noise and disturbance, home range impacts, wildlife/vehicle collisions, and riparian corridors. The 2005 Selected Alternative would convert 260 acres of land outside the existing right-of-way. An estimated 60 percent (156 acres) of this is useable wildlife habitat, i.e., wetland, upland forest and shrubland, or agriculture. In drawing conclusions regarding wildlife habitat impacts, the 2004 FEIS cited comments from NHF&GD stating that it "recognizes that the improvements, involving for the most part the widening of an existing interstate facility, are of less consequence to wildlife and fishery resources than would otherwise be the case with the construction of a brand new facility on new location. As such, fragmentation of the wildlife habitat is not an issue. The acreage of impact is substantial, but given that the area impacted is directly adjacent to an existing interstate facility, the wildlife, wetlands, and habitat resources are of lesser quality or only peripherally affected by the widening."

5.2.2 Threatened and Endangered Species

The 2004 FEIS identified one state-listed threatened plant that may be affected by the 2005 Selected Alternative. A small population of the perennial wildflower wild lupine (Lupinua perennis) is located within 15 feet from the travel lane on the west side of I-93 between Exits 1 and 2 within the currently maintained right-of-way.

Correspondence with NHNHI identified the eastern hognose snake as the only known state-listed wildlife species in the project vicinity. The 2004 FEIS noted that due to the difficulty of surveying for this species in the wild, an accurate assessment of project impacts is difficult. Through consultations with NHF&GD it was determined that impacts to the eastern hognose snake cannot be entirely ruled out due to the fact potential habitat appears to occur within the highway corridor.

In their review of the project USFWS expressed the opinion that the project would have no effect on the occasional, transient threatened bald eagles that may occur in the project area.

The field investigation for the candidate species New England cottontail did not locate any populations of the New England cottontail within the study corridor or the proposed mitigation sites, despite surveying all potentially suitable habitats.

5.3 Record of Decision Commitments/Mitigation

5.3.1 Wildlife Resources

The Record of Decision made the following commitments with respect to wildlife and fisheries resources:

- Direct habitat loss, in particular to wetlands, will be offset through the project mitigation in the form of extensive habitat preservation. Generally the preservation sites will be contiguous with adjacent undeveloped or protected properties to create larger unfragmented blocks and provide opportunity to manage portions for varying successional stages.

- The design of the wetland creation sites will include the goal of replacing the wildlife functions of impacted wetlands. Construction plans for restoration, enhancement, and creation will attempt to maximize the diversity and interspersion of wildlife food and cover, as done at the advanced wetland mitigation sites in Salem (Pelham Road) and Londonderry (South Road). A diverse group of native wetland plant species will be planted, where appropriate, to create a high structural and plant species diversity attractive to a wide variety of wildlife.

- All culverts and bridges at the major stream crossings along the highway corridor (i.e. Cohas Brook, Beaver Brook, Porcupine Brook and Policy Brook) will be examined during final design to determine how a dry-land passage (“shelf”) for mammals can be incorporated into the structures.

- Other culvert crossings for smaller perennial streams will also be examined to ensure there are no blockages to wildlife or fish passage. A number of potential improvements to culvert conditions to enhance passage of fish and wildlife have been identified and will be evaluated during final design and implemented where practical. For culverts that would need replacement, consideration would be given to oversizing these new structures, as appropriate, to better facilitate wildlife crossing.

- Data will also continue to be collected by District Maintenance staff on the frequency of wildlife-vehicle collisions so that this information can be used to decide whether additional warning signage or fencing along the highway is warranted.

- Several measures will be taken during construction to further reduce impacts on wildlife habitat. The amount of land cleared of vegetation will be limited as practical, especially in areas where there are currently only narrow buffer strips between the highway and other human development. Re-vegetation of the land disturbed by construction activities will take place as soon as possible after construction is completed, so that erosion is minimized and wildlife habitat is restored. Brush clearing or tree thinning in forests adjacent to the construction areas will not be proposed. Where feasible and safe, snags (i.e. dead standing trees) will be left adjacent to the mowed sections of the right-of-way in order to provide perch sites, nesting cavities, and den sites for wildlife.

- Maintenance of the highway right-of-way to provide clear zone areas will be limited to the degree practical. On one hand, maintaining large swaths of open areas are expensive and not beneficial to wildlife. On the other hand, providing clear zones for motorist's safety and discouraging wildlife from approaching the highway will be important.

5.3.2 Threatened and Endangered Species

The Record of Decision made the following commitments with respect to threatened and endangered species:

- Mitigation of impacts to wild lupine south of Exit 3 will focus on relocating these individuals by means of re-seeding or transplantation. A written mitigation plan specific to this population will be completed in consultation with the New Hampshire Natural Heritage Inventory prior to construction.

- A preconstruction study conducted in conjunction with the NHF&GF of potential eastern hognose snake habitat using GIS-level analysis and/or other means will evaluate a sample of known occupied habitats within southern New Hampshire to determine their characteristics. This effort will help identify potential habitat within the project area that might be affected.

- Construction contractor personnel will be trained to recognize the hognose snake and be informed of its protected status through a cooperative effort of NHDOT and NHF&GD.

Procedures for reporting occurrences of the snake will be established to ensure proper response and reporting of the snake, if encountered during construction.

5.4 2008 Update Evaluations

5.4.1 Changes in Regulations/Guidelines

On August 9, 2007, the bald eagle was removed from the federal list of threatened and endangered species. This change does not affect the analysis of potential threatened and endangered species impacts because the USFWS has determined that the widening of I-93 will have no effect on this species.

5.4.2 Changes in Analysis Methods

For the SEIS, updated information on the occurrence of rare, threatened and endangered species near the I-93 corridor was obtained from the New Hampshire Natural Heritage Bureau on July 21, 2008. Information was also requested from USFWS, however no response to the request was received.

The 2004 FEIS commitment to study wildlife crossing structure opportunities during final design has been met. Detailed reports were prepared documenting the characteristics of the existing crossing structures at stream crossings along the corridor, the availability and quality of upstream and downstream habitat at each crossing, and the engineering feasibility of potential wildlife/fish passage enhancements.[8] The specific measures that will be implemented continue to be coordinated with the resource agencies.

5.4.3 Changes in the Existing Conditions

The response from NHNHB did not identify any new known occurrences of rare, threatened or endangered species since the 2004 FEIS within the impact area of the 2005 Selected Alternative. The database search noted that Golden Brook may contain the brook floater (*Alasmidonta varicose*), a state-listed mussel. Golden Brook itself is outside the project limits, although two tributaries to Golden Brook originates in the project area.

No response to the request for information was received from the U.S. Fish and Wildlife Service.

5.4.4 Changes in the Future No Build and Build Conditions

Similar to wetland impacts, wildlife habitat impacts are expected to have increased slightly with final design as compared to the 2004 FEIS. Potential increases in total impacts may have occurred as a result of changes in stormwater treatment requirements which increased the size of some BMPs, among other design changes. Assuming the same 11 percent increase found for

[8] *Wildlife/Fish Corridor Enhancements. I-93 Improvements Project Windham to Manchester, New Hampshire*. Prepared by The Smart Associates, Inc. 2007. and *Wildlife and Fish Passage Inspection Report Salem to Manchester, IM-IR-93-1(174)0, 10418-C.* Prepared by The Louis Berger Group, Inc. 2008.

wetland impacts, the wildlife habitat impacts of the 2005 Selected Alternative would increase by 30 acres, to 290 acres total. As noted in the 2004 FEIS, the 2005 Selected Alternative primarily affects the edges of habitat areas adjacent to the existing I-93.

As noted in Section 5.4.3, the NHNHB response memo noted that the state-listed brook floater may occur in Golden Brook. Golden Brook is outside the project limits and is not impacted by the project, however two tributaries of Golden Brook originate in the corridor. The stormwater treatment practices associated with the 2005 Selected Alternative would attenuate the stormwater pollutant loadings, including sediment, to these waterbodies (See Section 2.4.4). Therefore the 2005 Selected Alternative would not have any effect on populations of the brook floater located farther (at least two miles) downstream in Golden Brook itself.

5.4.5 Mitigation

NHDOT will coordinate with the resource agencies regarding the potential increase in the total acreage of wildlife habitat impacts. Given the extent of the wildlife habitat being provided by the project wetland and upland land preservation sites, no increase in mitigation is warranted. No new threatened or endangered species impacts were identified; therefore no new mitigation is necessary.

NHDOT has examined the feasibility of a dry-land passage ("shelf") being incorporated into the major stream crossings of I-93 at Cohas Brook, Beaver Brook, Porcupine Brook, and Policy Brook. Additionally, other culvert crossings for smaller perennial streams were evaluated to determine if improvements to the culvert conditions would enhance passage of fish and wildlife. For culverts that would need replacement, consideration would be given to over-sizing these new structures, as appropriate, to better facilitate wildlife crossing. Coordination on wildlife crossing issues is ongoing with NHF&G, USFWS, ACOE and NHDES.

5.5 Conclusion

Although the total acreage of wildlife habitat impacted by the 2005 Selected Alternative may increase by 30 acres as result of final design, the 2004 FEIS conclusions regarding wildlife habitat impacts have not changed. The 2005 Selected Alternative primarily affects the edges of habitat areas adjacent to the existing I-93; it does not cause habitat fragmentation. The update evaluation did not identify any new known occurrences of threatened or endangered species. The mitigation measures identified in the Record of Decision remain valid. Continued coordination on wildlife crossing issues has been ongoing with the natural resource agencies.

6.0 References

Busnel, R.G. 1978. *Effects of Noise on Wildlife*.

Cobbetts Pond Watershed Restoration Plan Project. http://projects.geosyntec.com/BW0131/

Driscoll. 1990. *Pollutant Loadings and Impacts from Highway Stormwater Runoff: Volume 1: Design Procedures.*

Jeffrey H. Taylor & Associates and Center for the Environment, Plymouth State University. 2008. *Potential Solutions for Reducing Road Salt Use in New Hampshire*.

Jeffrey H. Taylor & Associates and Center for the Environment, Plymouth State University. 2007. *Results of the Workgroup Interviews for the I-93 Salt Reduction Workgroup*.

Letter from NHDES to Derek Monson, Cobbetts Pond Improvement Association. June 28, 2007.

Letter from Paul Currier, New Hampshire Department of Environmental Services to Charles Hood, New Hampshire Department of Transportation. February 2, 2009.

Letter from Stephen Perkins, U.S. Environmental Protection Agency to Paul Currier, New Hampshire Department of Environmental Services. January 22, 2009.

Memorandum from Mark Laurin, NHDOT to Peter Stamnas, Keith Cota and Steve Liakos, NHDOT. Re: Salem-Manchester, 10418C Potential Fish and Wildlife Passages. May 12, 2008.

Memorandum from New Hampshire Natural Heritage Bureau to Ray Bode, The Louis Berger Group, Inc. Re: Review by NH Natural Heritage Bureau. July 21, 2008.

Memorandum from Vanasse Hangen Brustlin, Inc to NHDOT. RE: Interstate 93 Improvements Floodplain Impacts and Mitigation, Southern Design Segment IM-IR-93-1(174)0, 10418-C. March 6, 2008

Memorandum from Vanasse Hangen Brustlin, Inc to NHDOT. RE: Interstate 93 Improvements Potential Floodplain Mitigation Haigh Avenue Site, I-93 Salem, NH. IM-IR-93-1(174)0, 10418-C. January 16, 2008

Memorandum from Vanasse Hangen Brustlin, Inc to NHDOT. RE: Interstate 93 Improvements Summary of Floodplain Impacts and Mitigation, IM-IR-93-1(174)0, 10418-C. August 21, 2008

NHDES. 2007. *Interim Guidance for the Design of Structural Stormwater Best Management Practices Needed to Achieve Results of Pollutant Loading Analyses.*

NHDES. 2007. *Data Report for the Total Maximum Daily Loads for Chloride for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH*

NHDES. 2008. *Total Maximum Daily Load Study for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Beaver Brook in Derry and Londonderry, NH.*

NHDES. 2008. *Total Maximum Daily Load Study for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Dinsmore Brook in Windham, NH.*

NHDES. 2008. *Total Maximum Daily Load Study for Waterbodies in the Vicinity of I-93 Corridor from Massachusetts to Manchester, NH: North Tributary to Canobie Lake in Windham, NH.*

NHDES. 2008. *Total Maximum Daily Load Study for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Policy-Porcupine Brook in Salem and Windham, NH.*

NHDES. 2006. *Water Quality Certification for Interstate 93 Improvements: Salem to Manchester.*

NHDES. 2006. *Total Maximum Daily Load Study for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Quality Assurance Project Plan.*

NHDES. 2008. Volunteer Lake Assessment Program Data for Canobie Lake and Cobbetts Pond.

NHDES. 1995. *Recommendations for Implementing Groundwater Protection Measures when Siting or Improving Roadways*.

NHDES and NHDOT. 2007. *I-93 Expansion BMP Efficiency Trend Monitoring Plan.*

NHDES and NHDOT. 2006. *I-93 Expansion Chloride Surveillance Monitoring Plan.*

NHDES and NHDOT. 2006. *Memorandum of Agreement between New Hampshire Department of Transportation and New Hampshire Department of Environmental Services relative to the Development and Implementation of Total Maximum Daily Loads for Chloride and Other Activities for Water Quality Protection on Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester.*

NHDOT. 2009. *Implementation Plan to Increase the Efficiency and Effectiveness of Road Salt Use To Meet Total Maximum Daily Load For Chloride In Water Bodies Along the I-93 Corridor From Salem to Manchester, NH: Beaver Brook, Dinsmore Brook, North Tributary to Canobie Lake and Porcupine-Policy Brook.*

The Louis Berger Group, Inc. 2008. *Wildlife and Fish Passage Inspection Report Salem to Manchester, IM-IR-93-1(174)0, 10418-C.*

The Smart Associates, Environmental Consultants, Inc. 2008. *Chloride Surveillance Monitoring I-93 Widening from Massachusetts to Manchester, NH*. Northern Section Annual Report, Year 1.

The Smart Associates, Inc. 2007. *Wildlife/Fish Corridor Enhancements: I-93 Improvements Project Windham to Manchester, New Hampshire*.

U.S. Army Corps of Engineers New England District. 2007. *Addendum to New England District Compensatory Mitigation Guidance: Compensation for Impacted Aquatic Resource Functions.*

U.S. Army Corps of Engineers New England District. 2007. *Clean Water Act Section 404 Permit 199201232/NAE-2004-2003*.

U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. 2008. *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States*.

U.S. Army Corps of Engineers. 1987. *Corps of Engineers Wetland Delineation Manual, Technical Report Y-87-1*.

U.S. Army Corps of Engineers. 1999. *Highway Methodology Workbook Supplement*.

U.S. Army Corps of Engineers New England District. 2007. *Mitigation Plan Checklist.*

U.S. Army Corps of Engineers New England District. *Mitigation Plan Checklist Guidance.*

Vanasse Hangen Brustlin, Inc. 2008. *I-93 Improvement Project: Chloride Surveillance Monitoring*. Southern Section Annual Report, Year 1.