Environmental Assessment/ Draft Section 4(f) Evaluation

Interstate 93 Improvements
Bow to Concord
FHWA #T-000(18), NHDOT #13742
Volume 1

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Interstate 93 Improvements
Bow to Concord
Merrimack County, New Hampshire

Volume 1
Environmental Assessment / Draft Section 4(f) Evaluation

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For NH Department of Transportation
Mr. Peter Stamnas
Director of Project Development

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For Federal Highway Administration
Mr. Patrick A. Bauer
New Hampshire Division Manager

The following personnel may be contacted for additional information concerning this document.

Mr. Jamie Sikora
NH Division Environmental Program Manager
Federal Highway Administration
53 Pleasant Street, Suite 2200
Concord, NH 03301
(603) 410-4870

Mr. Donald Lyford, P.E.
Project Manager
NH Department of Transportation
7 Hazen Drive
Concord, NH 03301
(603) 271-2165

The proposed project involves a 4.5-mile segment of Interstate 93 (I-93) between the Town of Bow and the City of Concord, New Hampshire. The purpose of the project is to address the existing deficiencies and future transportation needs for all users while balancing the needs of the surrounding communities.

Numerous alternatives were evaluated and a preferred alternative has been selected that addresses safety, capacity and operational issues throughout the 4.5-mile corridor including seven interchanges and portions of local roads. The preferred alternative includes the following elements: widening the mainline I-93 to six lanes (three lanes northbound / three lanes southbound) with auxiliary lanes and shoulders; addressing six Red List bridges; improvements to two system interchanges that connect two interstate highways (I-93 to I-89 connection and I-93 to I-393 connection at Exit 15); improvements to five local interchanges (Exit 1 along I-89 and Exits 12, 13 and 14 along I-93 and Exit 1 along I-393).

Impacts to the natural, cultural, and socio-economic environment were analyzed. Mitigation is proposed to offset unavoidable impacts associated with the project, where applicable.

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List of Acronyms

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
BMPs	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, Liability Act
CMAQ	Congestion Mitigation and Air Quality
CO	Carbon Monoxide
dBA	A-weighted decibels
DOE	Determination of Eligibility
DOI	Department of Interior
DNCR	New Hampshire Department of Cultural and Natural Resources
EA	Environmental Assessment
FEMA	Federal Emergency Management Agency
FHWA	US Department of Transportation, Federal Highway Administration
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
GPS	Global Positioning System
HOV	High Occupancy Vehicles
HUD	Housing and Urban Development
ISA	Initial Site Assessment
LEDPA	Least Environmentally Damaging Practicable Alternative
LOS	Level-of-Service
LRS	Limited Reuse Soils
MPO	Metropolitan Planning Organization
MS4	Municipal Separate Storm Sewer System
NAAQS	National Ambient Air Quality Standards
NB	Northbound
NEPA	Natural Environmental Policy Act
NHARD	New Hampshire Air Resources Division
NHDES	New Hampshire Department of Environmental Services
NHDHR	New Hampshire Division of Historical Resources
NHDOT	New Hampshire Department of Transportation
NHF&GD	New Hampshire Fish and Game Department
NHNHB	New Hampshire Natural Heritage Bureau
NHOSP	New Hampshire Office of State Planning
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NOx	Nitric Oxide and Nitrogen Dioxide
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
OHM	Oil and/or Hazardous Materials
PFAS	Per- and polyfluoroalkyl Substances

PSI	Preliminary Site Investigation
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROW	Right-of-Way
RSA	Revised Statues Annotated
SB	Southbound
SCS	Soil Conservation Service (currently NRCS)
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SOV	Single Occupancy Vehicle
SPUI	Single Point Urban Interchange
STIP	Statewide Transportation Improvement Program
TDM	Transportation (or Travel) Demand Management
TIP	Transportation Improvement Program
TMA	Transportation Management Association
TMO	Transportation Management Organization
TSM	Transportation Systems Management
USACOE	US Army Corps of Engineers
USDA	US Department of Agriculture
USDOT	US Department of Transportation
USEPA	US Environmental Protection Agency
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WHPA	Wellhead Protection Area

Executive Summary

ES.1 Project Overview

The New Hampshire Department of Transportation (NHDOT) and the Federal Highway Administration (FHWA) have prepared this Environmental Assessment/Draft Section 4(f) Evaluation (EA/4(f)) for proposed improvements to the Interstate Route 93 (I-93) corridor between the Town of Bow and the City of Concord, Merrimack County, New Hampshire. The basic purpose of the I-93 Bow-Concord project is to improve transportation efficiency and reduce safety problems within this approximately 4.5-mile segment of highway.

I-93 is the principal north-south arterial highway within New Hampshire and is part of the National System of Interstate and Defense Highways. I-93 extends a total distance of 132 miles within New Hampshire, from the Massachusetts border to the northern Vermont border. The proposed project covers a distance of approximately 4.5 miles from south of the I-93/Interstate Route 89 (I-89) Interchange in Bow to north of the I-93/Interstate Route 393 (I-393) Interchange (Exit 15) in Concord to just south of the Merrimack River Bridge. The segment of I-93 from Manchester to Exit 14 is also part of the Central Turnpike, commonly known as the F.E. Everett Turnpike. The project also extends along I-89 from its terminus with Route 3A (Bow Junction) approximately 4,700 feet to the west and includes the Exit 1 area. Along I-393 the project extends from just west of the bridge over the Merrimack River to the Route 202/North Main Street intersection, a distance of approximately 4,600 feet. Refer to **Figure ES.1 Study Area Overview** that depicts the study area and the project limits.

Due to population growth, development, and recreational opportunities in New Hampshire, the travel demands for I-93 between Bow and Concord have exceeded the capacity of this existing four-lane facility since about 2000. Population and traffic projections for the next twenty years support the conclusion that the existing facility will be increasingly less able to function at the levels of service (LOS) and safety for which it was originally designed. Decreases in the level of service are evident in reduced traveling speeds, increased density of traffic flow, as well as in the traffic backups at some interchanges during commuting hours.

During weekday peak hours, motorists traveling along the I-93 corridor currently experience traffic congestion and substantial delay. The congestion not only results in increased travel times, but also contributes to safety problems, as the limited spacing between vehicles does not afford the motorists sufficient movement to deal with frequent and abrupt lane change maneuvers, inadequate weaving space and sudden stops. Without substantial improvements, or dramatically reduced demand, traffic operations along this section of I-93 are expected to continue to deteriorate under future conditions as traffic volumes increase. This section of I-93, in central New Hampshire was constructed in the late 1950s and early 1960s as part of the Central Turnpike, more commonly known as the F.E. Everett Turnpike and as part of the Interstate Highway System. There were no substantial improvements made to the 4.5-mile segment through Bow and Concord until 2002 when reconstruction of Exit 13 in Concord was completed. This reconstruction included a new interchange and the ability to widen I-93 to six lanes at that location to accommodate future widening; however, only four lanes were constructed. Exit 13 was reconstructed with a single-point urban interchange (SPUI), a configuration that is similar to a diamond but includes one signalized intersection that provides control for all ramp movements at a “single point”.

“Part A” of a three-part project development process was conducted for the project between 2003 and 2008. It was considered a planning study that was summarized in the *Part A Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study.* The goals of Part A were to develop a project purpose and need, develop a range of reasonable alternatives, and determine the appropriate type of environmental document. The alternatives deemed reasonable during Part A were then carried forward into Part B of the project. However, funding constraints delayed the start of Part B of the process.

From 2010 to 2016, four Red List bridges within the project limits were taken off the red list due to either rehabilitation or replacement. Red List bridges are identified by NHDOT as those bridges whose condition or weight restriction requires more frequent inspections, at least twice per year instead of once every two years. Red List bridges require more frequent repairs due to known deficiencies, poor condition, or load restrictions, which are usually the result of structural deterioration. The bridge carrying I-93 over Loudon Road (NH Route 9) at Exit 14 was rehabilitated in 2010; however, no widening was included in that project. Replacement of the two bridges carrying I-93 over I-89 in Bow was completed in 2015. These bridges were constructed to accommodate six lanes at that location; however, only five lanes were provided. The bridge carrying NH Route 3A over I-93 at Exit 12 was replaced in 2016. This bridge was constructed to accommodate up to eight lanes (four in each direction) for I-93 and three lanes on NH Route 3A.

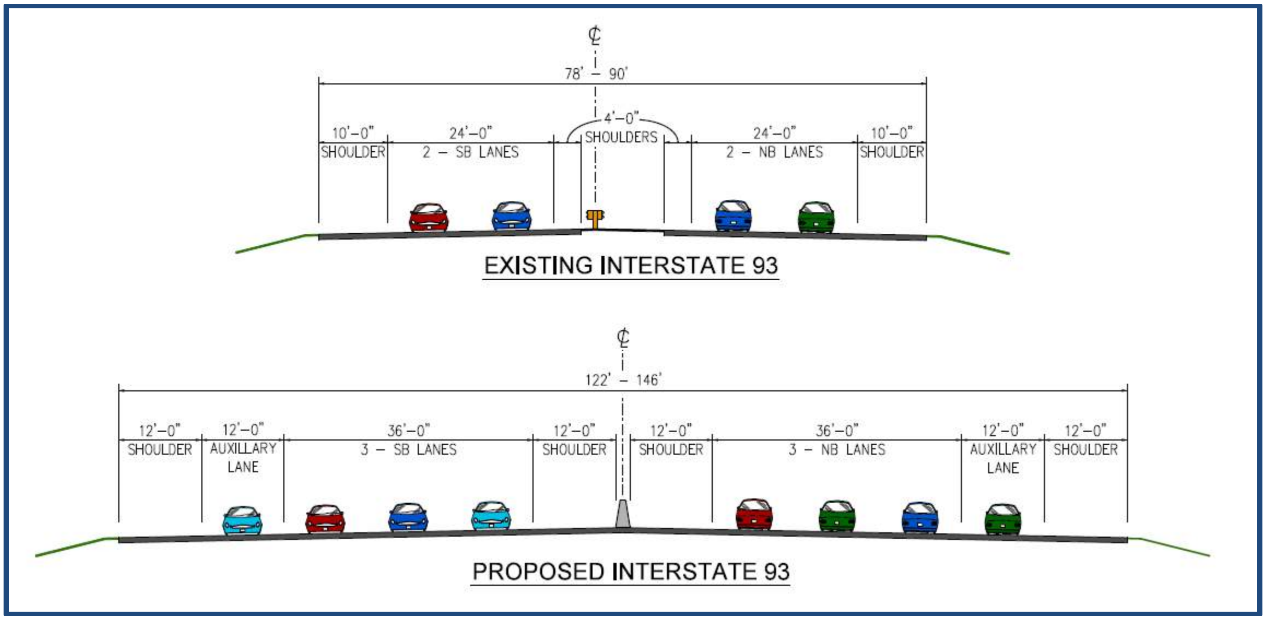
The need to address issues along I-93 in Bow and Concord was identified in 1990 when the Bow-Concord Widening Project was first placed on the State’s Ten-Year Plan. New Hampshire RSA 228:99 and RSA 240 require that the NHDOT propose a plan for improvements to the State's transportation system every two years.

This EA documents “Part B”, started in 2013, of the three-part project development process by NHDOT. This current part involves additional public involvement, preliminary design of the reasonable alternatives, selection of a preferred alternative, and preparation of the appropriate environmental document to disclose potential impacts as per NEPA.

ES.2 Proposed Action

The Preferred Alternative for the project proposes widening I-93 from a basic four-lane interstate to a basic six-lane interstate, adding one lane in each direction within the project limits. It also includes providing auxiliary lanes in each direction on I-93 between each interchange. I-93 would therefore have eight-lanes segments between the interchanges. See **Figure ES.2** for the proposed typical section.

Figure ES.2 I-93 Typical Sections



The Preferred Alternative is also the combination of the preferred concepts for each of the four project segments. Below is a description of the preferred concept for each project segment focused on the proposed interchange configurations. The widening of I-93 explained above is assumed for each segment.

<u>I-89 Area - Preferred Concept K</u>

Concept K retains the basic configuration of both the I-93/I-89 interchange and I-89 Exit 1. However, it proposes "braided" ramps between the two interchanges. The term "braid" refers to a grade separated crossing that occurs at an acute angle that resembles braids. The braided ramps eliminate the weaving section between the two interchanges. Additional ramps are proposed to allow retention of all of the existing accesses, but without the need for vehicles to cross each other in a weave.

To eliminate the southbound weave between the two interchanges, Concept K proposes a ramp that would accommodate traffic utilizing Exit 1 and travelling southbound on I-93. To eliminate the northbound weave between the two interchanges, Concept K proposes a local connector road between Route 3A and South Street to accommodate northbound I-89 traffic. This connector road would provide access to South Street from Bow Junction.

Concept K would include construction of a new directional ramp for northbound I-93 to northbound I-89 traffic. The new directional ramp proposed in Concept K would have a 40-mph design speed as compared to the existing loop ramp that has a 25-mph design speed. While the existing northbound C-D Road would remain, a significant portion of the traffic volume in the weave would be diverted since the northbound I-93 to northbound I-89 traffic would use the new directional ramp.

Providing the new directional ramp for northbound I-93 to northbound I-89 traffic would result in the elimination of the direct connection of the I-89 extension to Bow Junction. This traffic could still access Bow Junction, but would have a longer route to do so, using Exit 1 on I-89, Exit 12 on I-93, or the proposed I-93/I-89 interchange.

The existing I-89 Bicycle Path would be abandoned and replaced with accommodation on the new connector road proposed in Concept K.

The total cost for Concept K is estimated at $70.0 million, including mitigation costs.

Exit 12 Area - Preferred Concept F

Concept F proposes to retain the partial cloverleaf configuration of Exit 12 but would eliminate one exit ramp in each direction. Limiting each direction to one exit ramp allows standard exit ramp geometry and proper deceleration distance. The partial cloverleaf configuration was chosen for this concept over a standard diamond as the exit ramps for the diamond would require greater property and environmental impacts.

All exiting traffic would terminate at Route 3A at intersections with hybrid roundabouts. A hybrid roundabout is one that has some two-lane movements and some one-lane movements. In the case of Concept F, the southbound Route 3A traffic would have two lanes and the northbound traffic would have one lane. The northbound ramp intersection roundabout would also include a slip ramp for northbound Route 3A traffic entering northbound I-93.

The total cost for Concept F is estimated at $33.9 million, including mitigation costs.

Exit 13 Area - Preferred Concept B

Concept B proposes retaining the existing configuration of Exit 13 as this interchange was re-constructed in 2002. The northbound exit ramp to Manchester Street would be widened and the right turn would be signalized. This would allow for a dual right turn onto Manchester Street to address this heavy volume of traffic that causes backups onto I-93.

The total cost for Concept B is estimated at $39.0 million, including mitigation costs.

Exit 14 / 15 Area - Preferred Concept F2

Concept F2 proposes a modified diamond interchange at Exit 14 where the northbound entrance ramp would be eliminated. The elimination of the entrance ramp at Exit 14 would also eliminate the northbound weave between Exits 14 and 15. Concept F2 also includes a southbound C-D Road between Exits 14 and 15 that is preferred because there is less traffic and the speeds are lower.

Concept F2 also proposes a cloverstack interchange at Exit 15 where two of the loop ramps would be eliminated. The new directional ramps at Exit 15 would eliminate the four weaving sections that currently exist within Exit 15. The configuration of I-393 Exit 1 would not be altered by the project.

Concept F2 would eliminate the slip lane access to Stickney Avenue from the southbound entrance ramp to I-93 at Exit 15. A new connection from Stickney Avenue to South Commercial Street would be provided. The new connection requires an at-grade crossing of railroad tracks. This is an active railroad but with only sporadic use.

The total cost for Concept F2 is estimated at $125.0 million, including mitigation costs.

Preferred Alternative Summary

The Preferred Alternative is comprised of the preferred concept for each of the four segments as outlined in **Table ES.1** below.

Table ES.1: Preferred Alternative

SEGMENT	CONCEPT	COST
I-89 Area	K	$70.0 million
Exit 12 Area	F	$33.9 million
Exit 13 Area	B	$39.0 million
Exit 14/15 Area	F2	$125.0 million
Total		$267.9 million

See **Figure ES.3 Preferred Alternative** for a composite plan of the Preferred Alternative.

Coordination and input received from the public and resource agencies informed the selection of preferred concepts for the four project areas. The preferred concepts were selected in consideration of the extent to which each concept meets the Project's Purpose and Need. The four preferred concepts together form the Preferred Alternative for the project. The Preferred Alternative was presented to the public at Public Informational Meetings held on February 14 and 15, 2018.

ES.3 Other Alternatives Evaluated

Multiple concepts for each of the four project segments were developed and evaluated on their ability to meet the overall Purpose and Need identified for this project. Those concepts meeting the Purpose and Need were combined to create the Build Alternatives that were advanced and evaluated in this EA. In addition to the Build Alternatives, other alternatives including the No-Build Alternative, Travel Demand Management (TDM), and Transportation System Management (TSM) were evaluated.

The following is a summary of the other alternatives considered and evaluated:

1. The No-Build Alternative, which essentially serves as the baseline condition where no actions are proposed for comparison with the Build Alternatives. Under the No-Build scenario traffic volumes for the corridor are assumed to increase based on projections prepared by the Central NH Regional Planning Commission (CNHRPC). The increased traffic volumes would result in increased congestion, especially during peak periods. Crashes are likely to increase since the existing deficiencies would remain, with higher traffic volumes. Other aspects of the No Build include the continued deterioration of Red List and other bridges as well as the continued discharge of stormwater into area waterways without treatment. The No-Build was eliminated as a viable alternative since it did not meet the project’s Purpose and Need because it would not address the future transportation needs of I-93 within the project limits.

2. Travel Demand Management (TDM) strategies aim to reduce the demand for travel during peak travel periods such as the morning and afternoon commuting times, rather than increase the capacity of the transportation system. These strategies require changing travel behavior during peak travel periods to reduce the number of vehicles on the road. By eliminating trips, shortening trips, or shifting trips out of the peak periods, there is less demand for the transportation network to accommodate. TDM was eliminated as a viable alternative since it did not meet the project’s Purpose and Need as the TDM strategies would not sufficiently reduce future peak period traffic volumes.

3. Transportation Systems Management (TSM) refers to low cost easy to implement measures to address safety and congestions issues. These measures typically can be implemented without significant impacts or cost. Such measures generally do not address the long-term project purpose and need, but will help to alleviate problems in the near term. TSM was eliminated as a viable alternative since these are designed to be short-term measures and do not meet the project’s Purpose and Need to address future mobility needs.

ES.4 Summary of Beneficial and Adverse Impacts of the Preferred Alternative

Impacts associated with all the alternatives that were considered are summarized in Chapter 4. Impacts of the Preferred Alternative including transportation improvements and costs are summarized in Section 4.2.

Relative to air quality, the preferred alternative would not lead to any exceedance of State or Federal Carbon Monoxide (CO) standards. From a mesoscale level, the project will be in compliance with both the Clean Air Act and Amendments and the New Hampshire State Implementation Plan.

Increased noise levels resulting from the reconfiguration of the highway and projected increase of traffic, will necessitate further evaluation of a noise barrier located between I-93 northbound and the New Hampshire Technical Institute campus in the City of Concord. Assuming the benefitted receptors desire a noise barrier, a barrier meets the requirement of the NHDOT Noise Policy between the heights of 16 feet and 25 feet by a length of approximately 1,600 feet.

In addition to the NHTI property, the preferred alternative would result in noise impacts at various receptor locations along the project corridor. Abatement measures for each of these impacts were evaluated however, these additional abatement measures were found not to be feasible and/or reasonable in accordance with the NHDOT Noise Policy. In total, fourteen barriers were modeled but only the NHTI barrier met the criterion.

From a groundwater recharge standpoint, approximately 24 acres of stratified drift aquifer will be unavoidably covered with new, impervious roadway surface. The new impervious surface area is spread out along the project corridor.

From a water quality standpoint, pollutant loading will decrease based upon the proposed stormwater treatment sites, also known as best management practices (BMPs). These measures include detention and retention basins throughout the length of the project corridor. Currently 15 BMP sites are proposed. During final design additional investigation at these locations will be necessary to determine if all 15 sites are viable.

Potential impact to surface waters due to road salt application continues to be an issue of a regional nature. State agencies will continue to monitor chloride levels in selected streams in cooperation with New Hampshire Department of Environmental Services (NHDES) and the U.S. Environmental Protection Agency (USEPA). In addition, widening the highway will require the lengthening of one culvert located where I-93 crosses over Bow Brook. The lengthening of the culvert would result in some loss of aquatic habitat.

Floodplains and floodways are anticipated to be temporarily impacted by construction. Additional coordination will be conducted during final design to ensure that impacts are avoided or minimized to the extent practicable.

Wetland impacts are estimated at 1.8 acres with the possibility that impacts could increase to 3.4 acres if all potential stormwater BMPs are constructed.

The majority of the highway widening and other improvements will take place within the existing right-of-way, therefore, farmland soils are not anticipated to be impacted.

Cilley State Forest is located adjacent to and overlapping the project area within the Town of Bow. The preferred alternative would impact the Cilley State Forest to accommodate the placement of a realigned ramp to provide access to and from I-89 at Exit 1. The impact to Cilley State Forest is estimated at 0.7 acres. Consultation with the New Hampshire Department of Conservation and Natural Resources (NHDCNR) has taken place. Based upon the consultation, NHDCNR concurs with the impact and proposed mitigation. Land that is owned by the NHDOT, adjacent to the impacted area of the Cilley State Forest and which is of similar ecological value, would be offered as mitigation. During final design, the mitigation agreement will be formalized.

The preferred alternative would adversely effect two properties under the jurisdiction of Section 106 of the National Historic Preservation Act. These properties are located at 2 Valley Road (Upton House and Store) and 521 South Street/1 Valley Road (Lamora’s Garage) located in Bow. The roadway would be shifted near these properties and the property at 521 South Street/1 Valley Road would be fully acquired by the State and removed. There would be a retaining wall located less than 20 feet from 2 Valley Road, which would impact its setting. Five additional properties under the jurisdiction of Section 106, located in Concord, will be subject to partial acquisitions, but would not be adversely effected. These properties include: Boston, Concord & Montreal RR Historic District; NH Technical Institute Historic District; 22 Bridge Street (Concord Shoe Company/Ralph Pill Building); 24 Bridge Street (Concord Electric Light Station), and the NHDOT Garage Complex. Mitigation will be presented for the two adversely effected properties in a Memorandum of Agreement that will be included in the Revised Environmental Assessment.

The evaluation of properties under the jurisdiction of Section 4(f) of the Transportation Act indicates that the proposed project would result in an adverse effect to two historic properties: Larmora’s Garage and House and the Upton House and Store. The proposed project would result in the full or partial acquisition of three historic properties (Lamora’s Garage and House; NH Highway Garage Historic District; and the NH Technical Institute Historic Boundary) and would require permanent easement on one historic property (Boston, Concord & Montreal Railroad Historic District) resulting in a direct use of these Section 4(f) resources from the permanent incorporation of land into the transportation facility. The proposed project would also result in temporary impacts to two historic resources: The Concord Shoe Company/Ralph Pill Building and the Concord Electric Light Station. It has been determined that impacts to both resources will meet the criteria for a temporary occupancy exception and, therefore, would not constitute a 4(f) use. The proposed project would also temporarily impact recreational trails. The first impact consists of the relocation of a 20 to 30 foot section of path within the Healy Park trail system. The second impact consists of the replacement of the Delta drive bridge over I-93. The bridge is on a section of an on-street trail identified as part of the Heritage Trial by the City of Concord. Although the City has designated the sidewalk of this bridge as part of the Heritage Trail, it is part of the local transportation system and functions primarily for transportation. Therefore, this section of the Heritage Trail is not subject to Section 4(f) protection and the proposed bridge replacement would not constitute a 4(f) use. Lastly, the FHWA has made a *de minimus* impact determination for the proposed impacts on three historic properties: the Boston, Concord, & Montreal Historic District; the NH Highway Garage Complex; and the NH Technical Institute Historic District.

There are no properties under the jurisdiction of Section 6(f) of the Land and Water Conservation Fund Act with the project corridor.

Highway construction can have both short-term and long-term impacts on wildlife habitats and populations. Short-term impacts can result from disturbance caused by construction activities including: activities that result in increased noise levels and visual disturbances, tree clearing, earth disturbance, operation of machinery, and the presence of humans. Long-term impacts related to highway construction can include permanent habitat loss and fragmentation. The proposed project is located within an existing highway corridor and the surrounding habitats have already been fragmented by the original construction of the highway and surrounding development. A total of 39.3 acres of forested habitat is proposed for removal, which will occur in areas spread throughout the corridor and would not be concentrated in any one location. Adverse effects are not anticipated and mitigation is not proposed.

Adverse effects are not anticipated to occur to any State or Federal threatened or endangered species, species of special concern or exemplary communities. Based on the results of the acoustic survey, northern long-eared bat (a federally listed species) is considered absent from the project area; therefore, the project would result in a finding of “may affect - not likely to adversely affect” (NLAA). The project adheres to the criteria and conditions of the *Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat (*Version 3, May 2016). Coordination with USFWS would continue throughout final design to ensure compliance with applicable laws and agreements. Consultation with regulatory agencies and stakeholders will continue throughout final design and permitting to ensure that impacts are avoided or minimized to the extent practicable.

From a cultural resources standpoint, the preferred alternative may affect archaeological sensitive sites. Further work in the form of a Phase IB study will be conducted during final design. Appropriate protection and monitoring measures will be incorporated into final design and construction. The preferred alternative will also adversely affect two historic structures eligible for the National Register of Historic

Places (i.e., Upton House and Store and Lamora's Garage). Mitigation will be provided in consultation with Federal Highway Administration (FHWA) and the New Hampshire State Historic Preservation Office (known as the NH Division of Historical Resources) and the consulting parties in the form of a Memorandum of Agreement. The MOA will be included in the Revised Environmental Assessment.

Widening and interchange improvements associated with the preferred alternative will require the acquisition of 11 entire parcels and the partial acquisition of 32 parcels. During final design, refinements to the area of disturbance will be conducted and these estimated acquisitions may increase or decrease.

There will be no environmental justice impacts as no minority or low-income populations are differentially affected by the project. In addition, no community facilities (e.g., schools, fire stations, town buildings, public parks, etc.) will be directly affected. Secondary growth impacts in the I-93 region are not anticipated to occur as a result of this project.

Visual impacts of the preferred alternative would be largely limited to highway profile elevation changes, especially at the I-89/I-93 interchange in Bow and the noise barrier proposed along the New Hampshire Technical Institute campus in Concord. The reduction of the natural vegetation buffer between the highway and adjacent development would also have some negative effect on aesthetics.

There are numerous sites within the 4.5-mile corridor that may contain contamination, including surface, subsurface and within the groundwater. These sites, and the corridor overall, will require further study during final design. None of the contaminated sites is expected to pose a substantial problem.

From an energy standpoint, the preferred alternative will create a more efficient flow of traffic resulting in future fuel conservation as compared to the No Build (or do nothing) alternative. The widening and other improvements will require a higher expenditure of energy for various maintenance activities like plowing, sanding, roadway surface and bridge repairs, as compared to current conditions.

In addition to the project's direct impacts, indirect impacts from the project were also identified and are summarized in Chapter 4. Indirect effects are anticipated to a number of resources and are addressed along with the direct effects in the applicable resource categories. Indirect impacts to wetland systems can result from highway construction. For example, hydrological changes can occur in wetland systems from drainage modifications and/or grading changes. Tree clearing can reduce forested habitat and remove or thin the forest overstory, thereby eliminating shading of wetlands or streams. This has the potential to increase water temperature and have an adverse effect on the ecological community. Construction activities are also anticipated to result in an increase in sedimentation and pollution, which has the potential to adversely affect water quality in wetlands and streams if stormwater treatment BMPs are inadequate or not maintained.

Indirect impacts to wildlife and wildlife habitats are anticipated to result from the preferred alternative and could include increased noise levels associated with the additional travel lanes. This increased disturbance could displace some animals currently living in the vicinity of the project area. Tree clearing would result in some habitat loss, particularly of the edge habitat along the existing highway corridor. Construction of the proposed noise wall could also create barriers to wildlife passage, although the noise wall would be placed between the highway and the NHTI campus, where habitat value is limited.

Highway construction can result in additional indirect impacts including: stream channelization, loss of bank structural complexity, loss of stream flow complexity, shading from bridges or loss of shading from tree clearing, changes in water temperature, alterations in hydrology, and reduction of water quality from highway runoff.

Based upon the foreseeable projects in the region, minimal cumulative impact is anticipated to occur. The New Hampshire Department of Transportation (NHDOT) would closely coordinate the construction of the project with other projects in the region to minimize impacts to the traveling public.

Construction activities necessary to build the preferred alternative would in impacts. These impacts would be short-term and temporary in nature but could potentially result in adverse effects. The primary concerns include air quality, soil erosion and sediment control, traffic, and noise impacts. Consultation with agencies, abutters and stakeholders will continue throughout final design and construction to ensure that impacts are avoided or minimized to the extent practicable.

ES.5 Other Government Actions Required to Implement the Preferred Alternative

The FHWA and NHDOT are not aware of any additional action or any state or local government action within the project study area that could conflict with the proposed project.

The following are the actions remaining by Federal and State Agencies to implement the proposed project:

- In compliance with the requirements of Section 404 of the Clean Water Act and NH RSA 483-A, permit applications must be submitted for the Army Corps of Engineers Individual Permit and the NHDES Standard Dredge and Fill Permit. Compensatory mitigation for wetland impacts must also be approved by these agencies prior to application submittal.

- A Section 401 Water Quality Certificate is required from NHDES before the Section 404 permit can be issued.

- This project will require a Notice of Intent and Storm Water Pollution Prevention Plan (SWPPP) under the USEPA NPDES Construction General Permit.

- In compliance with the NH Shoreland Water Quality Protection Act, a permit application must be submitted to NHDES for a Shoreland permit for impacts within the protected shoreland of the Merrimack River, Turkey River, Horseshoe Pond, and Fort Eddy Pond.

- Per a Permit Exemption signed by NHDES and NHDOT in 2011, NHDOT projects are not required to obtain an AOT Permit but must still comply with AOT regulations. Therefore, AOT compliance will be required for this project.

- Approval by the FHWA as per the FHWA Interstate Access Policy for the proposed modifications to the existing Interchanges within the project corridor.

- A Finding of No Significant Impact (FONSI), issued by FHWA, is required before this project can proceed to final design. The FONSI is issued no sooner than 30 days after release of the Revised Environmental Assessment.

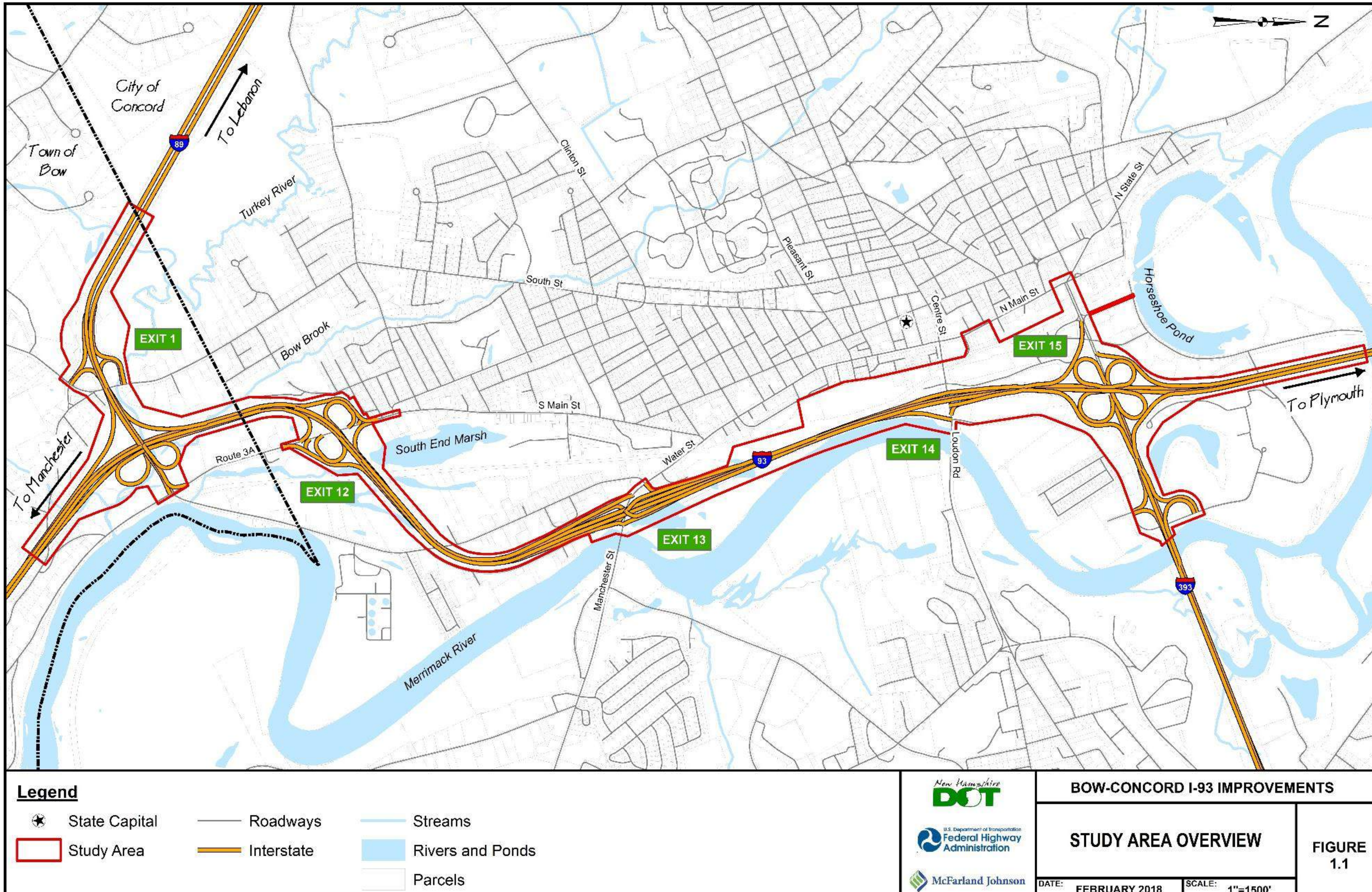
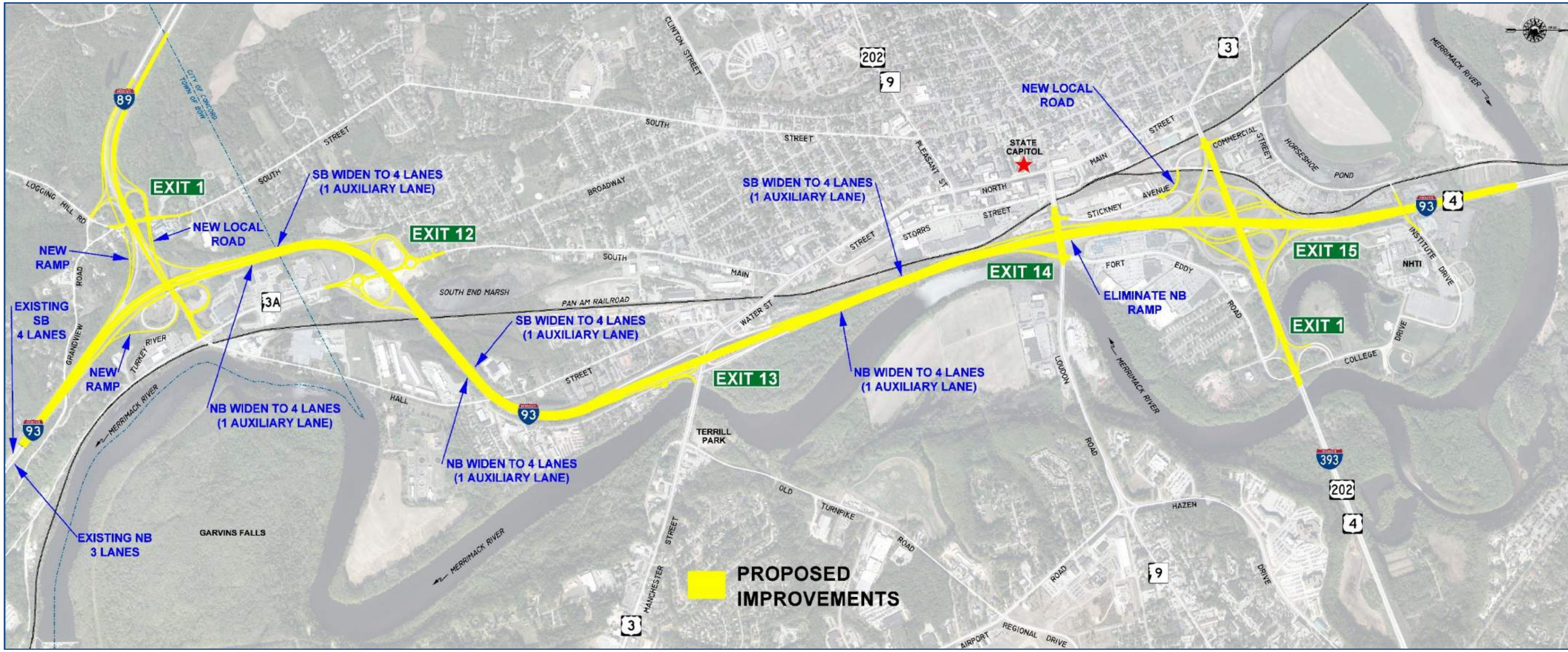

N
City of Concord
Town of Bow
To Lebanon
To Manchester
To Plymouth
89
93
393
Turkey River
Bow Brook
South End Marsh
Merrimack River
Horseshoe Pond
Clinton St
South St
Pleasant St
Centre St
N Main St
N State St
S Main St
Route 3A
Water St
Manchester St
Loudon Rd
EXIT 1
EXIT 12
EXIT 13
EXIT 14
EXIT 15
Legend
State Capital
Study Area
Roadways
Interstate
Streams
Rivers and Ponds
Parcels
New Hampshire DOT
U.S. Department of Transportation Federal Highway Administration
McFarland Johnson
BOW-CONCORD I-93 IMPROVEMENTS
STUDY AREA OVERVIEW
FIGURE 1.1
DATE: FEBRUARY 2018
SCALE: 1"=1500'

Figure ES.3: Preferred Alternative



Chapter 1
Introduction to the Project

1.1 Project Introduction

The New Hampshire Department of Transportation (NHDOT) and the Federal Highway Administration (FHWA) have prepared this Environmental Assessment/Draft Section 4(f) Evaluation (EA/4(f)) for proposed improvements to the Interstate Route 93 (I-93) corridor between the Town of Bow and the City of Concord, Merrimack County, New Hampshire. The basic purpose of the I-93 Bow-Concord project is to improve transportation efficiency and reduce safety problems within this approximately 4.5-mile segment of highway.

I-93 is the principal north-south arterial highway within New Hampshire and is part of the National System of Interstate and Defense Highways. I-93 extends a total distance of 132 miles within New Hampshire, from the Massachusetts border to the northern Vermont border. The proposed project covers a distance of approximately 4.5 miles from south of the I-93/Interstate Route 89 (I-89) Interchange in Bow to just north of the I-93/Interstate Route 393 (I-393) Interchange (Exit 15) in Concord. The segment of I-93 from Manchester to Exit 14 is also part of the Central Turnpike, commonly known as the F.E. Everett Turnpike. The project also extends along I-89 from its terminus with Route 3A (Bow Junction) approximately 4,700 feet to the west. Along I-393 the project extends from just west of the bridge over the Merrimack River to the Route 202/North Main Street intersection, a distance of approximately 4,600 feet. Refer to **Figure 1.1 Study Area Overview** that depicts the study area and the project limits.

This EA documents Part B of a three-part project development process that is being undertaken by NHDOT. The complete three-part process includes Part A, Part B and Part C with further details of the objectives of each listed in **Table 1.1 NHDOT Project Development Process for I-93 Bow Concord.**

This EA includes two volumes. Volume I includes all text and figures along with agency correspondence and comments received from the public, elected officials, agencies and organizations during development of the EA. Volume II contains the technical studies prepared for various areas of analyses.

The first chapter describes the project study area and project history, and provides a description of the overall purpose and need for this project. Chapter 2 describes the transportation improvement strategies and other alternatives that were originally considered in Part A and that led to the identification of a reasonable range of alternatives for detailed study in the Part B. Chapter 2 also details the preferred alternative. Chapter 3 describes the existing conditions in the study area, and Chapter 4 identifies the anticipated environmental impacts of alternatives studied in detail. Chapter 5 contains the Section 4(f) Evaluation. Chapter 6 identifies project commitments made by NHDOT and FHWA to avoid, minimize, or mitigate effects of the Preferred Alternative. Chapter 7 describes the agency coordination and public participation that has taken place to date. Chapters 8 and 9 provide a list of EA document preparers and a EA document distribution list to agencies, stakeholders and individuals. Reference materials can be found in Chapter 10.

Table 1.1: NHDOT Project Development Process for I-93 Bow-Concord

Project Part	Objective
Part A **Completed in 2008**	Part A included defining a project purpose and need; developing a range of reasonable alternatives (conceptual level); and identifying the level of environmental documentation required to implement the project as prescribed by the National Environmental Policy Act (NEPA) of 1969.
Part B **Current Phase**	Part B involves additional public involvement, preliminary design of the reasonable alternatives, selection of a preferred alternative, and preparation of the appropriate environmental document to disclose potential impacts as per NEPA. Draft and final versions of the environmental document are subject to public review.
Part C **Future Phase**	Part C will involve final design, implementation of environmental commitments agreed to in Part B, right-of-way acquisition, and construction advertisement.
Construction **Future Phases**	Construction will likely occur in several phases.

This EA has been prepared in conformance with the laws and regulations of the Council on Environmental Quality (CEQ) (40 CFR 1500-1508), National Environmental Policy Act (NEPA) (42 USC 55), and FHWA (23 CFR 771); the National Historic Preservation Act of 1966, as amended; and Section 4(f) of the U.S. Department of Transportation Act (23 CFR 774). The purpose of an EA is to provide full disclosure of potential impacts, and to inform decision-makers and the public of the reasonable alternatives, which would avoid or minimize adverse impacts. This EA describes existing transportation, social, economic, cultural, and environmental resources in the study area and discusses the potential effects of the various project alternatives, including the No-Build alternative, on these resources.

1.2 Project History

This section of I-93, in central New Hampshire was constructed in the late 1950s and early 1960s as part of the Central Turnpike, more commonly known as the F.E. Everett Turnpike and as part of the Interstate Highway System. There were no substantial improvements made to the 4.5-mile segment through Bow and Concord until 2003 when reconstruction of Exit 13 in Concord was completed. This reconstruction included a new interchange and the ability to widen I-93 to six lanes at that location; however, only four lanes were constructed. Exit 13 was reconstructed with a single-point urban interchange (SPUI), a configuration that is similar to a diamond but includes one signalized intersection that provides control for all ramp movements at a “single point”.

From 2010 to 2016, four Red List bridges within the project limits were taken off the red list due to either rehabilitation or replacement. Red List bridges are identified by NHDOT as those bridges whose condition or weight restriction requires more frequent inspections, at least twice per year instead of once every two years. Red List bridges require more frequent repairs due to known deficiencies, poor condition, or load restrictions, usually the result of structural deterioration. The bridge carrying I-93 over Loudon Road (NH Route 9) at Exit 14 was rehabilitated in 2010; however, no widening was included in that project. Replacement of the two bridges carrying I-93 over I-89 in Bow was completed in 2015. These bridges were constructed to accommodate six lanes at that location; however, only five lanes were provided. The bridge carrying NH Route 3A over I-93 at Exit 12 was replaced in 2016. This bridge was constructed to accommodate up to eight lanes (four in each direction) for I-93 and three lanes on NH Route 3A.

The need to address issues along I-93 in Bow and Concord was identified in 1990 when the Bow-Concord Widening Project was first placed on the State’s Ten-Year Plan. New Hampshire RSA 228:99 and RSA 240 require that the NHDOT propose a plan for improvements to the State's transportation system every two years. The purpose of the Ten-Year Plan is to develop and implement a plan allowing New Hampshire to fully participate in federally supported transportation improvement projects as well as to outline projects and programs funded with State transportation dollars. The first study of the corridor was conducted in 1991/1992 and was documented in the *I-93 Bow-Concord Feasibility Study* (published in 1992). The purpose of that study was to determine the feasibility of widening I-93 while maintaining all the existing access points. The proposed improvements from this 1992 study included the following:

- Widen I-93 to eight lanes south of I-89
- Widen I-93 to six lanes through the I-93/I-89 Interchange
- Widen I-93 to eight lanes from I-89 to I-393 (Exit 15)
- Widen I-93 to six lanes north of I-393 (Exit 15)
- Provide auxiliary lanes on northbound and southbound I-93 between Exits 13 and 14

- Reconfigure interchanges at the I-93/I-89 junction, Exits 12 through 15, and Exit 1 on I-89

The scale of these recommended improvements was not well received by the surrounding communities and none of these 1992 recommendations were implemented.

In 1998, the City of Concord embarked on a visioning effort, *20/20 Vision for Concord, NH,* which was completed in September 2001. This visioning effort included a comprehensive evaluation of the transportation system in Concord. The effort identified the importance of I-93 as a local road in addition to its role as a key commuter route and a route for recreational users. The *20/20 Vision* also developed options and recommendations for I-93.

The *20/20 Vision for Concord* process resulted in determining that a six-lane I-93 would be sufficient to handle traffic until 2020 and options were presented to shift and lower I-93 between Exits 13 and 14 to facilitate at-grade access and create open views to the Merrimack River from downtown. The desire for a pedestrian bridge over I-93 was also identified, which would require a reconfiguration of Exit 14 where Loudon Road would cross over I-93. These and other options developed by the *20/20 Vision* were included in the evaluations for this project during Part A (refer to Chapter 2, Alternatives for further details on Part A).

The City of Concord independently completed a *Concord Opportunity Corridor Master Plan* in April 2005. This master plan focused on the north-south area of Concord between downtown and the Merrimack River and developed a concept based on the *20/20 Vision* options that included specific recommendations for improvements to I-93. The Opportunity Corridor Concept recommendations included a six-lane I-93 corridor through downtown Concord, reconfigured Exits 14 and 15, an expanded Storrs Street, and a new local connection over I-93.

None of the improvements identified in the *20/20 Vision* or the *Concord Opportunity Corridor Master Plan* for I-93 have been implemented.

The current phase of the Bow-Concord project addresses the need for improvements that have been under study since the NHDOT formally recognized the need for improvements to this section of I-93 in 1986, at which time the project was included in the first Ten Year Highway Plan that was enacted into legislation.

The various Ten-Year Transportation Improvement Plans (TIP) signed into law through June 1, 2006, covering projects through to 2016, included significant funding for the improvement of I-93 in Bow and Concord. The Part A planning study was initiated to study the proposed improvements to I-93 under this funding level.

However, the TIP signed into law on June 25, 2008, covering 2009 to 2018, only included funding to fix four of the Red List bridges along I-93 in Bow and Concord. The long-term improvements to the I-93 corridor were deferred until after 2018. The TIP signed into law on June 28, 2010, covering 2011 to 2020, continued funding for the Red List bridges only. The TIP signed into law on June 11, 2012, covering 2013 to 2022, began the restoration of corridor funding by including funds to begin Part B. The next two TIPs continued this pattern and also included funds to address bridges that have been added to the Red List.

1.3 General Description of Study Area

The segment of I-93 under study is located in central New Hampshire within the Town of Bow and the City of Concord, Merrimack County. This 4.5-mile segment of I-93 and the adjoining land area comprises the I-93 study area. The study area is depicted on **Figure 1.1**. For purposes of inventorying resources that could be impacted as a result of improving the 4.5-mile interstate, the study area is generally defined as a band 300-feet wide surrounding the corridor. The study area is expanded adjacent to the interchanges and specific areas where additional impacts are anticipated. One of these areas is along Stickney Avenue between Exits 14 and 15 where additional roadway improvements may be necessary to maintain access to this area.

This section of I-93 extends from south of the I-89/I-93 Interchange to north of I-393 where I-93 crosses over the Merrimack River. I-93 is a limited (fully controlled) access highway originally constructed in the late 1950s and early 1960s. Limited access means access to the highway is only provided at interchanges. This segment of I-93 is fed by a network of state and local roadways. Major roads include I-89, NH Route 3A, US Route 3 (Manchester/Water Street), NH Route 9 (Loudon Road), and I-393.

The study area located with the Town of Bow is comprised of a of land under a variety of uses, including residential (a mix of lot sizes) located on the south side of I-89 with local access provided by Logging Hill Road, Grandview Road and South Street. Business, commercial, and industrial uses are located on the north side of I-89 along South Street and include the Bow Mobil, Hampton Inn and the Baker Public Library. The Cilley State Forest is also located within the study area on the north side of I-89. The study area within Bow also includes the area on the east side of I-93 along NH Route 3A. Businesses located in this area include Grappone Auto and Pitco Frialator. A NHDOT-owned Park and Ride facility is located at the intersection of Route 3A, Hall Street and I-89. Important natural features within the Town of Bow area include the Merrimack River, Turkey River, and Bow Brook.

The study area within the City of Concord can be characterized as an urbanized corridor that is dominated by industrial, commercial and transportation uses with a few areas of residential and recreational uses. This land use pattern in Concord is typical of many communities in New Hampshire where commercial land uses are located along heavily traveled regional roadways, such as I-93, while most of residential development is located away from these heavily traveled roadways.

In the area near Exit 12 on I-93, businesses include the Days Inn, Dunkin Donuts and Irving Gas with local access provided by Route 3A/South Main Street. I-93 spans the Pan Am Railroad line that passes under I-93 just north of Exit 12. At this location environmental resources present include the South End Marsh, a large open water area with forested and emergent wetland habitat located on the north side of I-93. A wetland mitigation site (owned by the NHDOT) is located on the south side of I-93 and is predominantly emergent and open water habitat. A large residential area is located on the north side of I-93 near the existing I-93 south on-ramp from Route 3A/South Main Street. Access to the residential area is provided from Route 3A/South Main Street to the residential streets of Joffre Street, Broadway and Donovan Street.

In the area near Exit 13, a large forested floodplain habitat is located between I-93 and the Merrimack River. The area is owned by the City of Concord and is known as West Terrill Park. From Exit 13, access to US Route 3/Manchester Street (east of I-93) and US Route 3/Water Street (west of I-93) is provided. Numerous businesses and office parks of various types and sizes are located on Manchester Street. US Route 3/Water Street provides direct access to S. Main Street and the downtown area of Concord. Businesses on US Route 3/Water Street within the study area include Granite State College, Burger King, Speedway gas station, The Common Man Restaurant, and the Fairfield Inn. Hall Street, intersects with Water Street providing access to other hotels in the corridor including the Best Western, Marriot Residence Inn and Comfort Inn.

The most urbanized areas in the study area are those located near Exit 14 and Exit 15. Exit 14 provides access to Loudon Road/NH Route 9 and Exit 15 provides access to I-393. Both interchanges provide direct access to the downtown area of Concord and the state capital building. Land uses within the study area are dominated by commercial, business, industrial and transportation uses. The west side of I-93 includes Burlington Coat Factory, a Unitil electrical substation, and the Concord Coach Bus Depot with access provided by Storrs Street (off of Loudon Road). Another major land use in the area is the Grappone Conference Center and Hotel located off Commercial Street. Within the study area on the east side of I-93 the landscape is dominated by “big box” retailers, such as clothing outlets, and supermarkets, including Hannaford’s, Market Basket and Shaw’s. Exit 15 also provides access to the New Hampshire Technical Institute, via I-393.

Important natural features with the study area near Exit 14 and 15 include the Merrimack River, Fort Eddy Pond, Horseshoe Pond, and their tributaries.

Also within the study area are two railroad corridors, both of which currently carry freight only. The Pan Am Railways (PAR) corridor, the “Main Line North”, which runs north-south through the study area generally parallel to I-93, crosses beneath I-93 just north of Exit 12. The Pan Am Railroad was previously part of the former Boston and Maine Railroad system that once dominated rail service in New Hampshire. The Main Line North veers northwest just north of Exit 14; however, no freight is carried on the portion north of Exit 15. The portion of the Main Line North located north of Exit 15 to the boundary of the Town of Boscawen has recently been abandoned by Pan Am Railways. The use of the Main Line North by Pan Am Railways within the project is limited to switching of cars up to five times a week. **Figure 1.2 Existing Rail Facilities** depicts the existing rail corridors in the project limits.

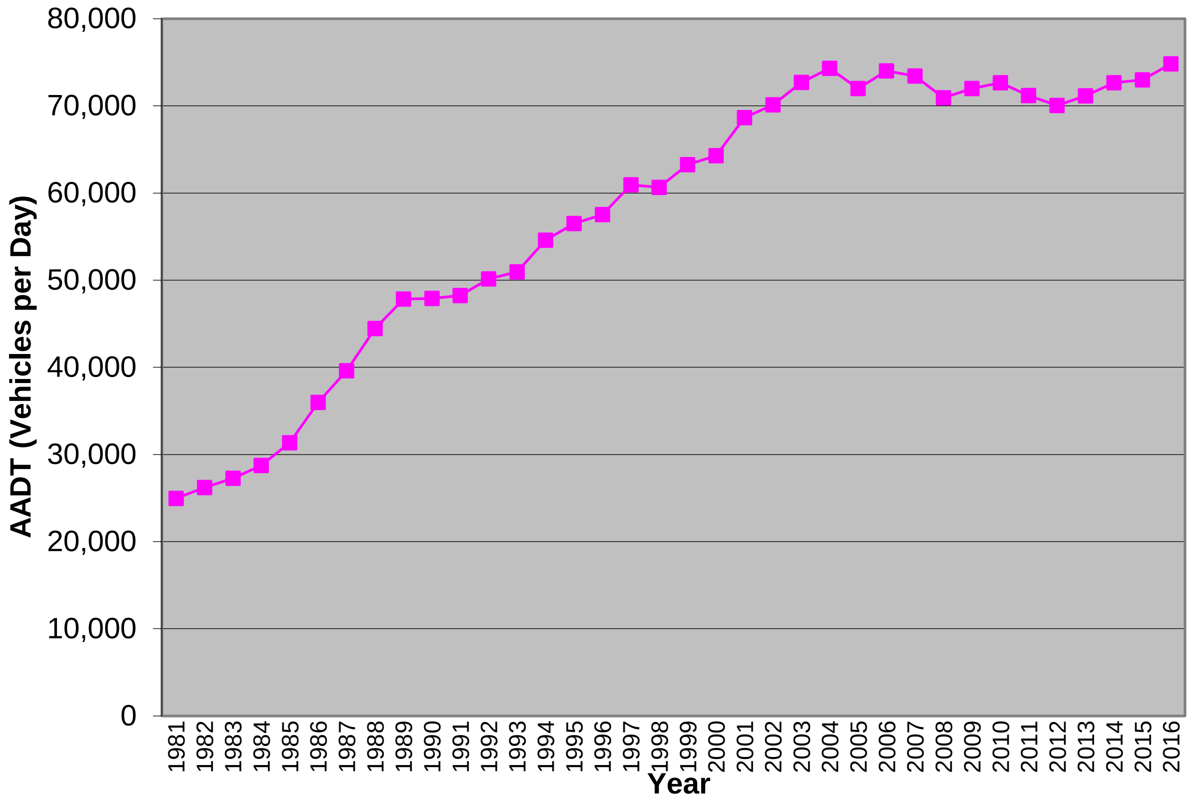
The NHDOT owns the Main Line North from the boundary of Boscawen to its terminus in the City of Lebanon. The majority of the NHDOT portion has been abandoned. Between Exits 14 and 15 the White Mountain Branch, an active line, begins as it separates from the Main Line North creating two independent rail corridors. The White Mountain Branch heads north and hugs the ramps at Exit 15 before heading north again. This rail line is owned by NHDOT. New England Southern (NEGS) operates freight service in the project area on railroad lines it leases from Pan Am Railways and NHDOT. They serve a few industrial customers located in the City of Concord on an as-needed basis and do not have regular service.

1.4 Overview of Existing Roadway Network

I-93 through Bow and Concord is a four-lane divided urban principal arterial highway, a major roadway whose primary purpose is to move high volumes of traffic, with limited access provided only at interchanges. An additional lane exists southbound from Exit 12 and extends south of I-89. South of the project limits, I-93 is a six-lane divided urban arterial highway. The posted speed limit within the project area is 55 miles per hour (mph). The design speed within the project limits varies but exceeds 60 mph in most cases. The 60-mph design speed is acceptable for urban freeways according to the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Design Standards – Interstate System* and *A Policy on Geometric Design of Highways and Streets*.

I-93, as originally constructed in the late 1950s and early 1960s, was expected to carry 20,000 vehicles per day within its design life of 20 years. This 4.5-mile segment now serves almost 75,000 vehicles per day with peak summer travel at over 85,000 vehicles per day. **Table 1.2 Average Annual Daily Traffic Between Exits 12 and 13**, shown below, depicts the growth in average annual daily traffic (AADT) between Exits 12 and 13 from 1981 to 2016. While the traffic on I-93 has leveled over the last decade, 2016 had the highest AADT on record.

Table 1.2: I-93 Average Annual Daily Traffic between Exits 12 and 13



Just south of the I-93/I-89 Interchange, I-93 is reduced from six lanes to four lanes. This lane reduction, coupled with the traffic from I-89, results in congestion on I-93 entering and through Concord during peak periods. The traffic backup on northbound I-93 during peak periods can stretch as far south as the Hooksett Toll Booth, a distance of about seven miles from the interchange. The traffic backup on southbound I-93 during peak periods can stretch as far north as Exit 17, a distance of about five miles from the Merrimack River.

There are seven existing interchanges within the project limits. A description of each, from south to north, is discussed below.

- Exit 1 on I-89 is a partial cloverleaf interchange with all ramps located on the west side of South Street and Logging Hill Road in order to provide separation with the ramps from the I-93/I-89 Interchange. Exit 1 provides access to the local road network and northern Bow via Logging Hill Road, as well as to the South End of Concord through South Street.

- The I-93/I-89 Interchange is a modified trumpet interchange where I-89 ends at I-93. There are direct and loop ramps connecting the two Interstate routes. In addition, the extension of I-89 connects directly to NH Route 3A via a signalized at-grade intersection. This is an important regional interchange providing the connection between I-89 and I-93, in addition to providing access to Bow and Concord via NH Route 3A. There is only 1,200 feet between the I-93/I-89 Interchange and I-89 Exit 1. The AASHTO recommended spacing between is one mile (5,280 feet).

- Exit 12 is also a partial cloverleaf interchange, but it has two sets of exit ramps from I-93. Exit 12 on I-93 connects to South Main Street (NH Route 3A). South Main Street provides access to northern Bow and the South End of Concord. The spacing between Exit 12 and the I-93/I-89 Interchange is about 3,600 feet.

- Exit 13 is a single point urban interchange (SPUI) with access to Water and Manchester Streets (US Route 3) in Concord. A SPUI terminates the ramps at a single point where a single traffic signal controls most of the movements within the intersection. To the west, Exit 13 provides access to downtown Concord by way of South Main Street. To the east, Manchester Street provides the first access across the Merrimack River in Concord. This is the main point of access to southeastern Concord and the Town of Pembroke. There is over a mile spacing between Exit 13 and Exit 12.

- Exit 14 is a diamond interchange providing access to Loudon Road (NH Route 9). Loudon Road provides access to downtown Concord and the State Capitol Building to the west and to the east across the Merrimack River to the Heights district of Concord, the commercial areas along Loudon Road as well as the State office complex. There is approximately 2,800 feet between Exits 14 and 15, and AASHTO recommends spacing of one mile between urban interchanges. There is over a mile spacing between Exit 14 and Exit 13.

- Exit 15 is a full cloverleaf interchange providing the connection between I-93 and I-393/NH 202. The extension of NH Route 202 to the west of I-93 connects to North Main Street providing access to downtown, the Northside of Concord and the State Capitol Building. Exit 15 is an important regional interchange, similar to the I-93/I-89 Interchange, connecting two Interstate routes. The spacing between Exit 14 and Exit 15 is about 2,800 feet.

- Exit 1 on I-393 is a partial cloverleaf interchange providing access to Fort Eddy Road and College Drive. Fort Eddy Road is a commercial area with several shopping malls, supermarkets and restaurants. College Drive is the main entrance to the New Hampshire Technical Institute. The spacing between Exit 1 on I-393 and Exit 15 is about 2,500 feet.

1.5 Red List Bridges

The following projects have been conducted to address Red List bridges within the project corridor from 2008 to 2016.

- Exit 14 Bridge Rehabilitation: The bridge that carries I-93 over Loudon Road at Exit 14 was rehabilitated in 2010. The rehabilitation removed the bridge from the Red List, but it is not large enough to accommodate any widening of I-93 or Loudon Road.

- I-93 Bridges over I-89 Replacement: The two bridges that carry northbound and southbound I-93 over the I-89 extension in Bow were replaced from 2013 to 2015. The two new bridges were constructed to accommodate six lanes of traffic, three lanes in each direction, as well as standard inside and outside shoulders.

- Exit 12 Bridge Replacement: The bridge that carries NH Route 3A over I-93 at Exit 12 was replaced from 2015 to 2016. The new bridge was constructed to accommodate up to eight lanes on I-93 and three lanes on NH Route 3A.

Below is a list of the six Red List bridges within the project limits, their 2017 State Priority Ranking, and how this project would address their removal from the Red List. The State Priority Ranking is based on a scoring system that considers a bridges condition, importance, risk, capacity, and type/size. The deck of the bridge consists of the horizontal surface of the bridge, the superstructure consists of the beams that support the deck, and the substructure consists of the abutments, piers, and foundations elements.

- I-393 Bridge over I-93 (Exit 15) (State Priority #7): Both the deck and substructure (piers and /or foundation) of this bridge are rated in poor condition. This bridge would be replaced as it could not accommodate the widening of I-93 that would be required for the Preferred Alternative nor any of the build alternatives evaluated.

- Southbound I-93 over Hall Street (State Priority #13): The substructure of this bridge is rated in poor condition. Also, this bridge has less than the desired vertical clearance over Hall Street. This bridge would be replaced as it does not accommodate the widening of I-93 that would be required for the Preferred Alternative nor for any of the build alternatives evaluated.

- US Route 202 over NHRR and Constitution Avenue (State Priority #15): The deck of this bridge is rated in serious condition and the substructure is rated in poor condition. Replacement of this bridge is required due to its deteriorated condition.

- I-89 over South Street (Exit 1) (State Priority #26): Both the deck and superstructure of this bridge are rated in poor condition. This bridge would be replaced as it does not accommodate the widening of I-89 that would be required for the Preferred Alternative nor any of the build alternatives evaluated.

- I-393 over Fort Eddy Road (Exit 1) (State Priority #34): The deck of this bridge is rated in poor condition. Replacement of this bridge is not required to accommodate the preferred alternative and it will be further evaluated for rehabilitation.

- Delta Drive over I-93 (State Priority #99): The deck of this bridge is rated in serious condition. This bridge would be replaced as it does not accommodate the Preferred Alternative nor the widening of I-93 that would be required for any of the build alternatives evaluated.

1.6 Safety and Roadway Geometry Issues

There are several safety issues that exist along I-93 within the project limits. Many of these issues are to be expected with a transportation system that is approaching 60 years of age. There are two main safety concerns; inadequate weaving lengths and inadequate deceleration distances.

Inadequate weaving lengths occur in several places and are a result of interchanges located too close to one another. The term weaving refers to the segment of highway between critical points where traffic is entering and exiting and the vehicle paths cross. Inadequate weaving lengths exist at the following locations:

- I-89 southbound between the Exit 1 entrance ramp and the I-93 southbound exit ramp
- I-89 northbound between the I-93 southbound entrance ramp and the Exit 1 northbound exit ramp
- I-93 southbound between Exits 14 and 15
- I-93 northbound between Exits 14 and 15
- I-93 southbound between Exit 15 loop ramps
- I-93 northbound between Exit 15 loop ramps
- I-393 eastbound between Exit 15 loop ramps
- I-393 westbound between Exit 15 loop ramps
- I-393 eastbound between Exit 15 and Exit 1 on I-393
- I-393 westbound between Exit 1 on I-393 and Exit 15

Inadequate deceleration distances exist at all four exit ramps at Exit 12. The four exit ramps have curved geometry with posted speed limits of 25 mph. The exit ramps leading to these curves are not of sufficient length for vehicles to comfortably decelerate outside the main flow of traffic on I-93 from 55 mph to 25 mph.

For the ten-year period from January 2007 to December 2016, a total of 2,195 crashes were reported to the NHDOT within the study area limits. These crashes occurred on I-93, I-89, I-393, the on and off ramps to each interstate, the intersections where the ramps terminate with other roadways, and these other roadways, all within the project limits. Of the 2,195 crashes, 512 resulted in 622 injuries, and there were 6 fatalities. One of the fatalities was a pedestrian who was struck along Fort Eddy Road near the I-393 Exit 1 entrance ramp.

The crashes reported within the study area limits for the ten-year period January 2007 to December 2016 are presented in **Figures 1.3 to 1.6 Crash History** (for each segment). The graphical presentation of the crashes demonstrates the correlation between the deficiencies listed above and increased numbers of crashes. There are clusters of crashes within the deficient weaving areas between I-89 Exit 1 and I-93, between Exits 14 and 15, and within Exit 15.

The 6 fatalities were the result of 6 separate crashes, 2 on I-93 near I-89, 1 on I-93 between Exits 14 and 15, 1 on I-93 at Exit 15, 1 on I-393 at the Merrimack River, and the pedestrian fatality near I-393 Exit 1.

1.7 Purpose and Need for the Project

The development of the Purpose and Need for the Project was initiated during the Part A Planning Study completed in 2008. The Part A process included extensive discussions with the public and stakeholders, including a Planning Group consisting of citizens, businesses, regulatory agencies, and other community representatives. The Part A process included the public vetting of topics including: community vision, safety, mobility, economic vitality, aesthetics, natural environment, access, transportation choice, and cultural resources. From these discussions consensus was achieved on a Problem Statement for the project. Then, building on the Problem Statement, consensus was achieved on a Project Goal Statement. From these two statements, the overall Purpose and Need was developed and refined during the Part B project. The Purpose and Need for the Project is as follows:

1.7.1 Purpose

The purpose of the Interstate Route 93 Bow-Concord project is to address the existing and future transportation needs for all users of this 4.5-mile segment of I-93, while balancing the needs of the surrounding communities, by providing a safe and efficient transportation corridor for people, goods, and services.

1.7.2 Need

<u>Mobility</u>
Interstate 93 is a principal north-south arterial Interstate highway within the State of New Hampshire and is part of the National System of Interstate and Defense Highways. The segment of Interstate Route 93 under study intersects two other Interstate highways, Interstate Route 89, and Interstate Route 393, providing a vital link for east/west travel, and passes through the City of Concord, the state capital. Interstates 93, 89 and 393 carry a mix of traffic including trucks, cars, buses, and other vehicles. The Interstate Route 93 corridor serves as an important link for New England wide tourist travel to the White Mountains, Lakes Region and Vermont, a regional commuting route for the

Concord area, as well as an important local route. As one of the main arterials in the New Hampshire highway system, it is important to maintain the mobility of people, goods, and services through this corridor.

Capacity

Interstate Route 93 was constructed in the 1960s to serve 20,000 vehicles per day and now serves nearly 75,000 vehicles per day with peak summer travel at over 85,000 vehicles per day. Traffic volumes on Interstate Route 93 through Bow and Concord tripled from 1980 to 2004. Between 2004 and 2012 traffic volumes remained steady or declined slightly. Since 2012, traffic volumes on Interstate Route 93 have begun to rise with 2016 having the highest all time average annual traffic. Growth in the region is expected to occur in the coming years and place a greater burden on the transportation system. With an estimated 80,000 vehicle trips per day by the year 2035, increased congestion and increased travel times are expected implementation of management strategies or improvements such as the proposed to this important regional travel corridor.

Regional Plans

The project corridor is recognized by the State of New Hampshire and the Central New Hampshire Regional Planning Commission (CNHRPC) as a vital link for statewide travel as well as an important local route within Concord and the Central New Hampshire region. In recognition of these deficiencies, the project has been included in the State's Ten-Year Transportation Improvement Plan for years 2015 to 2024 as an unfunded priority, and is a top long-term transportation priority for the Central New Hampshire Regional Planning Commission (CNHRPC).

Safety

The approximately 4.5-mile project corridor currently contains numerous geometric deficiencies based upon current highway design standards. The deficiencies include: inadequate distances between entrance and exit ramps (causing weaving), short deceleration distances at exit ramps and short acceleration distances at entrance ramps. A review of the crash data for the period between 2007 and 2016 indicates many of the crashes occur at ramps or between ramps where the deficiencies exist, causing both property damage as well as injuries to drivers. As traffic volumes increase on Interstate Route 93, these geometric deficiencies will become more problematic and crashes are anticipated to become more frequent. The corridor also contains six bridges that are currently on the Red List of state bridges.

Transportation Choice

This project corridor currently accommodates various modes of transportation, but the project could improve access to those modes or accommodate additional modes. This in turn would make travel more efficient for all users. Commuter rail service is a possibility and bus service continues to expand in the region. Bow and Concord have networks of public trails within and near the project corridor and are actively expanding their networks in an effort to complete the Heritage Trail along the Merrimack River. The project has considered access to and augmentation of these trail systems.

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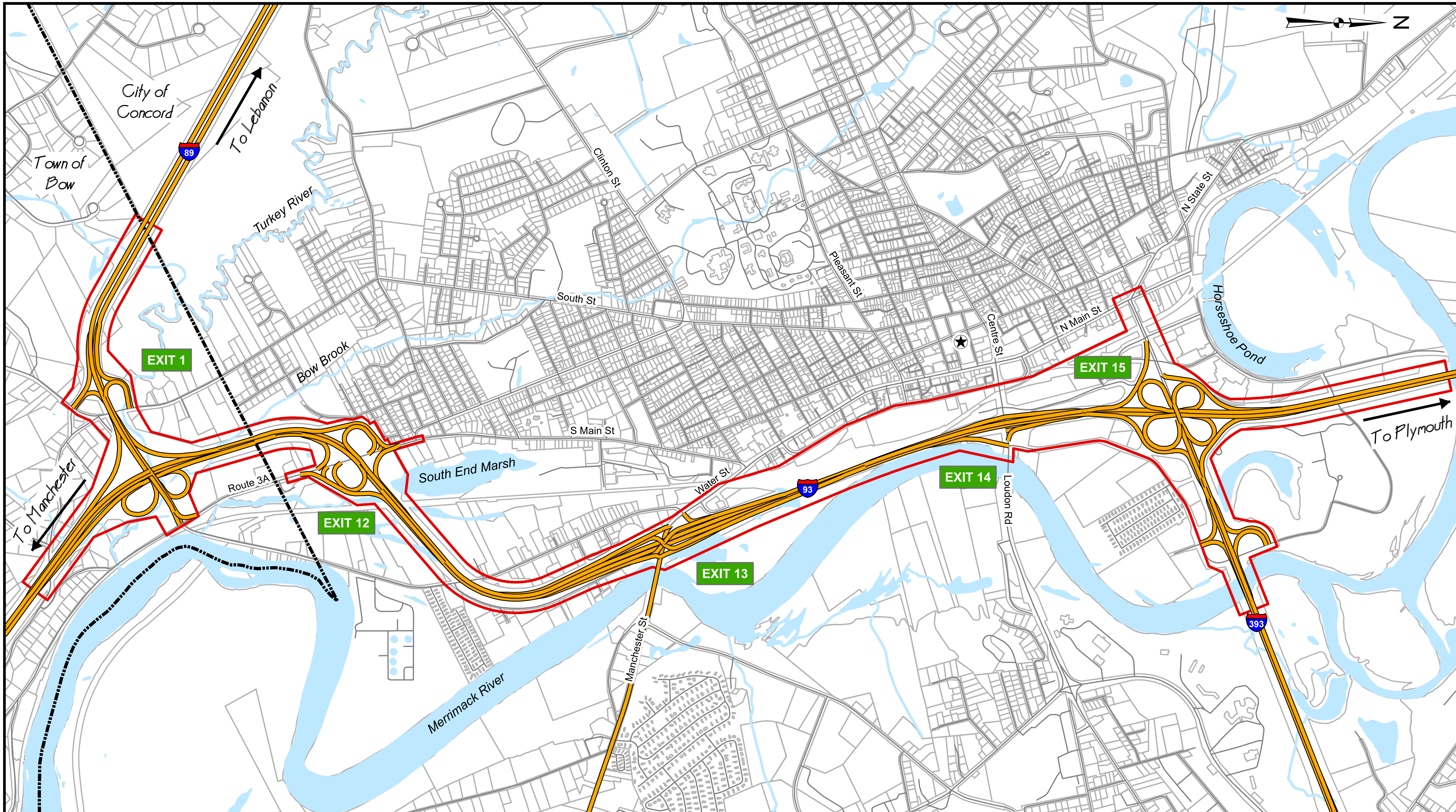


Legend

- State Capital
- Study Area
- Roadways
- Interstate
- Streams
- Rivers and Ponds
- Parcels

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

McFarland Johnson

BOW-CONCORD I-93 IMPROVEMENTS

STUDY AREA OVERVIEW

FIGURE 1.1

DATE: **AUGUST 2018**

SCALE: **1"=1500'**

M:\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\Study Area.mxd

Figure 1.2 – Existing Rail Facilities

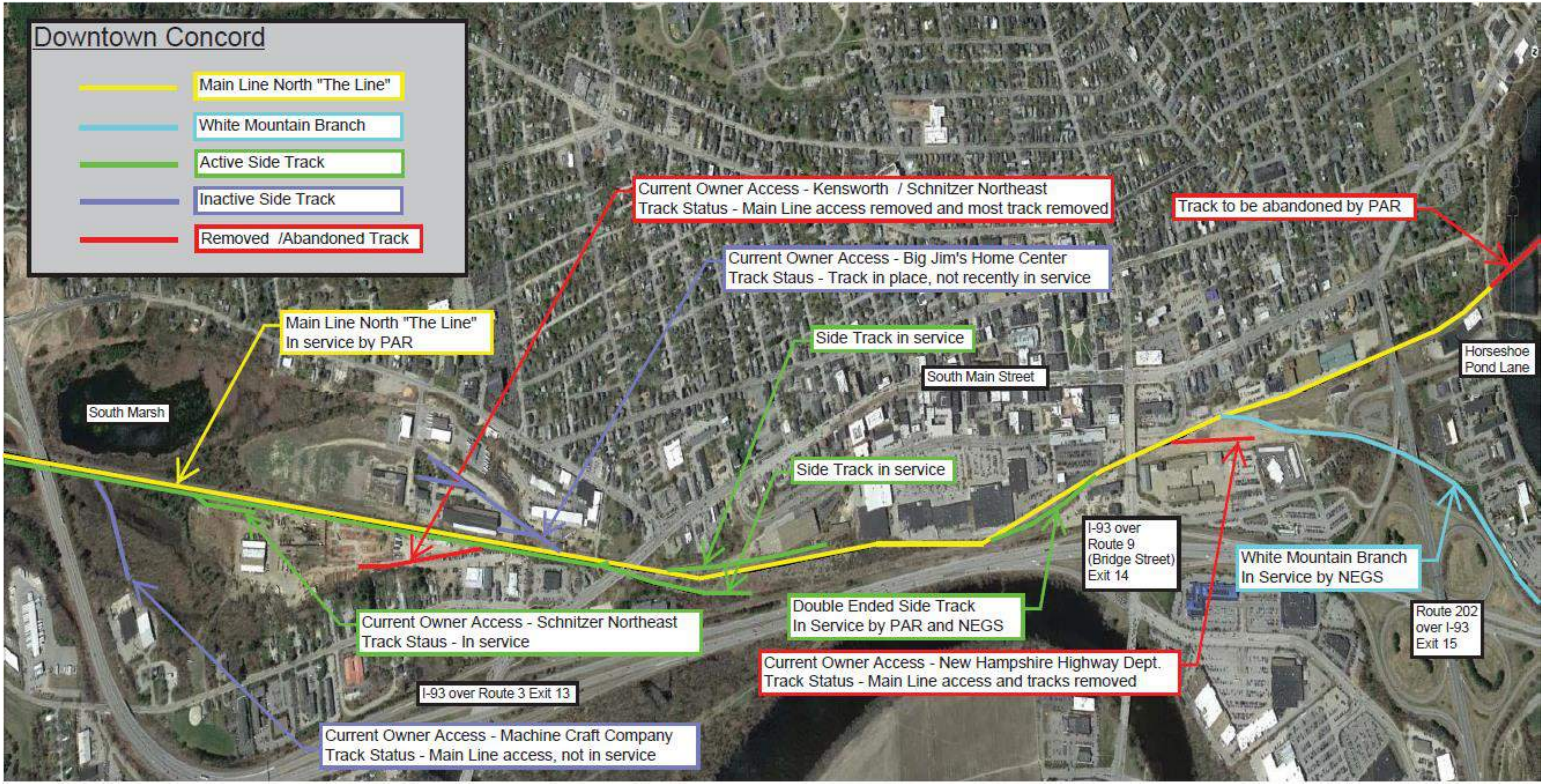


Figure 1.3 Crash History for the I-89 Area (2007 to 2016)

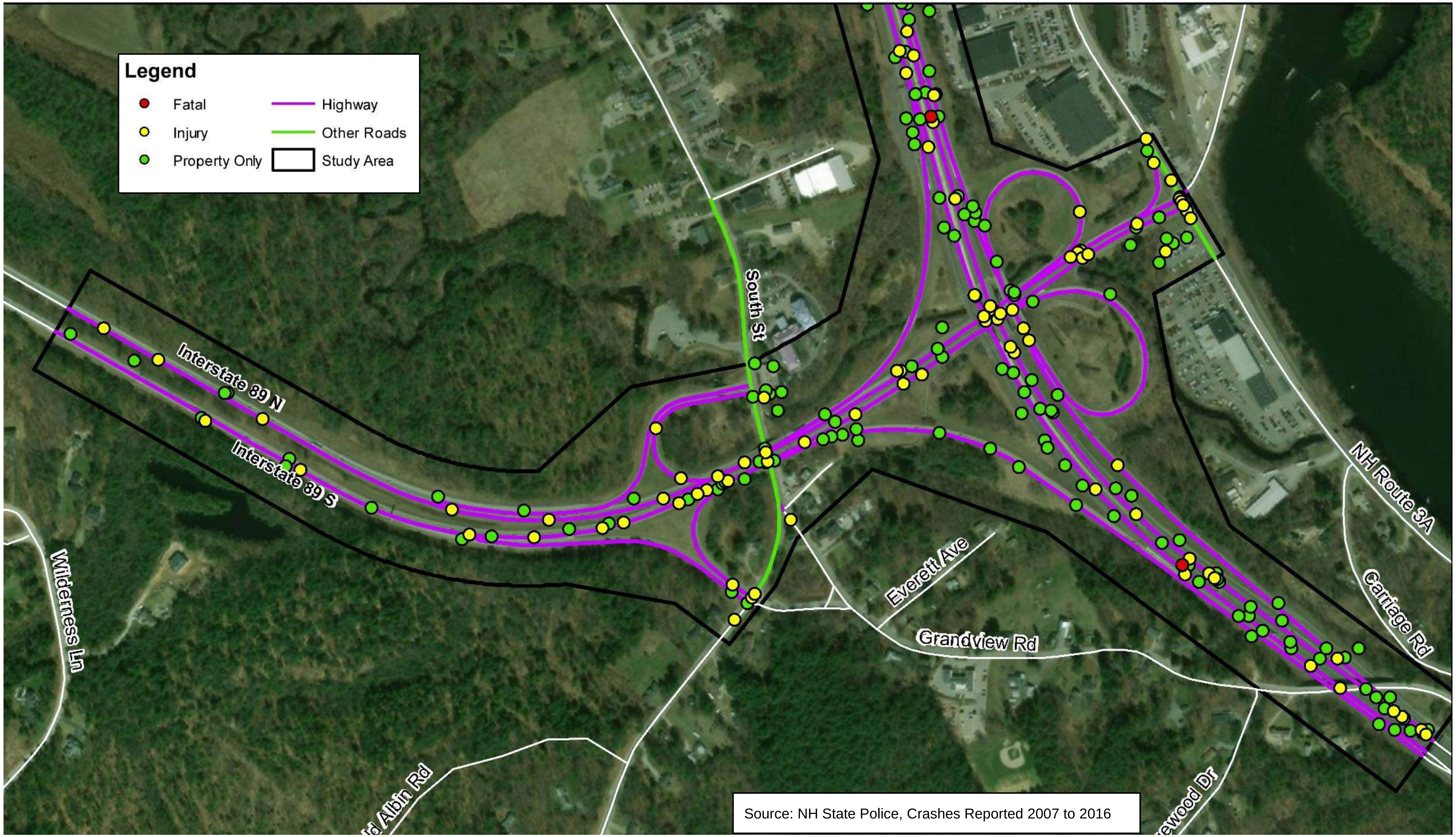


Figure 1.4 Crash History for the Exit 12 Area (2007 to 2016)

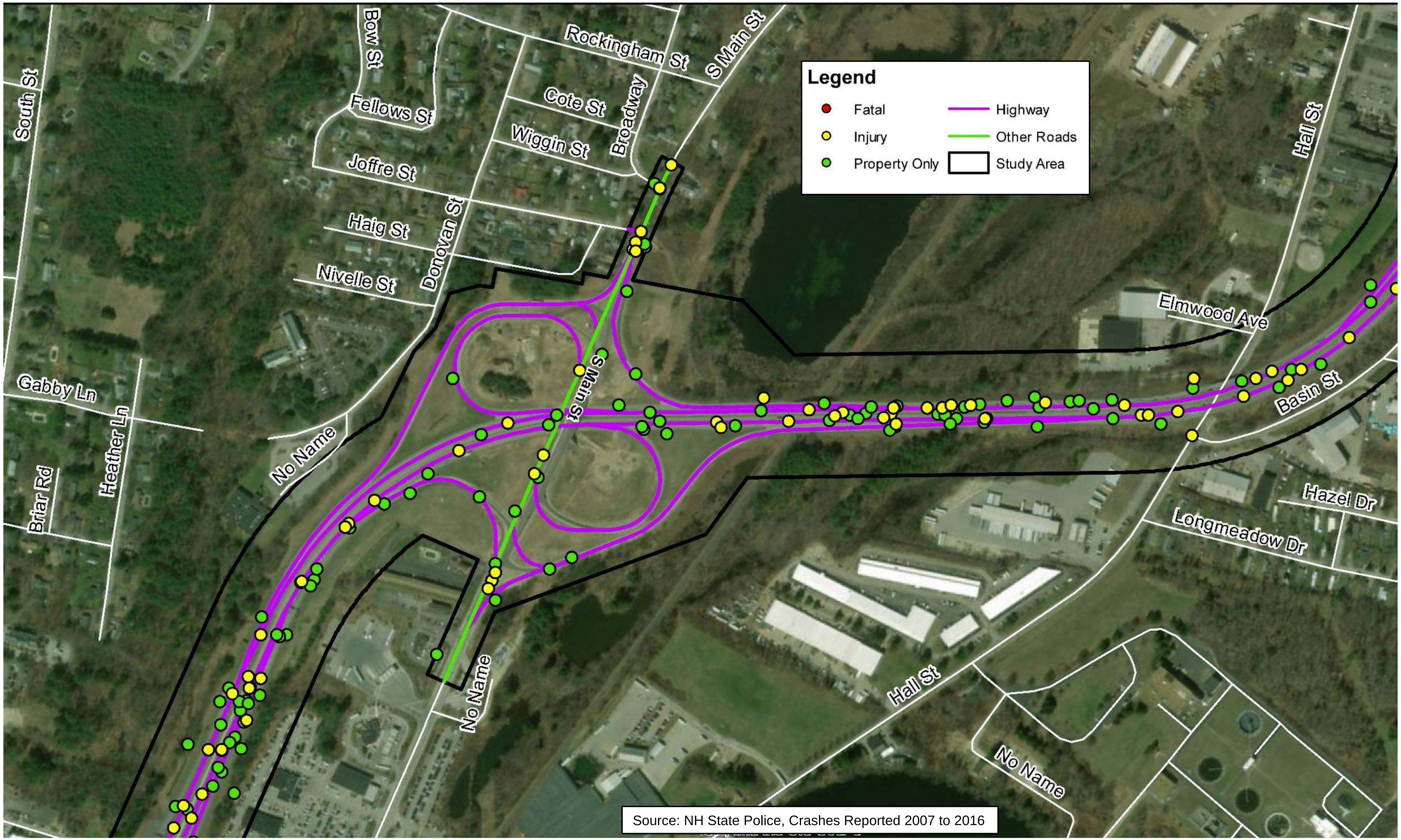
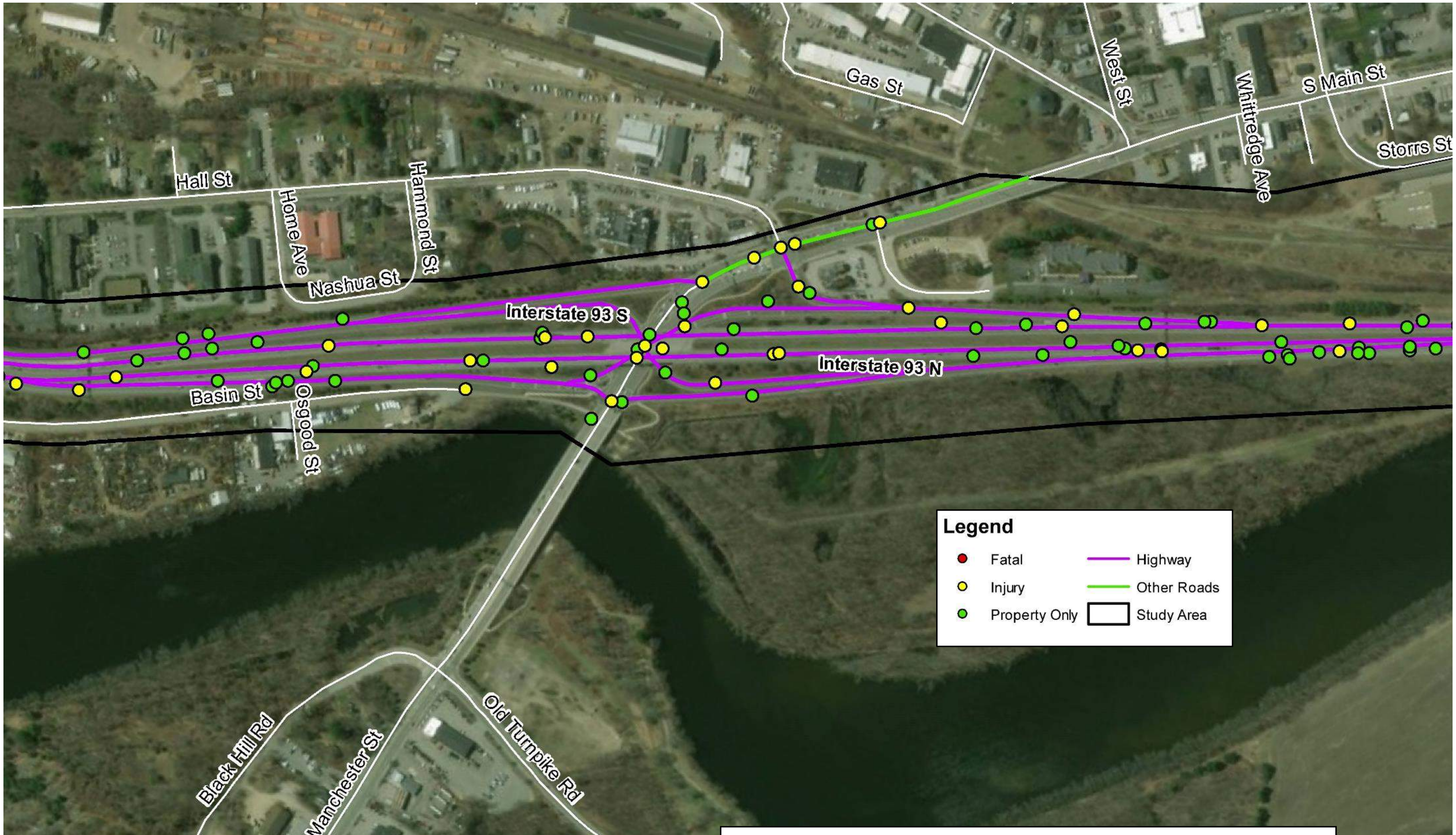
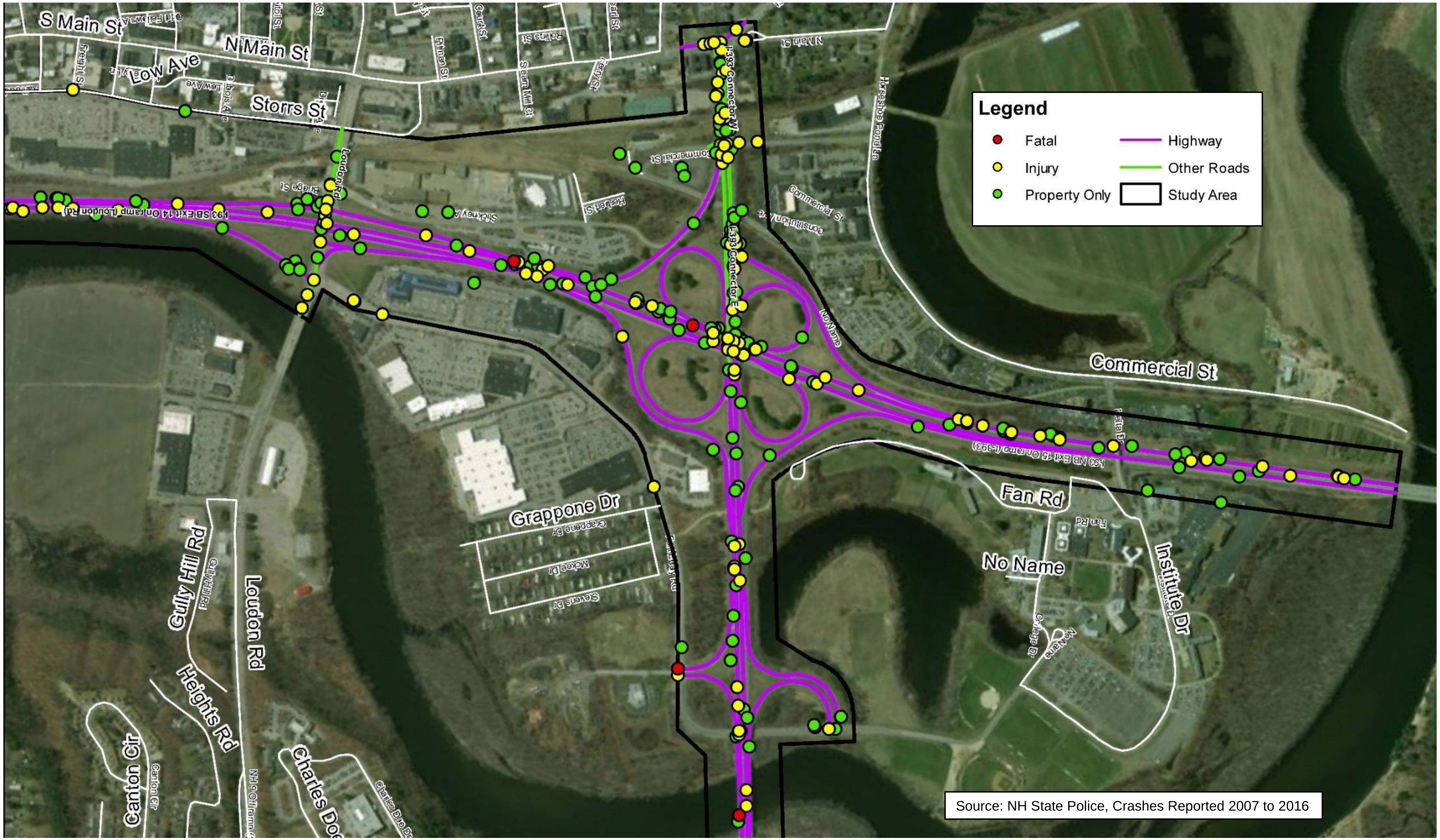


Figure 1.5 Crash History for the Exit 13 Area (2007 to 2016)



Source: NH State Police, Crashes Reported 2007 to 2016

Figure 1.6 Crash History for the Exit 14/15 Area (2007 to 2016)



Chapter 2
Alternatives Screened and Evaluated

2.1 Introduction

To address the capacity and operational issues within the study limits as stated in the Project Purpose and Need (see Section 1.7), the NHDOT has evaluated various roadway widening and interchange improvements along the 4.5-mile segment of I-93 in Bow and Concord. The development of potential solutions for the corridor occurred in two parts. Part A was a planning study to identify potential solutions, screening of these solutions using a qualitative set of criteria, and determining a range of reasonable solutions. Part B is preliminary engineering and environmental documentation that began with the range of reasonable solutions from Part A, developed build alternatives that meet the purpose and need for the project, and the selection of a Preferred Alternative. In addition to the Build Alternatives developed during Part B, the No-Build (or No Action Alternative) has been included in the alternatives analysis. This chapter provides a summary of the alternative development process and detailed descriptions of those alternatives considered during Part B.

2.2 Part A Alternatives Summary

The alternatives developed in Part A were conceptual in nature as the goal of the study was to "identify all alternatives, concepts or options that could be considered for the corridor", per the *Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study* dated April 2008. These Part A alternatives included measures such as widening of the existing I-93, as well as bypasses, alternative routes, passenger rail, and local road improvements. Many of these alternatives were deemed unreasonable due to their cost, inability to address the purpose and need, associated property impacts, and/or significant environmental impacts.

Chapter 5 of the *Part A Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study* provides details of how each alternative and component was screened. The screening process included extensive public involvement and utilization of a local stakeholders group, the Planning Group. The Planning Group was convened by NHDOT and included representation from community, environmental and transportation groups.

Part A also included "components" that were concepts that, by themselves, did not address the project purpose and need, but when combined with other alternatives or concepts potentially addressed the purpose and need. Components included shifting I-93 to the east, placing I-93 in a tunnel, passenger rail, and relocation of a section of the Merrimack River. In some cases, a concept was both an alternative and a component. As with the alternatives, some components were deemed unreasonable due to their cost, inability to address the purpose and need, associated property impacts, and/or significant environmental impacts.

Each alternative or component was screened by the Planning Group using standard criteria to ensure the credibility of the screening. A colored circle scoring system was used with red indicating a negative score and green indicating a positive score. A yellow circle was used to indicate a neutral score. **Figure 2.1 Part A Screening Scoring System** presents the scoring system in more detail.

Figure 2.1: Part A Screening Scoring System

Part A Scoring System				
Fatal Flaw Impact Serious Degradation Unreasonable Strong Opposition	Negative Impact Degradation Opposition	Neutral Not Applicable No Impact	Benefit Improvement Enhancement Support	Substantial Benefit Substantial Improvement Reasonable Strong Support

The screening resulted in reasonable and required alternatives and reasonable components as follows. The first three of these four are alternatives that are required to be evaluated in Part B by the NEPA and FHWA processes.

<u>Reasonable and Required Alternatives</u>

- No Build
- Travel Demand Management (TDM) strategies
- Transportation System Management (TSM) strategies
- Opportunity Corridor Concept Option 1 (widen I-93 with interchange improvements)

<u>Reasonable Components</u>

- Transportation System Management (TSM) strategies
- Alternate land use
- I-93 Tunnel
- Rail Transit in I-93 Median
- Preservation of the rail corridor
- Safety improvements
- Enhanced pedestrian and bicycle facilities
- Travel Demand Management (TDM) strategies

Several of the components that were specifically identified during Part A that should be part of all build alternatives in Part B include:

- Preservation of the rail corridor
- Safety improvements
- Enhanced pedestrian and bicycle facilities
- Travel Demand Management (TDM) strategies

2.3 Part B Alternatives

This section details the range of alternatives considered during Part B, including the three alternatives identified in Part A as required by NEPA/FHWA that have been brought forward to the Part B evaluation process. The required alternatives include No Build, TDM and TSM.

2.3.1 No Build Alternative

The No Build Alternative serves as a benchmark for comparison to the build alternatives. The No Build assumes that no improvements are made to the I-93 corridor or its interchanges to address capacity and operational issues within the project area. However, other projects that have been programmed and approved for the project area and region have been included, such as the following:

- Langley Parkway
- Storrs Street north extension
- Storrs Street south extension
- Whitney Road Extension
- Manchester Street widening to 2 lanes in each direction
- I-89 Exit 2 Roundabouts
- McKee Square Roundabout

Traffic volumes for the corridor are assumed to increase based on projections prepared by the Central NH Regional Planning Commission (CNHRPC), which is the designated Metropolitan Planning Organization for the region. The increased traffic volumes will result in increased congestion, especially during peak periods. Crashes are likely to increase since the existing deficiencies will remain, with higher traffic volumes. Other aspects of the No Build include the continued deterioration of Red List and other bridges as well as the continued discharge of stormwater into area waterways without treatment.

2.3.2 Travel Demand Management

Travel Demand Management (TDM) strategies aim to reduce the demand for travel during peak travel periods such as the morning and afternoon commuting times, rather than increase the capacity of the transportation system. These strategies require changing travel behavior during peak travel periods to reduce the number of vehicles on the road.

By eliminating trips, shortening trips, or shifting trips out of the peak periods, there is less demand for the transportation network to accommodate. Typical TDM strategies include:

- Expanded Transit Service
- Park and Ride Facilities
- Work from Home
- Flexible Work Hours
- Toll Pricing
- Increased Law Enforcement
- High Occupancy Vehicle Lanes
- Car-Pooling

2.3.3 Transportation Systems Management

Transportation Systems Management (TSM) refers to low cost easy to implement measures to address safety and congestions issues. These measures typically can be implemented without significant impacts or cost. Typical TSM measures include:

- Intelligent Transportation Systems
- Ramp Metering
- New Traffic Signals
- Re-timing Traffic Signals
- Turn Lanes
- New Lane Striping
- Signage

2.3.4 Development of Part B Build Alternatives

The only conceptual build alternative that was carried forward from Part A is the Opportunity Corridor Concept Option 1 (OCCO1). As discussed in the Part A *Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study,* the base Opportunity Corridor Concept was developed in greater detail because it was part of another study conducted in 2005, the *2005 Concord Opportunity Corridor Master Plan*. The *2005 Concord Opportunity Corridor Master Plan* developed a concept that included widening of I-93 to six lanes and reconfiguring Exits 14 and 15. It also included other improvements to the road network that are not part of this project.

The OCCO1 did not propose improvements to other interchanges within the limits of the project. OCCO1 did specify that there is a need to reconfigure the other interchanges within this project limits, however, no specific configurations were developed. Part A included four other options of the Opportunity Corridor Concept, but all of those were deemed unreasonable by the Planning Group during the screening process due to cost, property impacts and/or elements outside the scope of the project.

For the purposes of Part B, the OCCO1 has been developed to include improvements to the other interchanges in the project area, in addition to widening of I-93 and reconfiguring Exits 14 and 15 reviewed in the 2005 Concord Opportunity Corridor Master Plan. The specific configurations for Exit 14 and Exit 15 proposed by OCCO1 have been considered, but Part B did not limit the improvements of Exits 14 and 15 to those proposed in the OCCO1.

As discussed above in Section 2.2, there were four components identified in Part A that the Planning Group specifically recommended should be part of all build alternatives. Below is a discussion of how each of these components was incorporated into the Part B build alternatives.

- Preservation of the rail corridor: All build alternatives discussed later in this chapter preserve the existing rail corridor and accommodate for future passenger rail service as proposed in the Capitol Corridor Rail and Transit Alternatives Analysis.

- Safety improvements: The build alternatives have specifically addressed the deficiencies outlined in Sections 1.5 and 1.6 of the EA, including both the roadway geometry issues and the Red List Bridges. Six bridges within the project limits that are currently on the Red List would be addressed by all of the considered build alternatives.

- Enhanced pedestrian and bicycle facilities: Within the project limits the build alternatives include expanded sidewalks and bicycle lanes on all local roads. In particular, in all of the build alternatives Loudon Road would be improved to include sidewalks and bicycle lanes on both sides of the road, which would facilitate non-motorized access from Downtown Concord to Fort Eddy Road and The Heights District, a significant concern for residents of Downtown Concord.

- Travel Demand Management (TDM) strategies: The build alternatives preserve and in some cases expand Park and Ride capacities within the project limits.

2.3.5 Interstate 93 Widening

As stated in the Project Purpose and Need statement (Chapter 1, Section 1.7), “increased congestion and increased travel times are expected” along I-93 if traffic volumes increase. The traffic projections developed for the project indicate that traffic volumes would increase and by the 2035 design year, I-93 through Bow and Downtown Concord would require six traffic lanes, three in each direction, to accommodate this future traffic demand. See discussion below regarding auxiliary lanes, which are warranted and proposed between the interchanges. The traffic demand modeled for 2035 design year does not justify an eight-lane interstate, four lanes in each direction. Therefore, all the build alternatives developed for the project include the widening of I-93 to a basic six-lane interstate from south of I-89 through Exit 15. **Table 2.1 I-93 Traffic Volumes** outlines the peak hour traffic, both AM and PM, for the various segments of I-93 within the project limits for the base year 2014 and projected demand for 2035.

Table 2.1: I-93 Traffic Volumes

	Peak Hour Volumes (Vehicles per Hour)					
	Existing 2014[1]		Projected 2035[2]		Percent Change	
	AM	PM	AM	PM	AM	PM
Between I-89 and Exit 12						
Northbound	3,452	3,458	4,039	4,352	+17.0%	+25.9%
Southbound	2,617	3,625	3,267	4,192	+24.8%	+15.6%
Between Exit 12 & 13						
Northbound	3,430	3,807	4,045	4,747	+17.9%	+24.7%
Southbound	2,854	3,657	3,633	4,238	+27.3%	+15.9%
Between Exit 13 & 14						
Northbound	3,005	3,836	3,398	4,697	+13.1%	+22.4%
Southbound	3,246	3,128	4,077	3,968	+25.6%	+26.9%
Between Exit 14 & 15						
Northbound	2,035	3,351	2,265	4,104	+11.3%	+22.5%
Southbound	3,567	2,723	4,714	3,265	+32.2%	+19.9%

[1] The existing volumes are based on actual counts in 2014.
[2] The projected volumes are demand volumes from the Central NH Regional Model developed by RSG in 2015. The projected volumes represent true demand and not just the volume that can be accommodated by the existing roadway system.

Much of the proposed widening of I-93 is symmetric, meaning the centerline of the corridor is retained and the widening occurs equally on both sides. This balances the impacts and allows the widening to be completed within the existing right-of-way, in most cases. Retaining walls are proposed to avoid additional impacts to environmental and cultural resources and to reduce impacts outside of the I-93 right-of-way limits. The one exception to the centerline widening is near Exits 14 and 15 where shifts of I-93 are considered. These shifts are discussed later in this chapter.

The widening of I-93 and the reconstruction of the ramps at the interchanges also requires an evaluation of the need for auxiliary lanes on the mainline between successive ramps. As specified in AASHTO, the two main criteria used to evaluate the need for auxiliary lanes were the operation of the ramp merges and diverges and the spacing between successive entrance and exit ramps. As a result of this evaluation, it was determined that auxiliary lanes are warranted between interchanges for all segments of I-93, both northbound and southbound.

Between I-89 and Exit 12 and between Exits 13 and 14, the distance between the entrance ramps and subsequent exit ramps is less than the minimum 2,000 feet distance recommended by ASSHTO. Therefore, auxiliary lanes are proposed to address this deficiency.

Between Exits 12 and 13 the volume of traffic, and the amount of traffic entering and exiting I-93 with the concurrent merging and weaving of traffic, creates congestion that results in poor operations. The operations of these merges and diverges is measured by its Level of Service (LOS). LOS is the measure of density and speed that occurs at the merges and diverges. For the purposes of the project, a peak period LOS of A through D is considered acceptable. An LOS E or F is considered unacceptable. The auxiliary lanes improve the operations to the acceptable levels. **Table 2.2 LOS Criteria for Freeway Segments** outlines the various LOS grades and descriptions for basic, weave, merge, and diverge segments. Auxiliary lanes are proposed to provide an acceptable LOS between Exits 12 and 13 in both directions.

Table 2.2: LOS Criteria for Freeway Segments

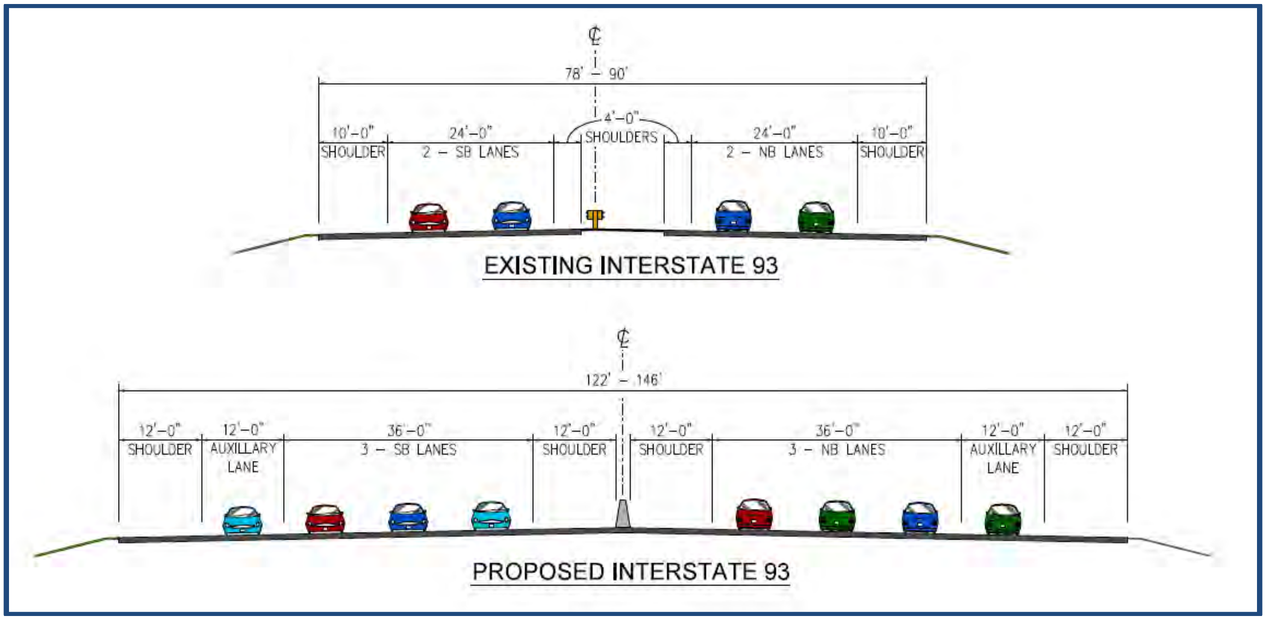
LOS	Characteristics	Density (Passenger cars per mile per lane)		
		Basic	Weaving	Merge/Diverge
A	Free-flow operations	≤ 11	0-10	≤ 10
B	Reasonably free-flow	> 11-18	> 10-20	> 10-20
C	Speeds near free-flow	> 18-26	> 20-28	> 20-28
D	Speeds decline	> 26-35	> 28-35	> 28-35
E	Operation at capacity	> 35-45	> 35-43	> 35
F	Breakdown/Unstable flow	Demand Exceeds Capacity OR Density > 45	> 43, OR Demand Exceeds Capacity	Demand Exceeds Capacity

Source: Highway Capacity Manual, 6th Edition

Between Exits 14 and 15 the distance between the entrance ramps and subsequent exit ramps is less than the minimum 2,000 feet distance recommended by AASHTO. However, the particular concept addresses this deficiency with different strategies, including auxiliary lanes, collector-distributor roads, or the elimination of ramps.

The widening would also accommodate standard 12-foot inside and outside shoulders throughout the 4.5-mile corridor. **Figure 2.2 I-93 Typical Sections** depicts the existing and proposed typical sections for I-93.

Figure 2.2: I-93 Typical Sections



Within the project area there are seven full access interchanges that would be impacted by the widening of I-93. Each of these interchanges have their own issues and deficiencies that this project must address as simply widening I-93 does not fully meet the project purpose and need. Some of these interchanges are in close proximity to each other and must be evaluated together due to their interaction. Therefore, for the purposes of alternatives development, the project area has been separated into four segments. The four segments are geographic and are referred to as follows:

- I-89 Area (Includes Exit 1 on I-89)
- Exit 12 Area
- Exit 13 Area
- Exit 14/15 Area (Includes Exit 1 on I-393)

Figure 2.3 I-93 Segments depicts the four project segments and improvement projects completed by NHDOT in 2002, 2010, 2015 and 2016.

The development of concepts for each of the four segments was completed in a multi-phased manner. The design team gathered information on each segment from previous studies, NHDOT generated concepts, or concepts previously developed. Once a concept was envisioned, the design team developed horizontal geometry to determine whether a concept was feasible and met the purpose and need. In many cases the concept was determined not to be feasible and it was discarded. At the end of this phase each segment had numerous concepts for consideration. These concepts were presented to the NHDOT for review and those that addressed the purpose and need to the fullest extent were retained for further investigation and development. In many cases two concepts were very similar and the better of the two was selected for further consideration. This is why the naming of concepts does not include all letters or numbers sequentially. **Table 2.3 Build Concepts for each Segment** lists the build concepts developed for each segment and the following sections contain detailed descriptions of the concepts that have been carried forward for detailed evaluation in this document.

Table 2.3 Build Concepts for each Segment

SEGMENT	CONCEPT	DESCRIPTION
I-89 Area	C	Shifted I-89 Exit 1.
	K	Eliminate weaving between I-89 Exit 1 and I-93.
	P	Same as Concept K with all directional ramps between I-89 and I-93.
Exit 12 Area	E	Partial cloverleaf with signalized intersections.
	F	Partial cloverleaf with hybrid roundabout intersections.
Exit 13 Area	A	Retain Exit 13 with new signal for northbound exit ramp.
	B	Retain Exit 13 with new signal and dual right turn for northbound exit ramp.
Exit 14/15 Area	D2	Retain Exit 14 and 15 configurations except eliminate northbound entrance ramp at Exit 14.
	F	SPUI[1] at Exit 14 and cloverstack at Exit 15 with C-D[2] Roads between Exits 14 & 15.
	F2	Retain Exit 14 configuration except eliminate northbound entrance ramp and cloverstack at Exit 15.
	O3	Flip Exit 14 orientation, depress I-93, directional ramps at Exit 15, C-D Road southbound between Exits 14 & 15.

[1] Single Point Urban Interchange
[2] Collector-Distributor Road

For each concept a total concept cost estimate has been developed based upon the preliminary design. For each of the project segments the cost estimates include the work on I-93, I-89 and/or I-393 as well as the work associated with the interchanges. The cost estimate includes the cost of construction, construction engineering, design engineering, right-of-way acquisition, mitigation, and utility relocation.

2.3.6 Interstate 89 Area

The I-89 Area covers the I-93/I-89 interchange area consisting of approximately 3,700 feet of I-93 beginning where the six-lane section extending from Manchester terminates just south of I-89 and continues north to a point approximately half way between the I-93/I-89 interchange and Exit 12 (Route 3A). There is a third southbound lane that originates at the Exit 12 on ramp and continues south through the I-93/I-89 interchange, which was constructed as part of a recent bridge replacement project. It also covers approximately 4,700 feet of I-89 from I-93 north to beyond Exit 1. I-89 begins at the I-93/I-89 interchange with the I-89 extending for an additional 1,000 feet from the ramps connecting with Route 3A and Hall Street, known as Bow Junction, which is also included within the project area. The intersection of I-89, Route 3A and Hall Street is known as Bow Junction to the travelling public. See **Figure 2.4 I-89 Existing Conditions** for the existing conditions of the I-89 Area.

A main element of this area is the I-93/I-89 Interchange, which is a critical junction in Central New Hampshire. It is a modified trumpet interchange where I-89 ends at I-93 and is a system interchange linking two freeways. There are direct and loop ramps connecting the two Interstate routes. Exit 1 on I-89 is located only ¼ mile from the I-93/I-89 Interchange. Exit 1 on I-89 is a partial cloverleaf interchange with all ramps located on the west side of South Street in order to provide the maximum separation between the ramps and the I-93/I-89 Interchange. Exit 1 is the only interstate full access interchange that provides direct access to the Town of Bow.

The close proximity of the two interchanges results in a short weaving section for both northbound and southbound I-89 traffic between the two interchanges. AASHTO describes weaving as “highway segments where the pattern of traffic entering and leaving at contiguous points of access results in vehicle paths crossing each other”. In particular, the southbound weave that involves traffic entering from Exit 1 and I-89 traffic exiting to southbound I-93 has long been a concern for those traveling in Bow. The distance between the entrance and exit ramps is approximately 440 feet, which is less than the AASHTO recommended 2,000 feet. This weave is made worse by the excessive speeds that are driven by traffic on southbound I-89. The grade of I-89 in the area is about 3% downhill and keeping traffic at or below the 40-mph speed limit has been unsuccessful. Reduced speed warning signs were installed several years ago but speeds continue to be well above the speed limit. The limited sight distance for those entering at Exit 1 contributes to the poor operations as this entering traffic is traveling at speeds much lower than the traffic it is weaving with I-89.

This weave currently operates at a level of service (LOS) E/D (AM Peak Period/PM Peak Period) that projects to LOS F/E by 2035. As stated above, for the purposes of the project, a peak period LOS of A through D is considered acceptable. An LOS E or F is considered unacceptable. For the southbound I-89 weave between Exit 1 and I-93, this unacceptable LOS exists even while input received at public meetings over many years has indicated that some residents of Bow avoid using Exit 1 because they feel the interchange is not safe.

The northbound I-89 weave between I-93 and Exit 1 currently has an LOS B/E that by 2035 is projected to be LOS F/E. There is a substantial increase in morning peak hour traffic on the southbound I-93 to northbound I-89 ramp that results in the dramatic reduction in LOS between 2014 and 2035. The distance between the entrance and exit ramps is approximately 500 feet, which is less than the AASHTO recommended 2,000 feet. Speed is not as critical an issue for this weave as traffic is starting from a stopped condition at the Route 3A/hall Street intersection.

There is also a short weave within the I-93/I-89 Interchange between the two loop ramps. A collector-distributor (C-D) Road connects the northbound I-93 ramp to I-89 northbound, as well as the southbound I-89 ramp to I-93 northbound. This weave currently has an LOS E/E that projects to LOS F/F by 2035. The distance between the entrance and exit ramps is approximately 400 feet, which is less than the recommended 1,600 feet for this location by AASHTO. AASHTO standards allow a shorter weave distance on C-D Roads than on highway mainlines. These ramps have high volumes of traffic as they accommodate traffic moving between the two interstates.

There is one Red List bridge within the I-89 Area; the bridge that carries I-89 over South Street (Bridge #132/160). The deck and superstructure of this bridge are rated in poor condition. The bridges that carry I-93 over I-89 were recently replaced with the ability to accommodate a six-lane interstate.

There are bicycle routes located in the I-89 Area that include one designated state bicycle path, the I-89 Bicycle Path in Bow. The I-89 Bicycle Path begins at the end of Valley Road where it heads northeast through the I-93/I-89 interchange. The path includes two tunnels under interchange ramps. The path ends at the Route 3A/Hall Street intersection. The remaining bicycle routes follow existing local roads.

2.3.6.1 – Interstate 89 Area Concept C

The first alternative under consideration for the I-89 Area is Concept C – Shifted Exit 1. Concept C proposes shifting Exit 1 further to the west to lengthen the weave between Exit 1 and the I-93 ramps to approximately 1,000 feet, which is less than the 2,000 feet recommended by AASHTO. Providing a longer weaving length does improve the operations of both the northbound and southbound weaves. The southbound weave would improve from LOS F/E to LOS D/C in 2035. The northbound weave would improve from LOS F/E to LOS B/B in 2035. Concept C does not address the weave for the northbound C-D Road within the I-93/I-89 Interchange. This concept replaces the I-89 Bridge over South Street, which is on the Red List. See **Figure 2.5 I-89 Area Concept C** for a plan.

There are four structures within the I-89/Exit 1 Area that do not need to be modified to accommodate Concept C, but which would have routine preservation work conducted by the project. Routine preservation planned for this alternative includes, but is not limited to, new pavement, new joints and protective membrane for bridges and concrete repairs for the culvert. The structures are:

- South Street bridge over the Turkey River
- I-93 southbound to I-89 northbound Ramp bridge over the Turkey River
- I-93 northbound C-D Road bridge over I-89 and the Turkey River
- I-89 over the Turkey River (box culvert)

The Bicycle Path in the I-89 Area would not be affected by Concept C.

The total cost for Concept C is estimated at $34.1 million.

2.3.6.2 – Interstate 89 Area Concept K

Concept K retains the basic configuration of both interchanges; however, it proposes “braided” ramps between the two interchanges. The term “braid” refers to a grade separated crossing that occurs at an acute angle that resembles braids. The braided ramps eliminate the weaving section between the two interchanges. Additional ramps are proposed to allow retention of all of the existing accesses, but without the need for vehicles to cross each other in a weave. See **Figure 2.6 I-89 Area Concept K** for a plan.

Concept K proposes a C-D Road for southbound I-89 traffic that would accommodate traffic utilizing Exit 1 and travelling southbound on I-93. The Exit 1 ramp would diverge from the C-D Road, which would continue and cross over the Exit 1 entrance ramp via a bridge. The Exit 1 entrance ramps would later split to accommodate traffic destined for northbound I-93, along I-89 south to the existing loop ramp area, and southbound I-93. Concept K proposes a local connector road between Route 3A and South Street to accommodate northbound I-89 traffic. This connector road would provide access to South Street from Bow Junction. The southbound exit ramp from I-93 to northbound I-89 would cross, or braid, the connector road, thereby eliminating the existing northbound weave. A signal would be necessary at the intersection of South Street, the new connector road, and the I-89 northbound ramps. All improvements proposed by Concept K would be accommodated by the new bridges that carry I-93 over I-89 and the Turkey River as well as the existing bridge that carries the C-D Road over I-89 and the Turkey River. New bridges would be needed to realize the braided ramps for both I-89 segments between I-93 and Exit 1.

Concept K would include construction of a new directional ramp for northbound I-93 to northbound I-89 traffic. The new directional ramp proposed in Concept K would have a 40-mph design speed as compared to the existing loop ramp that has a 25-mph design speed. While the existing northbound C-D Road would remain, a significant portion of the traffic volume in the weave would be diverted since the northbound I-93 to northbound I-89 traffic would use the new directional ramp. The reduced traffic would result in an improvement of the weave from LOS F/F to LOS D/B by 2035. The existing loop would be reconfigured to terminate at the new connector road, which would provide an access route to Bow Junction from I-93 that currently does not exist. This connection also perpetuates the connection for northbound I-93 traffic to access South Street.

Providing the new directional ramp for northbound I-93 to northbound I-89 traffic would result in the elimination of the direct connection of the I-89 extension to Bow Junction. This traffic could still access Bow Junction, but would have a longer route to do so, using Exit 1 on I-89, Exit 12 on I-93, or the proposed I-93/I-89 interchange. This diversion of traffic is of concern, including for local businesses, as Route 3A is a truck route and many trucks use the Bow Junction intersection to access I-89. The additional traffic on South Street and Logging Hill Road would require that both Exit 1 ramp intersections be signalized. Improvements to Logging Hill Road would also be included to provide adequate sight distance near the southbound ramps intersection.

There are two structures within the I-89/Exit 1 Area that do not need to be modified to accommodate Concept K, but which would have routine preservation work conducted by the project. Routine preservation includes, but is not limited to, new pavement, new joints and protective membrane for bridges and concrete repairs for the culvert. The structures are:

- I-93 northbound C-D Road bridge over I-89 and the Turkey River
- I-89 over the Turkey River (box culvert)

Retaining walls would be required along several of the ramps to minimize property impacts and impacts to the Turkey River. These walls would be between 6 feet and 25 feet in height and would be adjacent to homes and businesses.

The existing I-89 Bicycle Path would be abandoned and replaced with accommodation on the new connector road proposed in Concept K.

The total cost for Concept K is estimated at $70.0 million.

2.3.6.3 – Interstate 89 Concept P

Concept P is identical to Concept K except that it proposes new 50 mph directional ramps to replace both loop ramps at the I-93/I-89 Interchange. The northbound I-93 to northbound I-89 directional ramp proposed in Concept K would have a 40-mph design speed. All of the results discussed above in Concept K concerning Exit 1 and the weaving between Exit 1 and I-93 would be the same for Concept P. The proposed southbound I-89 to northbound I-93 directional ramp would be a third level flyover bridge. See **Figure 2.7 I-89 Area Concept P** for a plan.

The new directional ramps at the I-93/I-89 Interchange eliminate the need for the existing C-D Road and eliminate the weave within the interchange. Concept P also proposes a ramp off the northbound I-93 to northbound I-89 ramp to the new connector road. This provides access to Bow Junction from I-93 that currently does not exist. The area once utilized for the northbound I-93 to northbound I-89 loop ramp could be used as a Park and Ride lot as shown in the plan for Concept P, **Figure 2.7**.

Retaining walls would be required along several of the ramps to minimize impacts to properties and impacts to the Turkey River. These walls would be between 6 feet and 25 feet in height and would be adjacent to homes and businesses. The proposed flyover ramp for Concept P would require a 40-foot high retaining wall along I-89 to allow the flyover ramp to rise adjacent to I-89. A retaining wall would also be required along I-93 northbound to minimize impacts to properties and impacts to Bow Brook.

The existing I-89 Bicycle Path would be abandoned and replaced with accommodation on the new connector road proposed in Concept P.

The total cost for Concept P is estimated at $92.8 million.

2.3.6.4 – Interstate 89 Area Summary

Table 2.4 I-89 Area Comparison Matrix below provides a comparison of the three concepts considered for the I-89 Area.

Table 2.4: I-89 Area Comparison Matrix

CONSIDERATIONS/ RESOURCES	CONCEPT C	CONCEPT K	CONCEPT P
Exit 1 To I-93 Weaves	Improved	Eliminated	Eliminated
I-93 northbound to I-89 northbound Weave	No Change	Improved	Eliminated
I-89 / Route 3A Access	No Change	Via Exit 1 or Via I-93 Exit 12	Via Exit 1 or Via I-93 Exit 12
Property Impacts	• Cilley State Forest • 4 full parcel acquisitions • 9 partial parcel acquisitions	• Cilley State Forest • Bow Mobil and 5 full parcel acquisitions • 14 partial parcel acquisitions	• Cilley State Forest • Bow Mobil and 5 full parcel acquisitions • 16 partial parcel acquisitions
Red List Bridges	1	1	1
Existing Bridges Retained	7	4	2
Existing Bridges Replaced/ Rehabilitated/Widened	0	3	4
New Bridges	0	4	5
Estimated Project Cost	$34.1 M	$70.0 M	$92.8 M
Wetland Impacts	0.6 Acres	0.7 Acres	1.8 Acres
Conservation Land Impacts	9.7 Acres of Cilley State Forest	0.7 Acres of Cilley State Forest	0.7 Acres of Cilley State Forest
Wildlife Considerations	• State-listed species and Species of Concern • Essential Fish Habitat	• State-listed species and Species of Concern • Essential Fish Habitat	• State-listed species and Species of Concern • Essential Fish Habitat
Potentially Contaminated Parcels Impacted	1	2	2
Historic Property Impacts	No Historic Properties Effected	2 Historic Properties Effected	2 Historic Properties Effected

2.3.7 Exit 12 Area

The Exit 12 Area covers approximately 4,000 feet of I-93 beginning from a point half way between I-93/I-89 Interchange and Exit 12 (Route 3A) to a point half way between Route 3A and Exit 13 (Route 3 - Manchester Street). The area includes Exit 12, which provides access to Route 3A. Exit 12 is a partial clover-leaf interchange with dual exit ramps for both northbound and southbound exiting traffic. The bridge carrying Route 3A over I-93 was replaced in 2016 as a single-span bridge and can accommodate up to eight lanes of traffic on I-93. The bridge was constructed with three Route 3A lanes to accommodate the existing configuration, which includes a center turn lane. See **Figure 2.8 Exit 12 Area Existing Conditions** for the existing conditions of the Exit 12 Area.

Three of the exit ramps at Exit 12 have deficient deceleration distances as vehicles exit I-93 and approach the first horizontal curve of the ramps. Both of the southbound exit ramps and the northbound exit ramp to northbound Route 3A have deficient deceleration distances.

The intersections of the Exit 12 ramps with Route 3A are currently operating at acceptable levels. The traffic analysis indicates that they will continue to operate at acceptable levels in 2035 because the dual exit ramps provide a high level of access from I-93 to Route 3A. However, the deficient deceleration that exists because of the dual exit ramps requires this configuration to be revised.

There are no Red List bridges within the Exit 12 Area. The existing I-93 bridge over the Pan Am Railroad would need to be widened for both of the concepts considered.

A 5-foot sidewalk, ending at Broadway, is provided along the west side of Route 3A within the project limits. There are no dedicated bicycle lanes provided along Route 3A, however, 5-foot shoulders were provided on the bridge that can accommodate bicycles.

2.3.7.1 Exit 12 Concept E

The first alternative under consideration for the Exit 12 Area is Concept E, which proposes to retain the partial cloverleaf configuration, but would eliminate one exit ramp in each direction. Limiting each direction to one exit ramp allows standard exit ramp geometry and proper deceleration distance. The partial cloverleaf configuration was chosen for this concept over a standard diamond as the exit ramps for the diamond would require greater property and environmental impacts

All exiting traffic would terminate at Route 3A at an intersection compared to the existing exit ramps that merge with Route 3A. Intersection control would be required in order to provide acceptable levels of service because all exiting I-93 traffic would access Route 3A via an intersection. Concept E proposes two signalized intersections to accommodate northbound and southbound I-93 traffic. The LOS at the southbound intersection would be LOS B/B and the northbound intersection would be to LOS C/C by 2035. See **Figure 2.9 Exit 12 Area Concept E** for a plan.

The two intersections would be only about 1,000 feet apart, which restricts the amount of vehicle storage that can be provided for those vehicles turning left to access I-93…. Also, exiting traffic from northbound I-93 to southbound Route 3A and southbound I-93 to northbound Route 3A would be required to make a left turn to access Route 3A rather than a right merge, as all traffic does presently. The stop condition would result in queuing occurring on Route 3A for these approaches.

Retaining walls would be required along southbound I-93 near the South End Marsh to avoid impacts to the City of Concord's sewer main and wetlands. Retaining walls would be required along the northbound entrance ramp to avoid impacts to the railroad, wetlands, and an existing wetland mitigation site.

The sidewalk along the west side of Route 3A would be retained by Concept E. Also, shoulder/bike lanes would be provided in both directions of Route 3A within the project limits.

The total cost for Concept E is estimated at $36.2 million.

2.3.7.2 Exit 12 Concept F

The other alternative for the Exit 12 Area is Concept F – Roundabout Intersections. Concept F has the similar configuration as Concept E, a partial cloverleaf with single exit and entrance ramps. However, the two ramp intersections are proposed as hybrid roundabouts. A hybrid roundabout is one that has some two-lane movements and some one-lane movements. In the case of Concept F, the southbound Route 3A traffic would have two lanes and the northbound traffic would have one lane. The northbound ramp intersection roundabout would also include a slip ramp for northbound Route 3A traffic entering northbound I-93. See **Figure 2.10 Exit 12 Area Concept F** for a plan.

The LOS at the southbound intersection roundabout would improve to LOS A/C and the northbound intersection roundabout would improve to LOS B/B by 2035.

The retaining walls mentioned above for Concept E would all be required for Concept F.

The sidewalk along the west side of Route 3A would be retained by Concept F. Also, shoulder/bike lanes would be provided in both directions of Route 3A within the project limits.

The total cost for Concept F is estimated at $33.9 million.

2.3.7.3 Exit 12 Summary

Table 2.5 Exit 12 Area Comparison Matrix below provides a comparison of the two concepts considered for the Exit 12 Area.

Table 2.5: Exit 12 Area Comparison Matrix

CONSIDERATION	CONCEPT E	CONCEPT F
Northbound Ramps Intersection LOS (AM/PM)	LOS B/B with Queuing	LOS B/B with Little Queuing
Southbound Ramps Intersection LOS (AM/PM)	LOS B/B with Queuing	LOS B/B with Little Queuing
Property Impacts	• 4 full parcel acquisitions • 2 partial parcel acquisitions	• 6 partial parcel acquisitions
Red List Bridges	0	0
Existing Bridges Retained	1	1
Existing Bridges Replaced/Rehabilitated/Widened	2	2
New Bridges	0	0
Estimated Project Cost	$36.2 M	$33.9 M
Wetland Impacts	0.29 Acres	029 Acres
Conservation Land Impacts	0.0 Acres	0.0 Acres
Wildlife Considerations	State-listed species and Species of Concern	State-listed species and Species of Concern
Potentially Contaminated Parcels Impacted	0	0
Historic Property Impacts	No Historic Properties Effected	No Historic Properties Effected

2.3.8 Exit 13 Area

The Exit 13 Area covers approximately 6,900 feet of I-93 beginning from a point half way between Route 3A and Route 3 (Manchester Street) and a point half way between Route 3 (Manchester Street) and Route 9 (Loudon Road). The area also includes Exit 13, which provides access to Route 3 (Manchester Street and Water/South Main Street) and the State Capitol Building. Exit 13 is a diamond configuration with a single point urban interchange (SPUI). The Pan Am rail corridor parallels the west side of I-93 north of Exit

13. See **Figure 2.11 Exit 13 Area Existing Conditions** for the existing conditions of the Exit 13 Area.

Exit 13 was reconstructed in 2002 with the SPUI and a new bridge that accommodates up to six lanes on I-93. The intersection and ramps were also designed so that they would not be impacted when the widening of I-93 occurred. However, the ramp entrances and exits would have to be reconstructed to accommodate the widening and addition of auxiliary lanes. Therefore, the majority of the improvements associated with the Exit 13 Area would be widening of I-93 within the existing median.

One deficiency identified for Exit 13 concerns the northbound exit ramp. During AM peak periods, traffic backs up daily onto I-93 from the intersection of Manchester Street (Route 3). The cause of the backup is the high volume of traffic that makes a right turn onto Manchester Street. This movement is controlled by a stop sign and additionally the limited sight distance requires each turning vehicle to wait to make the turn.

The City of Concord is planning a project to improve the Manchester Street/Old Turnpike Road intersection, which is about 1,100 feet south of the SPUI. The City is proposing to widen the intersection to provide dual left turn and dual right turn movements between Manchester Street and Old Turnpike Road to accommodate the high volume of commuter traffic traveling between Exit 13 and Old Turnpike Road (shown in red on **Figure 2.12**).

There is one Red List bridge within the Exit 13 Area; it is the bridge that carries southbound I-93 over Hall Street (Bridge #201/096). The substructure of this bridge is rated in poor condition. This bridge also has a deficient vertical clearance (13'-6") over Hall Street. A truck hit and damaged a beam in 2008. This bridge would be replaced for all of the build concepts and the new bridge would be built with adequate vertical clearance (15'-0") provided.

The bridge that carries I-93 over US Route 3 at Exit 13 does not need to be modified to accommodate any of the concepts, but would have routine preservation work conducted by the project. Routine preservation includes, but is not limited to, new pavement, new joints, and a new protective membrane.

Sidewalks exist along both sides of Route 3 within the project limits. There are shoulders on both sides of Route 3 that are wide enough to accommodate bicycles. These would be retained by both build alternatives.

2.3.8.1 Exit 13 Area Concept A

The first alternative under consideration for the Exit 13 Area is Concept A – Signalized Northbound Right Turn. Concept A proposes retaining the existing configuration of Exit 13 with one exception, signalizing the northbound exit ramp right turn onto Manchester Street. By signalizing this movement the queue of vehicles that currently backs onto I-93 can be reduced and it would only back up about half way along the ramp in 2014.

However, by 2035 the anticipated increased volume of traffic would cause the backup to extend onto I-93. See **Figure 2.12 Exit 13 Area Concept A** for a plan.

The total cost for Concept A is estimated at $33.6 million. Most of the cost for the Exit 13 Area Concept A is for the widening of I-93.

2.3.8.2 Exit 13 Area Concept B

The other concept for the Exit 13 Area is Concept B - Widened Northbound Right Turn. Concept B proposes retaining the existing configuration of Exit 13 with widening the northbound exit ramp to Manchester Street. and the right turn would also be signalized as discussed for Concept A. The widening of the ramp would allow for a dual right turn onto Manchester Street to address the heavy volume of traffic. The backup issue on the ramp would be eliminated. See **Figure 2.13 Exit 13 Area Concept B** for a plan.

The widening of the ramp requires an approximately 160-foot bridge from the shore connecting to the existing bridge that carries Manchester Street over the Merrimack River. Property acquisition is also required. The existing bridge is capable of accommodating the proposed ramp bridge. Retaining walls would also be required to avoid impacts to the river.

The total cost for Concept B is estimated at $39.0 million. Most of the cost for the Exit 13 Area Concept B is for the widening of I-93.

2.3.8.3 Exit 13 Area Summary

Table 2.6 Exit 13 Area Comparison Matrix below provides a comparison of the two concepts under consideration for the Exit 13 Area.

Table 2.6: Exit 13 Area Comparison Matrix

CONSIDERATION	CONCEPT A	CONCEPT B
Queuing on the northbound Exit Ramp	Onto I-93 by 2035	No queuing onto I-93 by 2035
Property Impacts	• 3 full parcel acquisitions • 1 partial parcel acquisition	• 4 full parcel acquisitions • 1 partial parcel acquisition
Red List Bridges	1	1
Existing Bridges Retained	1	1
Existing Bridges Replaced/Rehabilitated/Widened	1	1
New Bridges	0	1
Estimated Project Cost	$33.6 M	$39.0 M
Wetland Impacts	0.0 Acres	0.0 Acres
Conservation Land Impacts	0.0 Acres	0.0 Acres
Wildlife Considerations	• State-listed species and Species of Concern • Essential Fish Habitat	• State-listed species and Species of Concern • Essential Fish Habitat
Potentially Contaminated Parcels Impacted	1	1
Historic Property Impacts	No Historic Properties Effected	No Historic Properties Effected

2.3.9 Exit 14/15 Area

The Exit 14/15 Area covers approximately 10,000 feet of I-93 beginning from a point half way between Route 3 (Manchester Street) and Route 9 (Loudon Road) to just south of the bridge that carries I-93 over the Merrimack River. It also covers approximately 2,700 feet of I-393 from I-93 to just west of the bridge that carries I-393 over the Merrimack River. I-393 begins at I-93 but the project limits continue onto US Route 202 for an additional 2,000 feet to the North Main Street intersection. This last section of roadway is not considered I-393, but remains US Route 202. See **Figure 2.14a Exit 14/15 Area Existing Conditions** for the existing conditions of the Exit 14/15 Area. See **Figure 2.14b I-93 North Existing Conditions** for the existing conditions of the north portion of I-93. See **Figure 2.14c I-393 Exit 1 Existing Conditions** for the existing conditions of the I-393 portion of Exit 14/15 Area.

One particularly challenging area just south of Exit 14 is referred to as the “Pinch Point”. At this location the Merrimack River, I-93, a Unitil electrical -substation, the Pan Am rail corridor, historic resources, and a shopping plaza all converge at one location. The widening of I-93 and potential improvements to Exit 14 at the “Pinch Point” could impact one or more of these elements.

This segment includes three interchanges; Exit 14 and Exit 15 on I-93 and Exit 1 on I-393. These interchanges are in close proximity to one another and therefore cannot be evaluated independently. Exits 14 and 15 are only 2,800 feet apart and Exit 15 and Exit 1 are only 2,200 feet apart. AASHTO states a “general rule of thumb for minimum interchange spacing is 1 mile (5,280 feet) in urban areas and 2 miles in rural areas.” It also states that “in urban areas, spacing of less than 1 mile may be developed by grade separating ramps or by adding collector-distributor roads.”

Exit 14 provides access to Loudon Road (Route 9), which is one of the main access points to the State Capitol. It is currently a diamond interchange with the northbound ramps offset where they connect to Loudon Road (Route 9). The bridge that carries I-93 over Loudon Road was rehabilitated in 2010, however, it was not widened to accommodate widening of I-93 and it was not lengthened to accommodate widening of Loudon Road. This bridge would therefore have to be replaced.

The layout of Loudon Road within Exit 14 is comprised of up to seven narrow lanes with no shoulders. This configuration was implemented several years ago when a large retail store was opened along Fort Eddy Road in order to fit double left tune lanes to I-93 southbound under the existing I-93 bridge. The seven lane section narrows to the east to 5 lanes as Loudon Road crosses the Merrimack River. Within the project limits in the Exit 14 area, there are four signalized intersections along Loudon Road within 650 feet that cause significant queuing and delay during peak periods. In particular, the westbound approach to the Loudon Road/Fort Eddy Road/northbound Exit Ramp intersection is modeled to have a LOS F/F by 2035.

Exit 15 connects I-93 to I-393 and is a system interchange linking two freeways. It also connects I-93 to the City of Concord’s downtown area by way of Route 202. Exit 15 is a full cloverleaf configuration that includes four loop ramps and four directional ramps connecting these interstate highways. There are four short weave sections within the interchange, two for I-93 and two for I-393. These weaves are problematic because of the high volume of traffic using the ramps and because the weaves occur on the mainline. The weave distances are below those recommended by AASHTO, however, AASHTO treats cloverleaf interchanges differently than other weave conditions.

The weaves within Exit 15 along I-93 operate at unacceptable levels while those along I-393 operate at acceptable levels. The southbound weave within Exit 15 currently operates at LOS F/E that is anticipated to deteriorate to a LOS F/F by 2035. The northbound weave within Exit 15 currently operates at LOS C/E that is anticipated to remain LOS C/E by 2035.

The Exit 15 area includes two Red List bridges; the bridge that carries I-393 over I-93 (Bridge #152/108) and the bridge that carries Route 202 over the NH Rail and Transit Railroad (NHRR) tracks and Constitution Avenue (Bridge #150/107). The I-393 Bridge would be replaced with any of the build concepts because it does not accommodate the widening of I-93 and is also in poor condition. The Route 202 Bridge would be replaced with any of the build alternatives due to its poor condition.

Exit 1 of I-393 provides access to Fort Eddy Road and College Drive. College Drive is the main access to the New Hampshire Technical Institute (NHTI). Exit 1 of I-393 is a partial cloverleaf with all ramps on the west side of College Drive because of its close proximity to the Merrimack River. The bridge that carries I-393 over Fort Eddy Road/College Drive is on the Red List due to the poor condition of its deck. This bridge is a candidate for rehabilitation, because the build alternatives would not require the widening or lengthening of the bridge.

The minimal distance between Exits 14 and 15 results in deficient weaves on I-93 for both southbound and northbound directions. AASHTO recommends 2,000 feet between entrance and exit ramps for this ramp condition, the existing southbound weave is 380 feet long and the existing northbound weave is 370 feet long. The southbound weave along I-93 between Exits 14 and 15 operates at unacceptable levels. The current LOS F/D that projects to LOS F/E by 2035. The northbound weave along I-93 between Exits 14 and 15 operates at unacceptable levels where the current LOS C/E is anticipated to be LOS C/F by 2035.

The close proximity of I-93 Exit 15 and I-393 Exit 1 results in deficient weaves on I-393 for both eastbound and westbound directions. AASHTO recommends 2,000 feet between entrance and exit ramps for this ramp condition. The existing eastbound weave is 540 feet long and the existing westbound weave is 600 feet long. However, the LOS for these two weaves is acceptable due to the relatively low volume of ramp traffic using I-393 Exit 1.

There is one remaining Red List bridge in the Exits 14/15 Area, it is Delta Drive over I-93 (Bridge #142/116) at the northern end of the project. This bridge would be replaced for all build alternatives due to its poor condition and as it is not long enough to accommodate the widening of I-93.

There are two bridges within the Exit 14/15 Area that do not need to be modified to accommodate the build alternatives but would have routine preservation work conducted by the project, the Route 202 bridge over the Pan Am Railroad and I-393 bridge over the pedestrian underpass. Routine preservation includes, but is not limited to, new pavement, new joints and new protective membranes for bridges and concrete repairs for underpasses.

There are several rail facilities within the Exit 14/15 Area. The active “Main Line North” freight rail line parallels I-93 to the west until just south of Exit 14. It then veers to the northwest where is passes under Loudon Road adjacent to Storrs Street underneath the same bridge that crosses over Storrs Street. The “Main Line North” continues northwest away from I-93 where it passes under Route 202 and bridges over Horseshoe Pond. The “Main Line North” line is owned and operated by Pan Am Railways within the project limits.

Pan Am Railways has abandoned the “Main Line North” line from Horseshoe Pond north to the Boscawen Town Line, where its ownership ends. The NHDOT owns the “Main Line North” from the Boscawen Town Line to its terminus in Lebanon. The majority of the NHDOT portion has been abandoned and converted to a rail trail.

Between Exits 14 and 15 the “White Mountain Branch” line begins as it separates from the “Main Line North” creating two independent rail corridors. The “White Mountain Branch” line heads north and hugs the ramps at Exit 15 before heading north again. This line is owned by NHDOT.

The current freight traffic through the area utilizes the “Main Line North” up to the point where the “White Mountain Branch” connects and then uses the “White Mountain Branch”. The freight operations are conducted by Pan Am Railways on the “Main Line North”, but are conducted by New England Southern Railroad on the “White Mountain Branch”.

Preservation of the rail corridors is an established goal of the project. There have been recent studies exploring opportunities for enhancing passenger rail for New Hampshire including the *Capitol Corridor Rail and Transit Alternatives Analysis*, which proposed a Concord Rail Station between Exits 14 and 15. The design goal for the I-93 project is to preserve both rail corridors and to accommodate a future passenger platform in the Exit 14/15 Area. Though Pan Am Railways has abandoned the “Main Line North” line north of Horseshoe Pond, this corridor must still be preserved for potential future use.

Sidewalks exist along both sides of Loudon Road within the project limits. There are no bicycle lanes provided along Loudon Road.

The City of Concord has a proposed project within the Exit 14/15 Area (shown in red on Figures 2.14a through 2.20a) that would extend Storrs Street north and connect it to either Constitution Avenue or South Commercial Street. Relocation of the railroad tracks would be required for the Storrs Street Extension

The Stickney Avenue area is of particular interest to the City of Concord as they have identified it for potential redevelopment as well as the location of a potential future rail station. A Concord Coachline Bus Depot and a NHDOT Park and Ride lots presently exist in this area. NHDOT owns other property in the area that was once the Highway Garage, but it is no longer used for this purpose. Maintaining access to this area from I-93 is a prime goal for the project.

2.3.9.1 Exit 14/15 Concept D2

Many concepts were developed to address the deficiencies that exist within the Exit 14/15 Area. In the end, four alternatives were selected for further consideration. The first is Concept D2, which retains most of the existing configurations for each interchange and proposes widening I-93 to six lanes to a point south of the bridge over the Merrimack River. The one exception to maintaining the existing configuration is at Exit 14 where the northbound entrance ramp would be eliminated. Eliminating this ramp would allow the alignment of I-93 to be shifted east at the "Pinch Point" to avoid impacts along the west side of the corridor. Concept D2 avoids impacts to Stickney Avenue, the Unitil substation, the Pan Am railroad, and a shopping plaza. See **Figure 2.15a Exit 14/15 Area Concept D2** for a plan. See **Figure 2.15b I-93 North Concept D2** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.15c I-393 Concept D2** for a plan of the I-393 portion of Exit 14/15 Area.

The elimination of the northbound entrance at Exit 14 would also eliminate one of the deficient weaving sections on I-93. However, the remaining deficient and undesirable weaves in the area remain. The widening of I-93 would improve the LOS of the weaves. By adding a lane and capacity to the mainline, vehicles passing through the area on I-93 could remain in the left lanes, which would provide more capacity in the right lanes for the weaving traffic. The southbound weave on I-93 between Exits 14 and 15 that is presently at LOS F/D, and is modeled to be LOS F/D by 2035, would improve to an acceptable LOS C/B under Concept D2. The northbound weave on I-93 between Exits 14 and 15 which is presently at LOS C/E, and is modeled to be LOS B/E by 2035, would improve to an acceptable LOS B/C under Concept D2. And finally, the southbound weave within Exit 15 that is presently at LOS F/E, and is modeled to be LOS F/E by 2035, would improve to an acceptable LOS C/B under Concept D2.

The Loudon Road corridor would benefit from the ramp elimination as well because this signalized intersection would be eliminated. Also, standard lane widths and shoulders would be provided along Loudon Road since the new bridge over Loudon Road would be longer. The westbound approach to the Loudon Road/Fort Eddy/northbound Exit Ramp intersection that is projected to be at a LOS F/F by 2035, would improve to LOS C/E with minimal delays. The PM delay would be reduced from 765 seconds to 65 seconds.

Sidewalks and bicycle lanes would be provided along both sides of Loudon Road within the project limits for Concept D2. All proposed build alternatives would provide the sidewalks and bicycle lanes.

Stickney Avenue would not be impacted by Concept D2 and could therefore continue to function as it does today. Access to the historic Ralph Pill Building, a National Register eligible building, would be maintained.

Concept D2 would not alter the weaves between Exit 15 and Exit 1, on I-393, therefore the deficient weaves would remain. The LOS for these two weaves would remain at acceptable levels due to the relatively low volume of ramp traffic at Exit 1.
Concept D2 would include a new connection from the end of Stickney Avenue across the railroad tracks that would connect to South Commercial Street and the proposed extension of Storrs Street. This new connection would provide access to northbound I-93 that would be lost under this concept at Exit 14. The new connection would also provide access to Stickney Avenue from the I-393 extension (Route 202) that would be lost due to the proposed elimination of the existing slip ramp from the I-93 southbound entrance ramp at Exit 15.

There is one bridge within the Exit 14/15 Area, Route 202 over the Pan Am Railroad, that would not be impacted by Concept D2 but which would have routine preservation work conducted by the project. Routine preservation includes, but is not limited to, new pavement, new joints, and new protective membrane for bridges.

A retaining wall would be required along the east side I-93 south of Exit 14 at the “Pinch Point” to avoid impacts to the Merrimack River.

The total cost for Concept D2 is estimated at $91.7 million.

2.3.9.2 Exit 14/15 Concept F

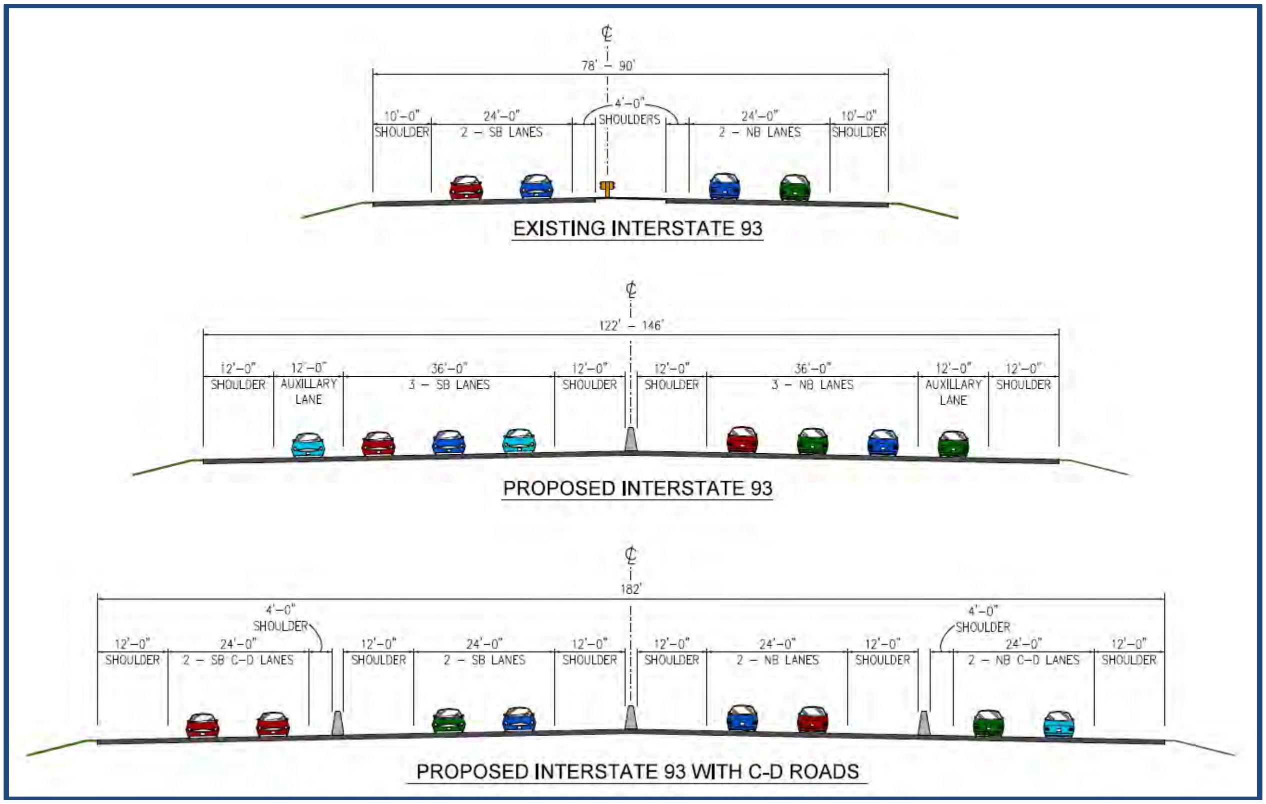
Concept F proposes significant changes to I-93, Exit 14 and Exit 15 as follows:

- Collector-Distributor (C-D) Roads for northbound and southbound I-93.
- A Single Point Urban Interchange (SPUI) at Exit 14.
- A Cloverstack interchange at Exit 15.
- A new access to Stickney Avenue Area.

See **Figure 2.16a Exit 14/15 Area Concept F** for a plan. See **Figure 2.16b I-93 North Concept F** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.16c I-393 Concept F** for a plan of the I-393 portion of Exit 14/15 Area.

Concept F does not propose changes to Exit 1 of I-393. Concept F does propose a separation of I-93 traffic from south of Exit 14 to north of Exit 15. I-93 traffic that is passing through the area and not desiring to exit I-93 to Exits 14 or 15 would be directed to remain to the left where two lanes would be carried through the area. Traffic destined for Exits 14 or 15 would be directed to remain to the right to access the C-D Roads. The C-D Roads would run parallel to, but separated from the through lanes by concrete barriers. See **Figure 2.17** below for a Typical Section of I-93 that includes the C-D Road configuration.

Figure 2.17 I-93 Typical Section with C-D Roads



The weaving that currently occurs on I-93 between Exits 14 and 15 would occur on the C-D Roads for Concept F. Weaving on C-D Roads is preferred because there is less traffic and the speeds are lower. AASHTO recommends 1,600 feet between entrance and exit ramps when using a C-D Road, compared to 2,000 feet between entrance and exit ramps when on the mainline. For Concept F, the southbound weave would increase to about 550 feet and the northbound weave would increase to about 600 feet, still less than recommended. The slower speeds and reduced traffic would result in improvement of the LOS of the weaves.

The southbound weave on I-93 between Exits 14 and 15 that is modeled to have a LOS F/D by 2035, would improve to an acceptable LOS B/B under Concept F. The northbound weave on I-93 between Exits 14 and 15 that is anticipated to be LOS B/E by 2035, would improve to an acceptable LOS A/B under Concept F.

Concept F proposes a SPUI for Exit 14. A SPUI would utilize a single signalized intersection to control the four ramps that would intersect Loudon Road. This is the same configuration that currently exists at Exit 13. The northbound exit ramp that intersects opposite Fort Eddy Road would remain.

The Loudon Road corridor would benefit from the elimination of two signalized intersections as part of Concept F. The SPUI intersection would operate at acceptable levels in 2035. Also, standard lane widths and shoulders would be provided along Loudon Road since the new bridge over Loudon Road would be longer than the existing and designed to accommodate the proposed 8 lanes. The westbound approach to the Loudon Road/Fort Eddy/northbound Exit Ramp intersection that is modeled to have a LOS of LOS F/F by 2035, would improve to LOS B/E.

The proposed widening of I-93 and the footprint of the SPUI at Exit 14 under Concept F would require the corridor to be shifted to the west to avoid the Merrimack River. As a result, Concept F would impact Stickney Avenue, an electrical substation, overhead electric lines, the railroad, historic properties, and a shopping plaza. The Stickney Avenue connection to Loudon Road could not be maintained in Concept F. Other access options for Stickney Avenue would need to be provided as discussed below. Also, the driveway opposite Stickney Avenue that provides access to the Ralph Pill Building, the Concord Electric Light Station building, and the Unitil substation could not be maintained. Access to the Ralph Pill Building, the Concord Electric Light Station building, and the Unitil substation would be eliminated by Concept F.

Various options for accessing the Stickney Avenue area other than Loudon Road have been evaluated, including the following:

- Option A: An extension of South Commercial Street from where it meets Constitution Avenue over the NHRR railroad tracks as shown on **Figure 2.18a**. This would include an at-grade railroad crossing. Access from Stickney Avenue to I-93 would be straightforward by way of Exit 15. However, access from I-93 to Stickney Avenue would be circuitous utilizing Exit 15, Commercial Street along Horseshoe Pond, and Constitution Avenue.
- Option B: A grade separated crossing of the railroad near the existing northern limit of Storrs Street as shown on **Figure 2.18b**. Storrs Street would be elevated to allow the grade separated crossing. Access to I-93 would include using North Main Street to Loudon Road and Exit 14.
- A new overpass from Fort Eddy Road over I-93 to Stickney Avenue as shown on **Figure 2.18c**. Access to I-93 would entail using Fort Eddy Road to Exit 14. The high volume of traffic on Fort Eddy Road would be an issue for this option.

The options presented above could be combined with any alternative that would not maintain the Stickney Avenue connection to Loudon Road.

Figure 2.18a Stickney Avenue Access Option A

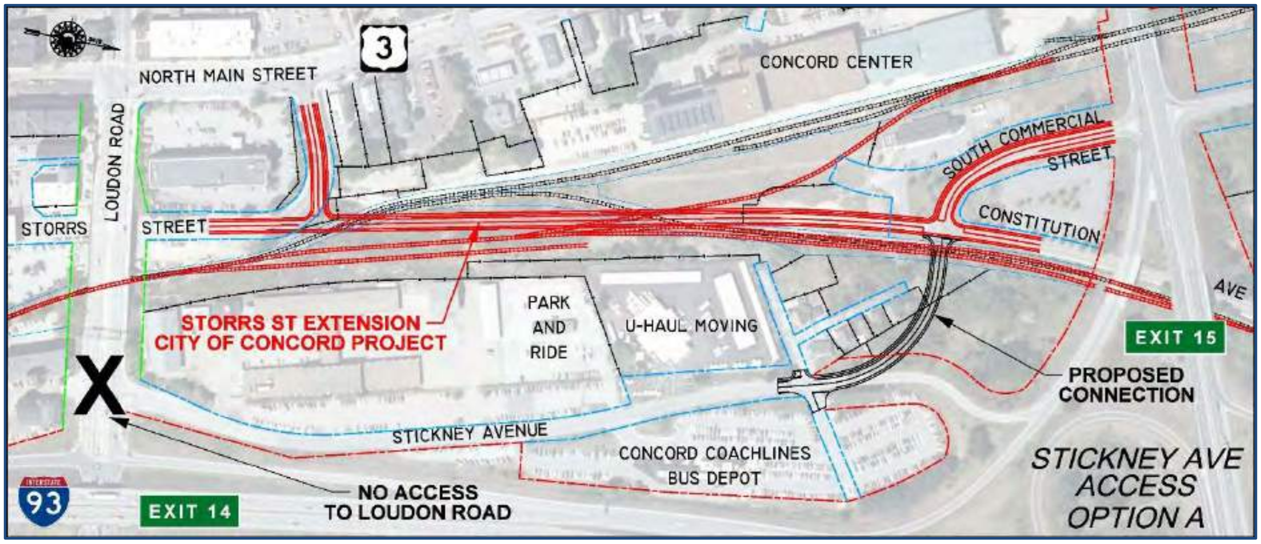


Figure 2.18b Stickney Avenue Access Option B

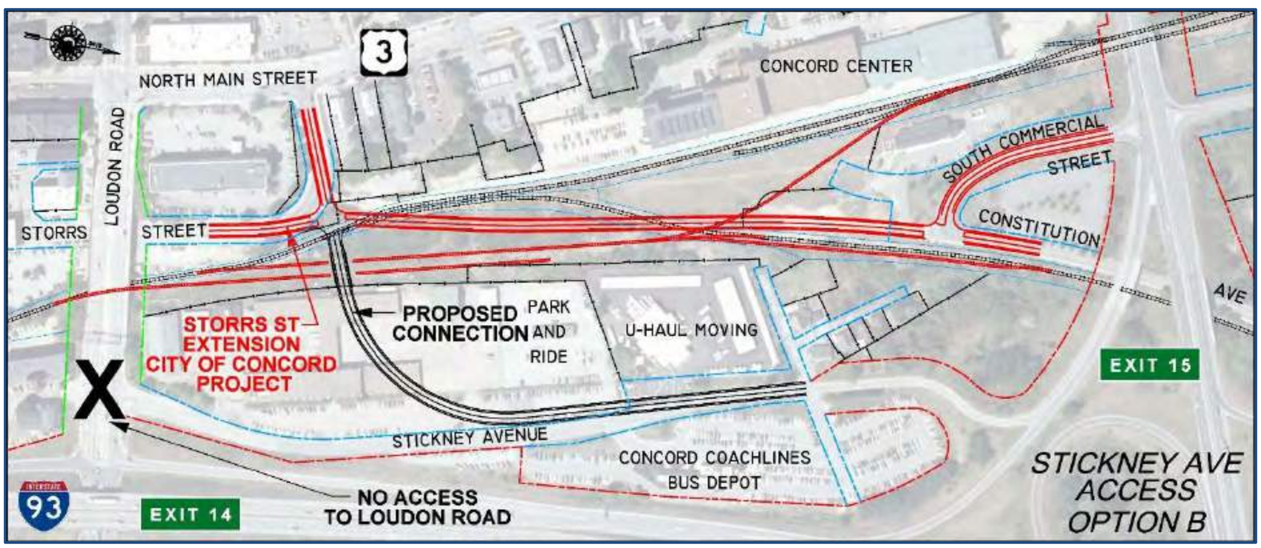
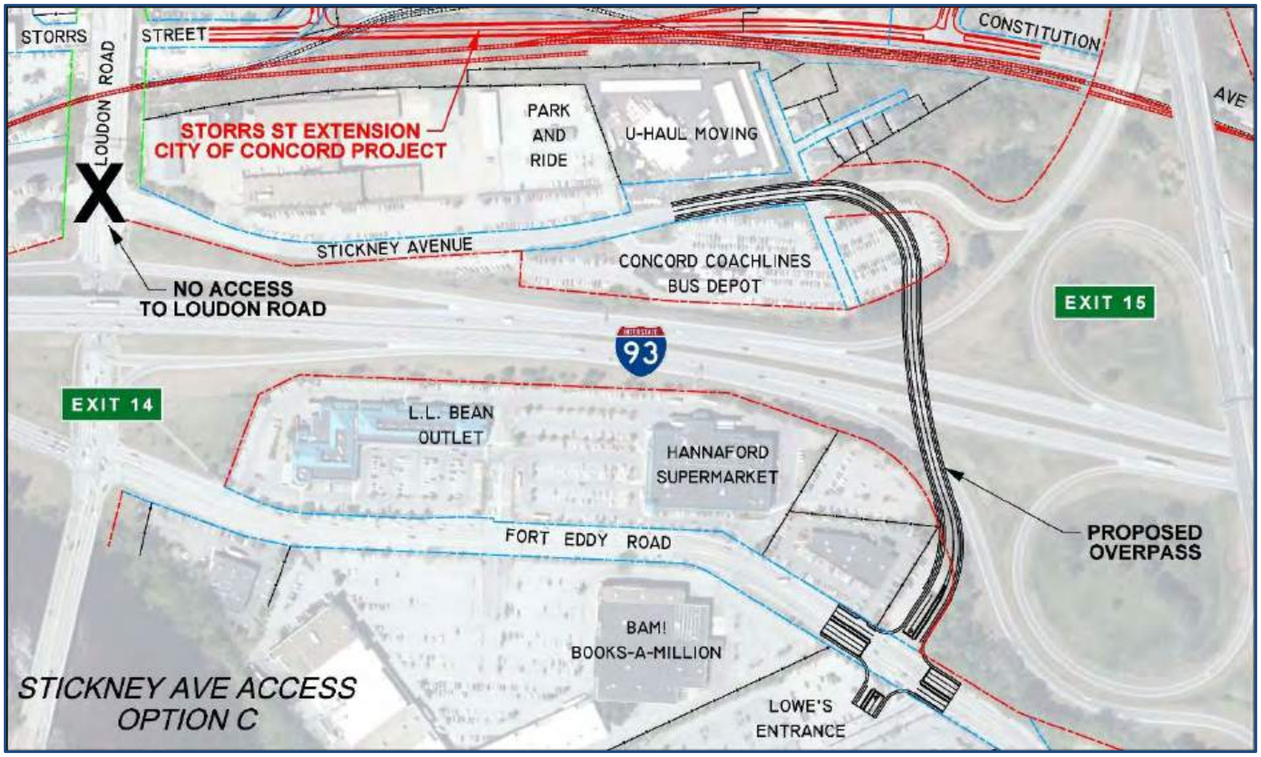


Figure 2.18c Stickney Avenue Access Option C



Concept F proposes a cloverstack configuration for Exit 15. A cloverstack is a hybrid interchange that retains elements of the cloverleaf but without the weave sections. As proposed for Concept F, two loop ramps would be eliminated and replaced with directional ramps. The limited space at Exit 15 restricts the geometry of the new directional ramps and the design speed is increased from 20 mph to 35 mph. By eliminating two of the loop ramps at Exit 15, four weave sections would be eliminated.

The alterations to Exit 15 as part of Concept F would increase the weave distances between Exit 15 on I-93 and Exit 1, on I-393. The eastbound weave would increase to 800 feet and the westbound weave would increase to 740 feet. Also, Concept F proposes formal auxiliary lanes for this weave. The auxiliary lanes would improve the weave segments as the weaving operation occurs at lower speeds.

The total cost for Concept F is estimated at $189.1 million.

2.3.9.3 Exit 14/15 Concept F2

Concept F2 is a hybrid alternative that contains elements of Concept F and Concept D2. Like Concept D2, it includes a modified diamond interchange at Exit 14 where the northbound entrance ramp would be eliminated. The elimination of the entrance ramp at Exit 14 would also eliminate the northbound weave between Exits 14 and 15. It would also include a southbound C-D Road between Exits 14 and 15. Like Concept F, it would include a cloverstack interchange at Exit 15 where two of the loop ramps would be eliminated. The directional ramps for Concept F2 would have a design speed of 30 mph as opposed to 35 mph for Concept F in order to eliminate impacts to the bus depot on Stickney Avenue. See **Figure 2.19a Exit 14/15 Area Concept F2** for a plan. See **Figure 2.19b I-93 North Concept F2** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.19c I-393 Concept F2** for a plan of the I-393 portion of Exit 14/15 Area.

The benefits identified above for Concepts D2 and F that are also realized for Concept F2 would include the following:

- Avoids impacts to the Unitil substation, the railroad, historic properties and a shopping plaza.
- Maintains access to Stickney Avenue, the Ralph Pill Building, and the Concord Electric Light Station from Loudon Road.
- Eliminates four of the weave segments within Exit 15.
- Eliminates one of the signalized intersections along Loudon Road.
- Allows longer weave segments between Exit 15 and Exit 1.

A retaining wall would be required along the east side I-93 south of Exit 14 at the "Pinch Point" to avoid impacts to the Merrimack River.

The total cost for Concept F2 is estimated at $125.0 million.

2.3.9.4 Exit 14/15 Concept O3

Concept O3 proposes several substantial modifications to the Exit 14/15 Area. At Exit 14, Concept O3 proposes "flipping" the interchange whereby I-93 would be depressed and Loudon Road would cross over the interstate. A benefit of the flip is that the White Mountain Line active rail corridor could be shifted east closer to I-93, thereby potentially creating an area between it and Storrs Street for redevelopment without the rail corridor bisecting it. However, the existing "Main Line North" rail corridor north of Exit 14 must be preserved for any potential future use of the corridor. The northbound entrance ramp at Exit 14 would be eliminated. See **Figure 2.20a Exit 14/15 Area Concept O3** for a plan. See **Figure 2.20b I-93 North Concept O3** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.20c I-393 Concept O3** for a plan of the I-393 portion of Exit 14/15 Area.

Two of the loop ramps at Exit 15 would be eliminated and replaced with directional ramps. As with the cloverstack configuration in Concepts F and F2, this would eliminate the four weaves that exist within Exit 15. The limited space at Exit 15 restricts the geometry of the new directional ramps, but the design speed would increase from 20 mph to 40 mph.

Access to and from southbound I-93 for Concept O3 would be provided with a combination of C-D roads and "slip ramps". A C-D road would be provided for southbound traffic between Exits 14 and 15. A portion of this road would be for two-way traffic and a portion would be for one-way traffic. The two-way portion would provide access to the Stickney Avenue area by the way of bridges over the relocated railroad corridor. The one-way portion of the C-D road would provide access to Loudon Road from southbound I-93 and westbound I-393. The southbound connection between Exits 15 and 14 would be eliminated by Concept O3 and this traffic would have to use local roadways.

The proposed combination of eliminating ramps, directional ramps, C-D Roads, and slip lanes would result in the elimination of all weaving sections along I-93 at Exits 14 and 15. The only weaving sections to remain would be those between Exit 15 and Exit 1 on I-393, which operate at acceptable levels of service by 2035.

A benefit of Concept O3 is that the area around Stickney Avenue identified for redevelopment would not be bisected by the active railroad corridor. However, the bus depot would be impacted and would need to be relocated.

The Loudon Road corridor would benefit from the ramp elimination as well because one of the signalized intersections would be eliminated. Also, standard lane widths and shoulders would be provided along Loudon Road since a new bridge would carry Loudon Road over I-93. The westbound approach to the Loudon Road/Fort Eddy/northbound Exit Ramp intersection that projects to be LOS F/F by 2035, would improve to LOS D/D with minimal delay. The PM delay would be reduced from 765 seconds to 46 seconds.

One anomaly of Concept O3 is that the southbound exit ramp from I-93 to Loudon Road that is now accommodated by Exit 14 would occur north of the exit ramp to Route 202 west that is now accommodated by Exit 15. In other words, the southbound exit for Exit 14 would occur before the exit for Exit 15.

The reconstruction of Exit 14 to depress I-93 and carry Loudon Road over the highway would require the closure of Loudon Road for an extended period of time. The closure would last at least a year and possibly longer to allow for the phased lowering of I-93 while maintaining traffic on I-93. The Loudon Road bridge over Storrs Street would have to be replaced due to the revised profile of Loudon Road.

A retaining wall would be required along the east side I-93 south of Exit 14 at the “Pinch Point” to avoid impacts to the Merrimack River.

The total cost for Concept O3 is estimated at $171.0 million. This cost does not include any cost to relocate the rail, as the rail would remain in its current location unless development in the area would propose for it to be relocated.

The Exit 14 “flip” proposed by Concept O3 could be a component of any alternative. It would have similar benefits as described above as well as the same challenges. Any flip of Exit 14 would require extensive retaining walls along I-93, a lengthy closure of Loudon Road to construct, and limit views of the City for drivers on I-93. It would allow for the relocation of the railroad and redevelopment opportunities for the Stickney Avenue area.

2.3.9.5 Exit 14/15 Area Summary

Table 2.7 Exit 14/15 Area Comparison Matrix below provides a comparison of the four concepts under consideration for the Exit 14/15 Area.

Table 2.7 Exit 14/15 Area Comparison Matrix

CONSIDERATION	CONCEPT D2	CONCEPT F	CONCEPT F2	CONCEPT O3
Exit 14 To Exit 15 Weaves	Improved	C-D Roads	Northbound – Eliminated Southbound – C-D Roads	Eliminated
Exit 15 Weaves	Improved	Eliminated	Eliminated	Eliminated
Northbound Entrance Ramp	Eliminated	No Change	Eliminated	Eliminated
Property Impacts	• 1 full parcel acquisition • 5 partial parcel acquisitions	• Ralph Pill Bldg. • Electric Light Station Bldg. • Unitil Substation • Railroad Corridor • Storrs Street Shopping Plaza • Bus Depot • 6 partial parcel acquisitions	• 1 full parcel acquisition • 11 partial parcel acquisitions	• Bus Depot • 1 full parcel acquisition • 4 partial parcel acquisitions
Red List Bridges	4	4	4	4
Existing Bridges Retained	2	2	2	2
Existing Bridges Replaced/ Rehabilitated/ Widened	5	5	5	5
New Bridges	0	4	2	7
Estimated Project Cost	$91.7 M	$189.1 M	$125.0 M	$171.0 M
Wetland Impacts	0.3 Acres	0.4 Acres	0.4 Acres	0.2 Acres
Conservation Land Impacts	0.0 Acres	0.0 Acres	0.0 Acres	0.0 Acres

Table 2.7 Exit 14/15 Comparison Matrix (cont'd)

CONSIDERATION	CONCEPT D2	CONCEPT F	CONCEPT F2	CONCEPT O3
Wildlife Considerations	• State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community	• State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community	• State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community	• State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community
Contaminated Parcels Impacted	3	3	3	3
Historic Property Impacts	5 Historic Properties Effected	5 Historic Properties Effected	4 Historic Properties Effected	5 Historic Properties Effected

2.4 Agency and Public Input Received on Alternatives Considered

This section summarizes the agency and public involvement process that occurred concurrently with the development of the concept alternatives and the selection of the preferred alternative. The process involved evaluating conditions along the corridor, considering resources potentially subject to impact, and considering issues of concern to local officials, members of the community, state, and federal agencies.

A number of meetings were held by the NHDOT with the various Federal, State and local project stakeholders. These include regularly scheduled Natural Resource Agency and Cultural Resource meetings held at NHDOT, an effects determination meeting with NH State Historic Preservation Office, (NHSHPO), planning board meetings, selectmen meetings, and several meetings with town and city staff. The NHDOT and the FHWA are the state and federal agencies responsible for technical oversight and development of the EA. Information gathered during development of the conceptual ideas as well as during development of the concept alternatives, and technical analysis of the alternatives was presented or distributed to the various agencies and to the general public in attendance at four Public Informational Meetings and through the Project Website.

Another level of review includes both federal and state environmental Natural Resource Agencies, such as the U.S. Army Corps of Engineers and the NH Department of Environmental Service. These agencies are responsible for making or influencing permitting decisions based on state and federal laws and regulations, and serve to protect natural, cultural, and socio-economic resources potentially affected by the project. The agencies are focused on assuring the least environmentally damaging practical alternative (LEDPA) in which the impacts are minimized to the extent practicable, while providing a feasible solution that meets the project purpose and need.

Meetings with local and regional, appointed and elected public officials of the two communities directly affected as well as the general public were held periodically. These meetings included review of project findings, concept alternatives, and the preferred alternative, and discussion of the project schedule including construction time frame. Public Informational Meetings were held to present and review project-related information, and importantly to obtain information and solicit input from these stakeholders. Revisions and additional studies, as appropriate, have been conducted to address comments received.

A complete listing of the agency, local officials, and public meetings that have occurred during Part B is included in Chapter 7 Coordination and Consultation.

2.5 Preferred Alternative

The coordination and input received from the public and resource agencies described above in Section 2.4 informed selection of preferred concepts for the four project areas. The preferred concepts were selected in consideration of the extent to which each concept meets the Project's Purpose and Need. The following sections outline the most important features of each project area and the reasons for selection of the preferred concept. The four preferred concepts together form the Preferred Alternative for the project. The Preferred Alternative was presented to the public at Public Informational Meetings held on February 14 and 15, 2018 (see **Figure 2.21**).

2.5.1 Interstate 89 Area Preferred Concept (Concept K)

The key considerations for selection of the preferred concept for the I-89 Area include:

- Maintain valued interstate access for the Town of Bow
- Address the deficient weaves that discourage the use of Exit 1 due to safety concerns
- Address the deficient northbound weave at the I-93/I-89 interchange
- Minimize property impacts
- Minimize resource impacts

Concept K has been selected as the Preferred Concept for the I-89 Area because it is the most cost-effective concept with the fewest impacts that addresses the project Purpose and Need as well as the key considerations for the area. The deficient weaves within the area are all addressed by Concept K with minimal impacts outside the existing interstate right-of-way. The direct access between Route 3A at Bow Junction and I-89 would be eliminated. To travel between Bow Junction and I-89, traffic would use the proposed local connector road to South Street and access I-89 at Exit 1. Exit 1 and the access road would need to be designed to accommodate the high volume of truck traffic that would be expected.

Concept C was not selected as it does not provide sufficient improvement to the area weaves and it requires a 9.6-acre impact to the Cilley State Forest.

Concept P was not selected because the additional directional ramps would be very expensive. Construction of Concept K would not preclude the future construction of the additional directional ramps if determined to be required.

2.5.2 Exit 12 Area Preferred Concept (Concept F)

The key considerations for selection of the preferred concept for the Exit 12 Area include:

- Address the deficient deceleration distances for the exit ramps
- Provide acceptable LOS for the Route 3A intersections
- Minimize property impacts
- Minimize resource impacts

Concept F has been selected as the Preferred Concept for the Exit 12 Area because it addresses the project Purpose and Need as well as the key considerations for the area, and provides the better LOS for the Route 3A intersections compared to the signalized intersections, Concept E. The use of roundabouts has been supported by the public at this location, as well as throughout the City of Concord.

2.5.3 Exit 13 Area Preferred Concept (Concept B)

The key considerations for selection of the preferred concept for the Exit 13 Area include:

- Address the daily back-up that occurs at the Exit 13 northbound exit ramp.
- Minimize property impacts
- Minimize resource impacts

Concept B has been selected as the Preferred Concept for the Exit 13 Area because it addresses the project Purpose and Need as well as the key considerations for the area, and addresses the queuing issue for the northbound exit ramp beyond 2035. The widened northbound exit ramp eliminates the queuing that extends onto I-93.

Concept A was not selected because it does not address the queuing issue for the northbound exit ramp by 2035.

2.5.4 Exit 14/15 Area Preferred Concept (Concept F2)

The key considerations for selection of the preferred concept for the Exit 14/15 Area include:

- Address the deficient weaves between Exits 14 and 15
- Address the deficient weaves within Exit 15
- Maintain access to the Stickney Avenue area
- Minimize property impacts
- Minimize resource impacts

Concept F2 has been selected as the Preferred Concept for the Exit 14/15 Area because it addresses the project Purpose and Need as well as the key considerations for the area. The northbound entrance ramp at Exit 14 is eliminated and this diverted traffic must be accommodated throughout the area by ensuring the other roadways and intersections would function at acceptable levels of service. The additional cost of Concept F2 was deemed acceptable due to the benefit of addressing the weaving that occurs within Exit 15.

Concept D2 was not selected because it does not sufficiently address the weaving sections in the area.

Concept F was not selected because it includes extensive impacts to property, historic resources and infrastructure, and these impacts are quite costly.

Concept O3 was not selected because of the high construction cost, construction impacts, and visual impacts.

The “flip” of Exit 14 was not selected as a component because the cost, long term disruptions in order to construct this Concept, and the visual impact are considered to be unreasonable.

2.5.5 Preferred Alternative Summary

The Preferred Alternative is comprised of the preferred concept for each of the four segments as outlined in **Table 2.8 Preferred Alternative** below.

Table 2.8 Preferred Alternative

SEGMENT	CONCEPT	COST
I-89 Area	K	$70.0 million
Exit 12 Area	F	$33.9 million
Exit 13 Area	B	$39.0 million
Exit 14/15 Area	F2	$125.0 million
Total		$267.9 million

See **Figure 2.21 Preferred Alternative** for a composite plan of the Preferred Alternative.

Figure 2.3 I-93 Segments

Figure 2.4 I-89 Area Existing Conditions

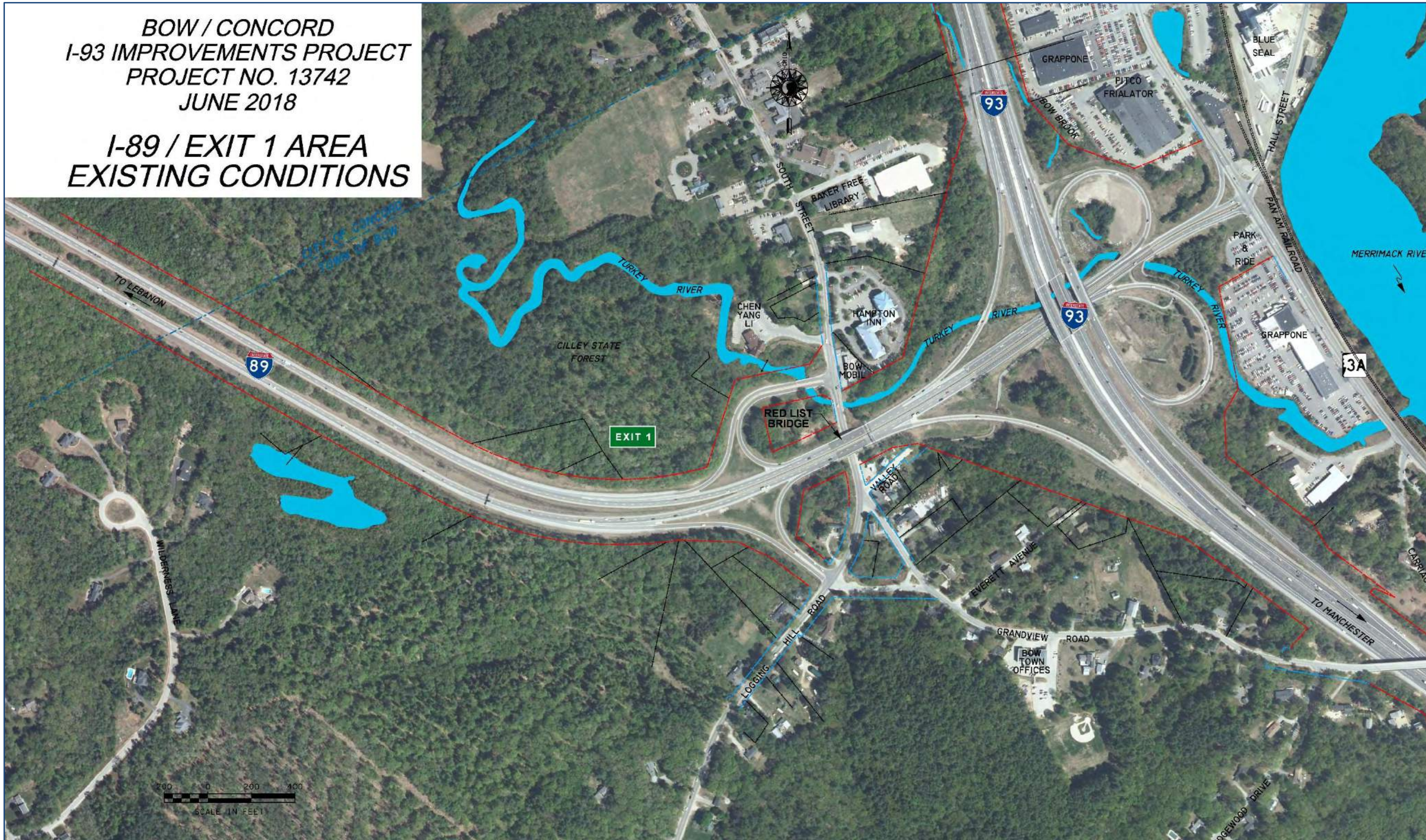


Figure 2.5 I-89 Area Concept C

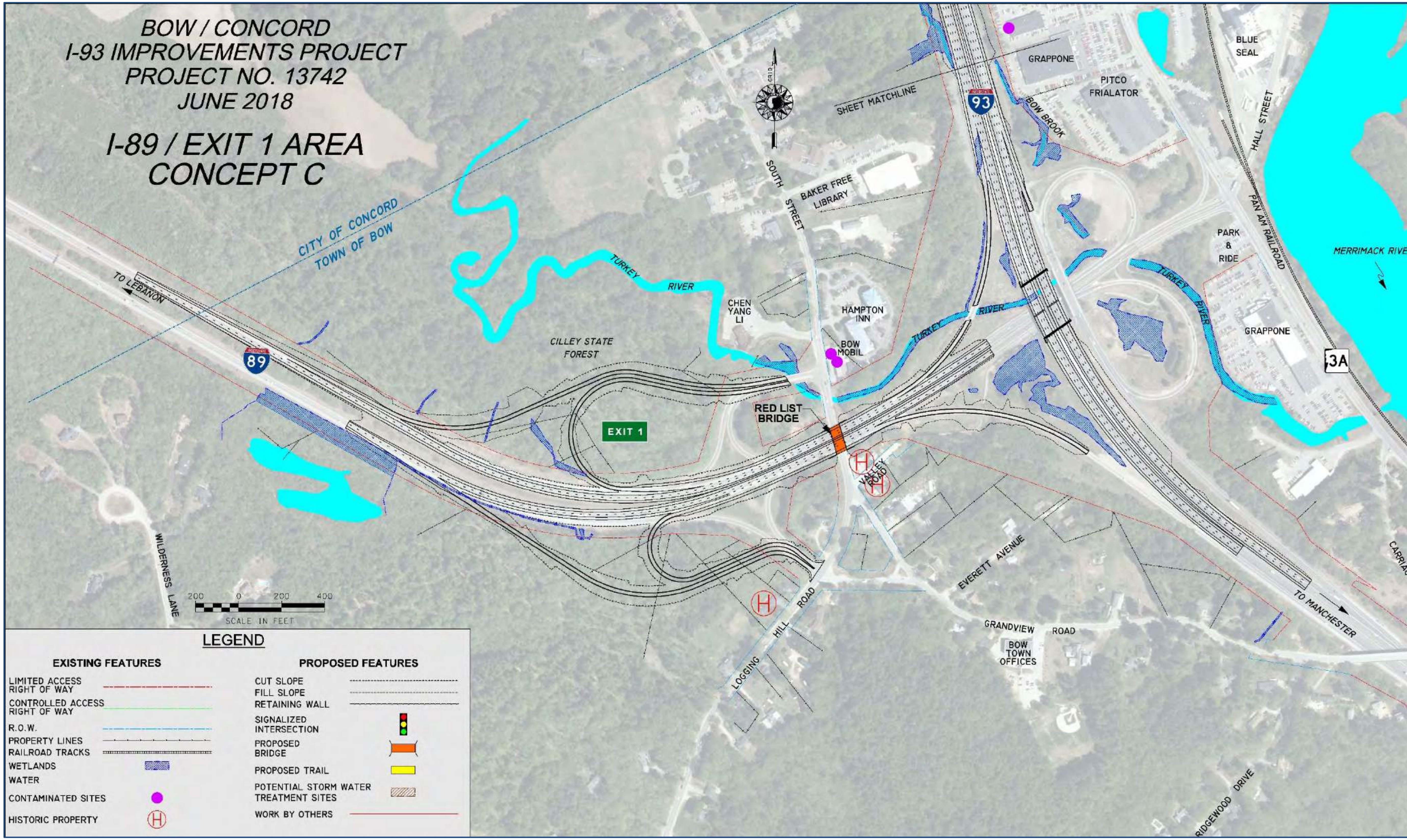


Figure 2.6 I-89 Area Concept K

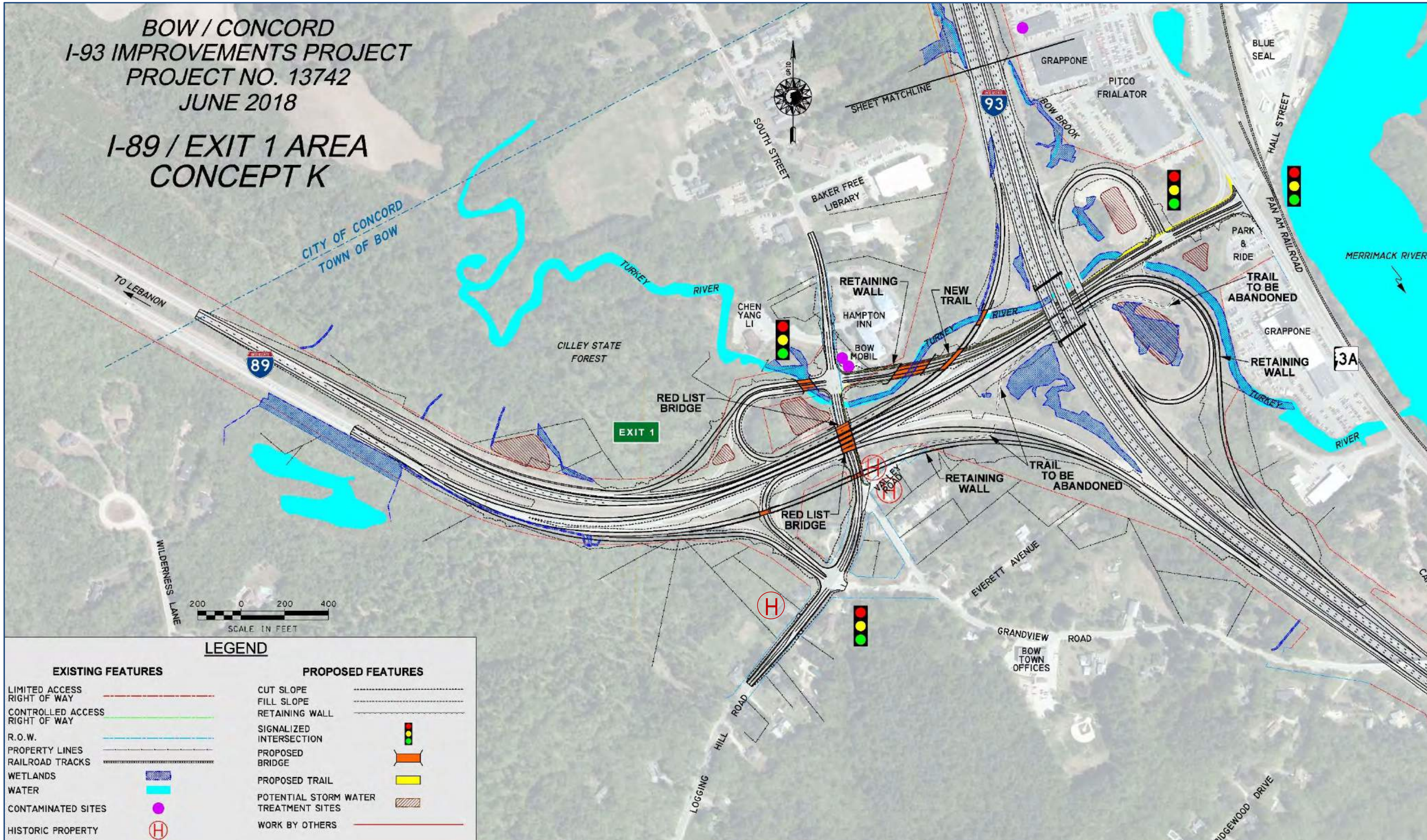


Figure 2.7 I-89 Area Concept P

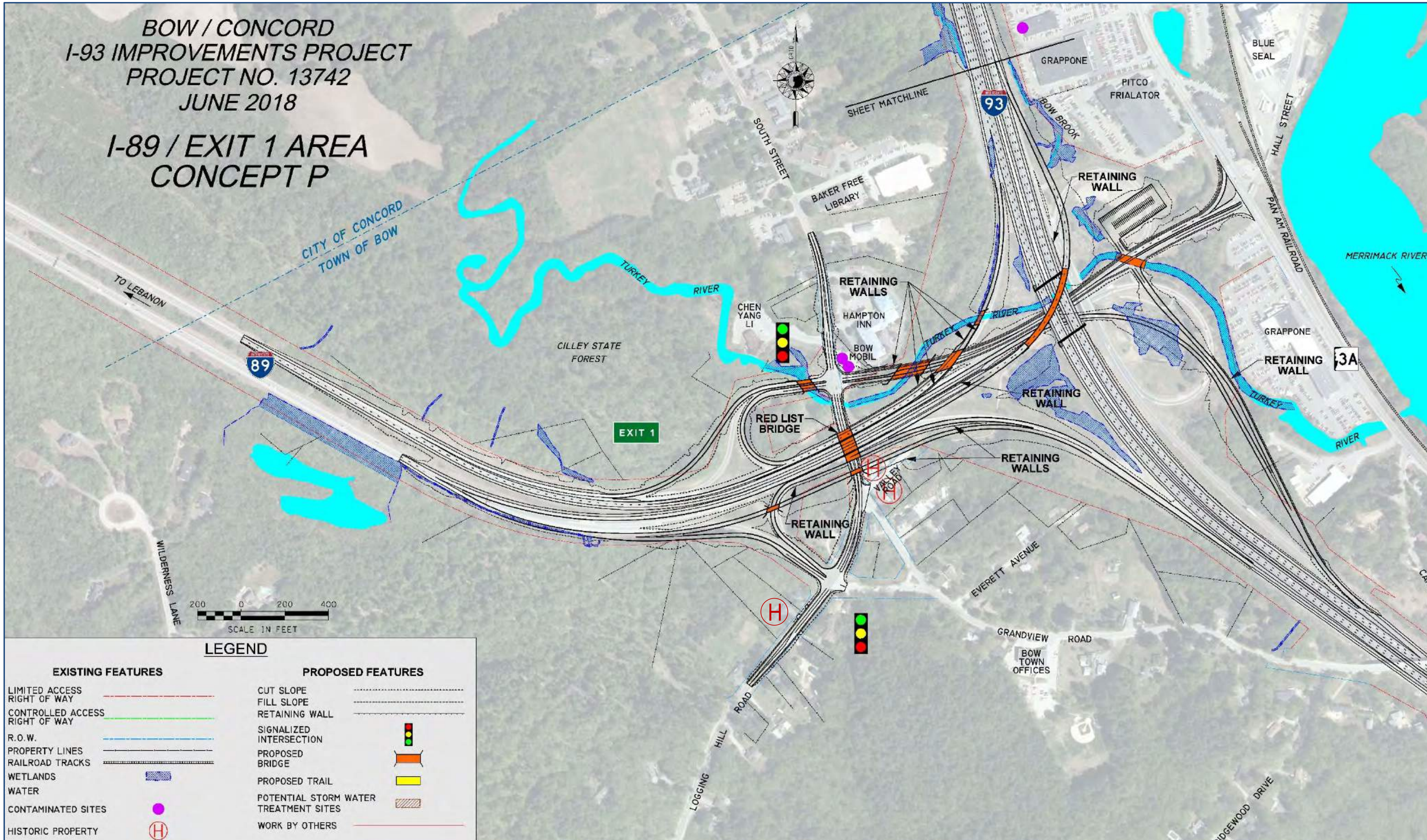


Figure 2.8 Exit 12 Area Existing Conditions

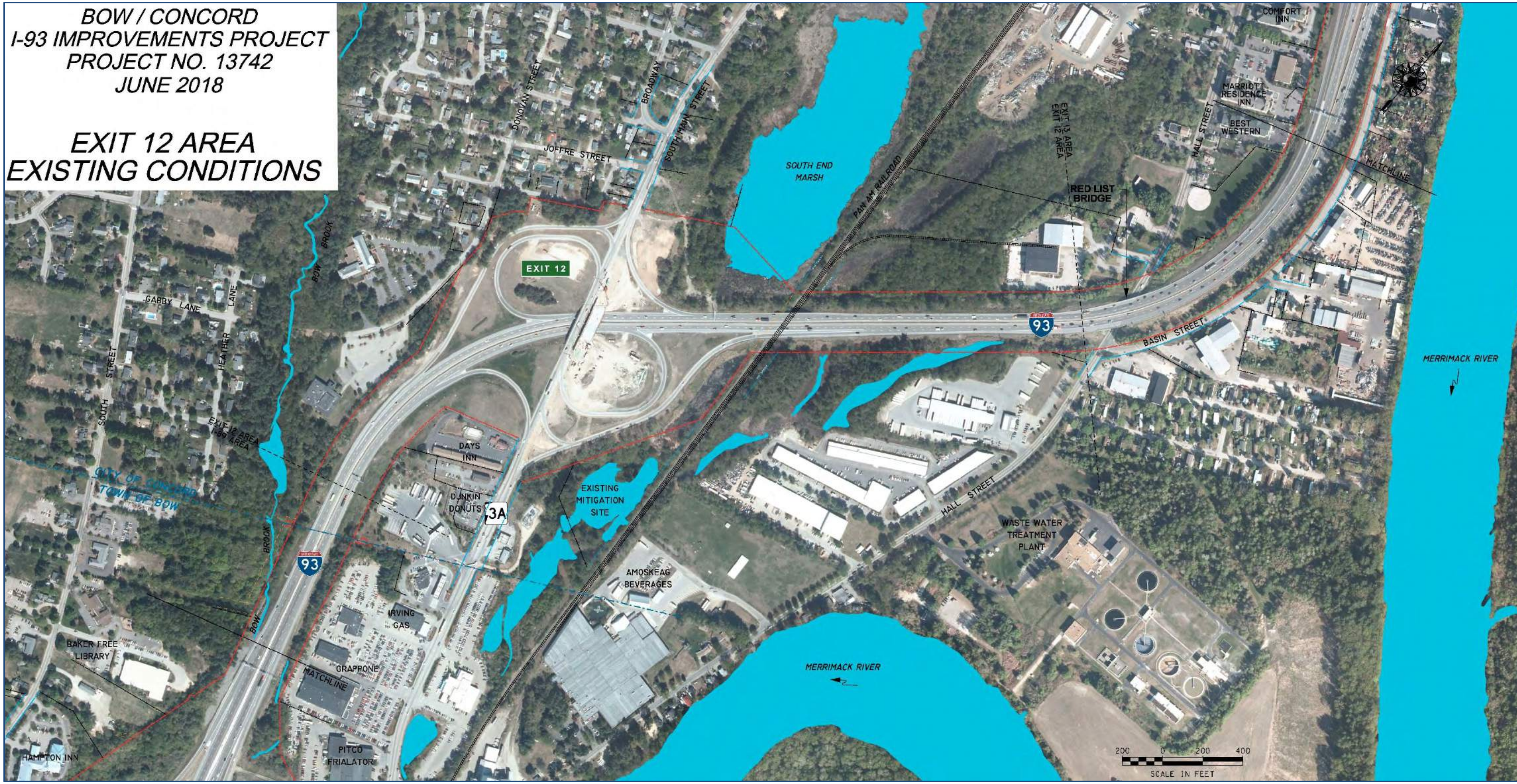


Figure 2.9 Exit 12 Area Concept E

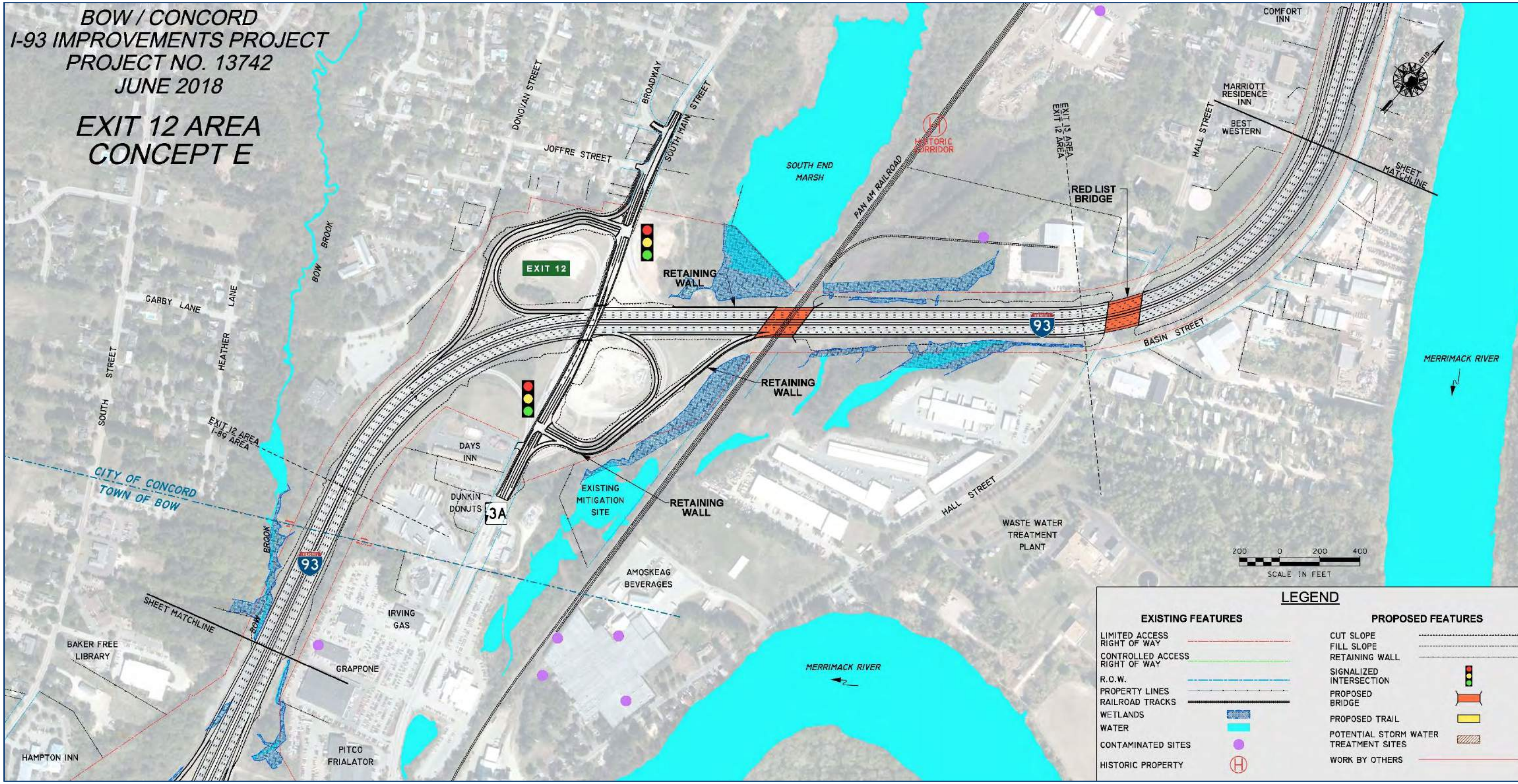


Figure 2.10 Exit 12 Area Concept F

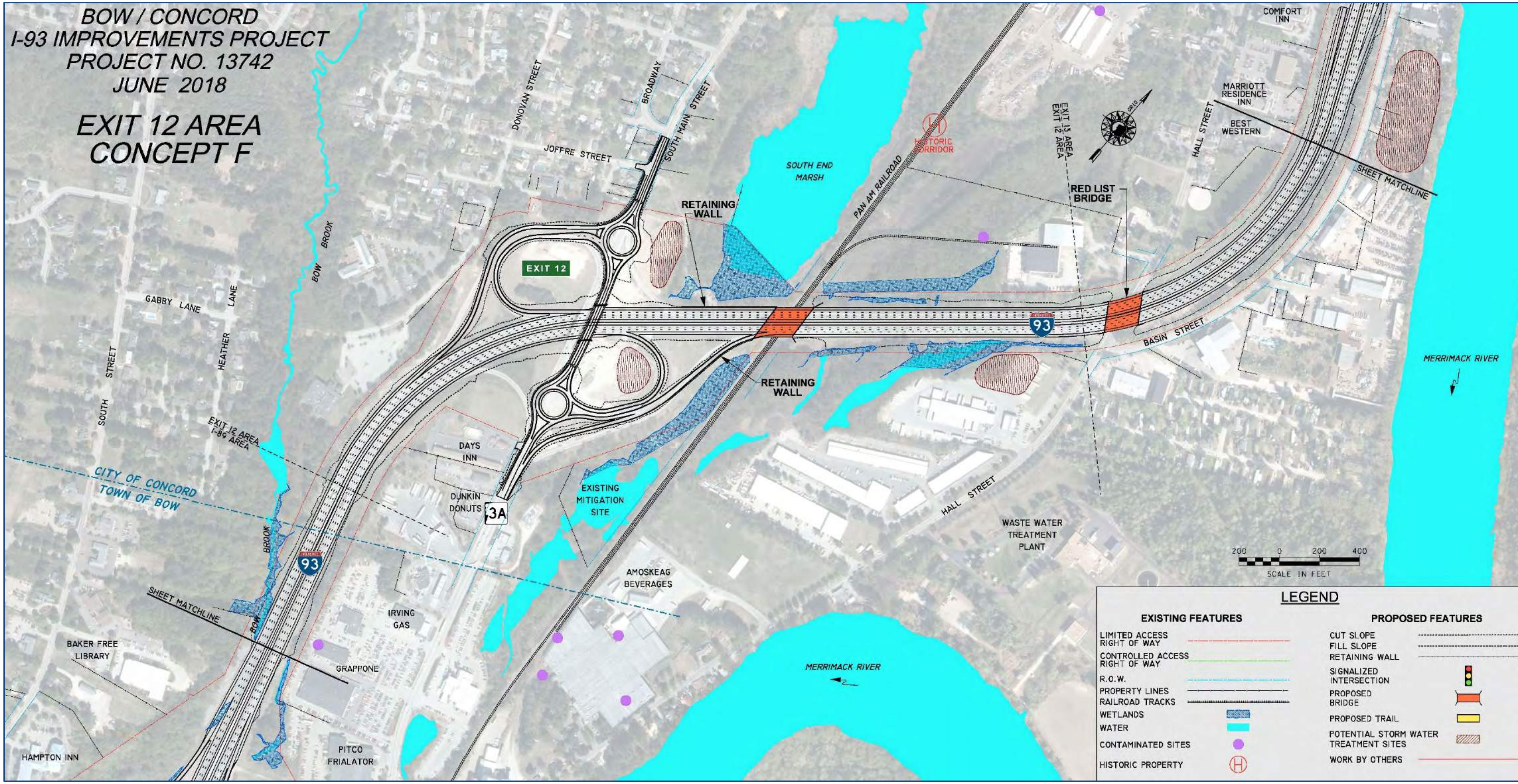


Figure 2.11 Exit 13 Area Existing Conditions

Figure 2.12 Exit 13 Area Concept A

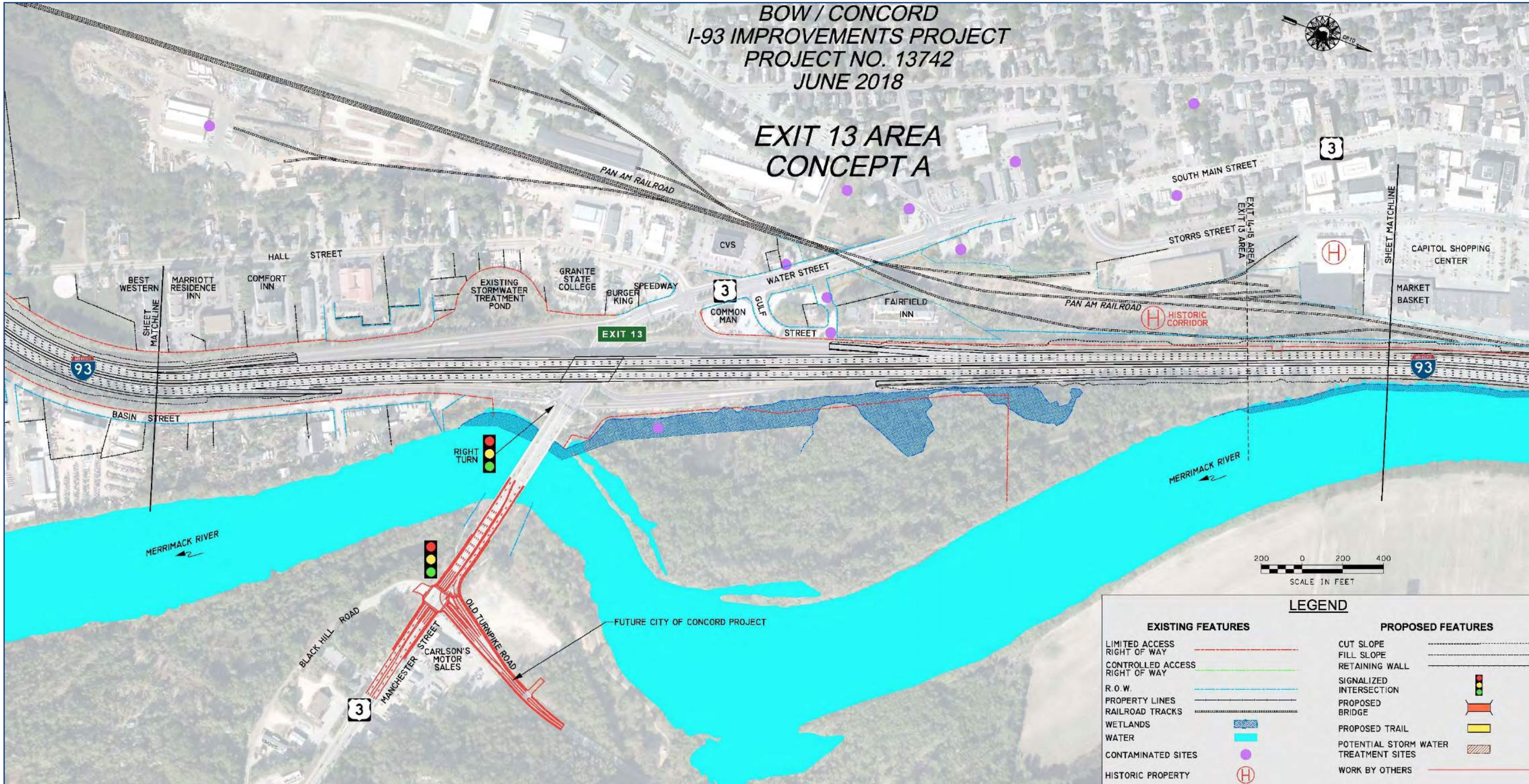


Figure 2.13 Exit 13 Area Concept B

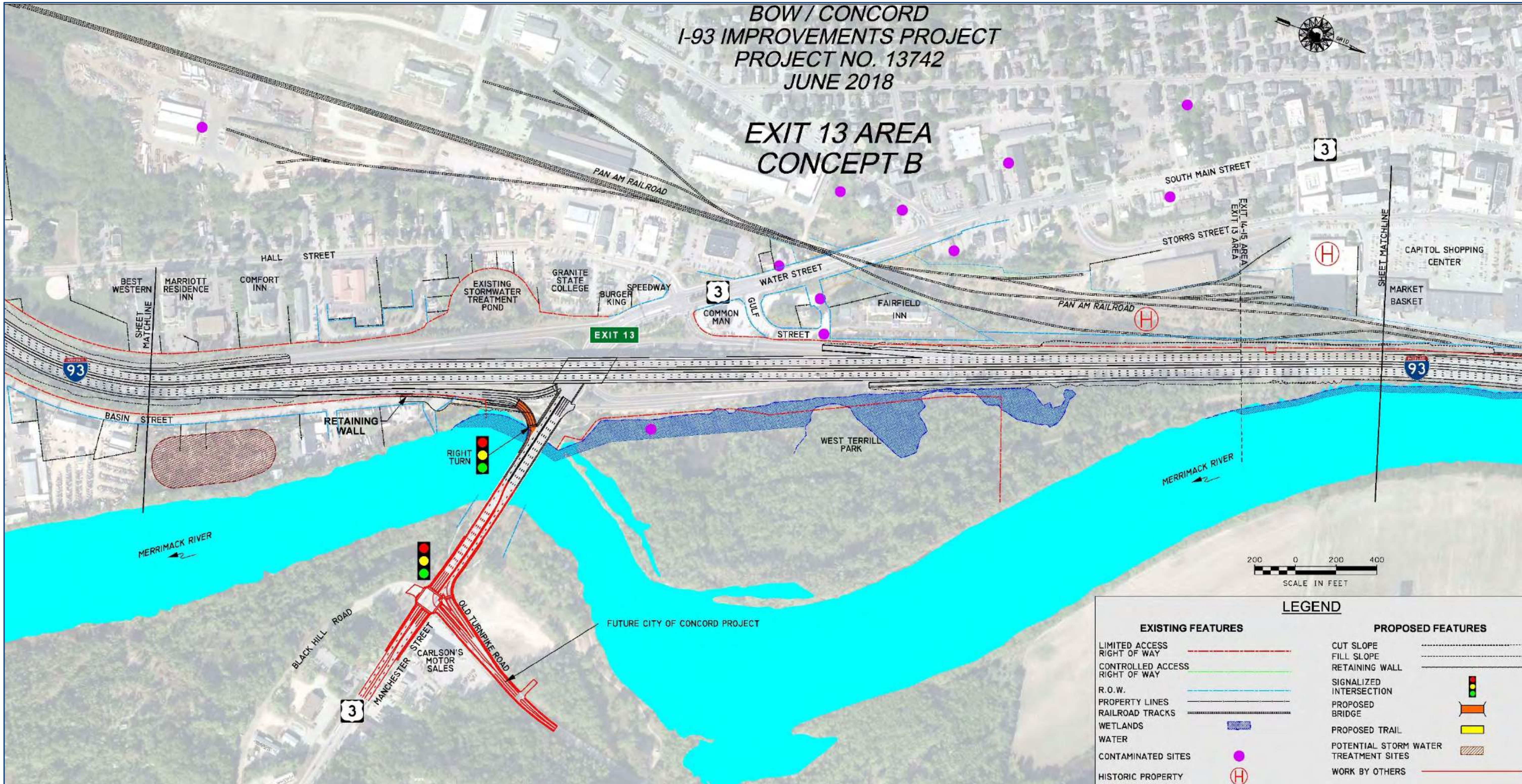


Figure 2.14a
Exit 14/15 Area Existing Conditions

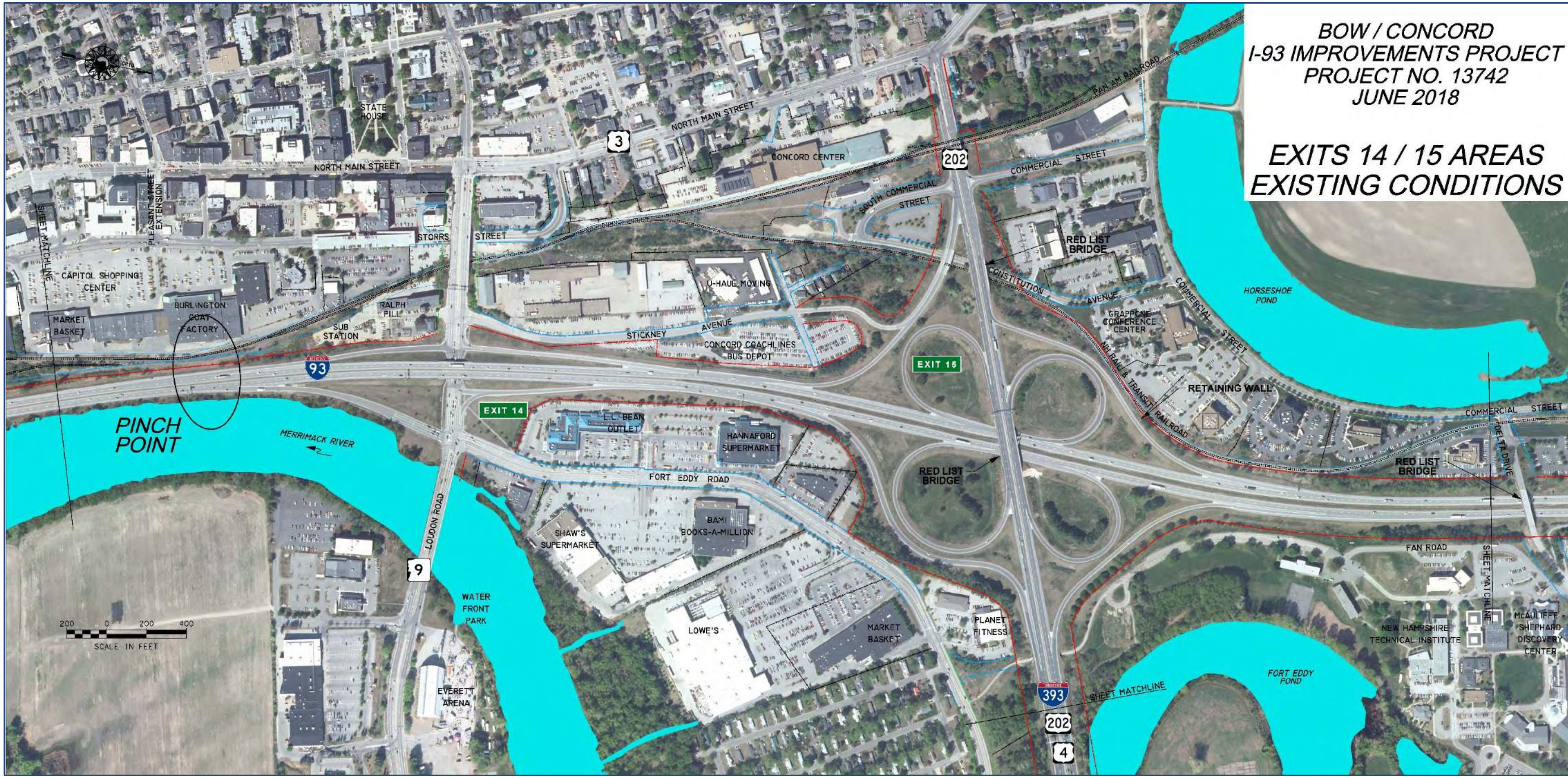


Figure 2.14b I-93 North Existing Conditions

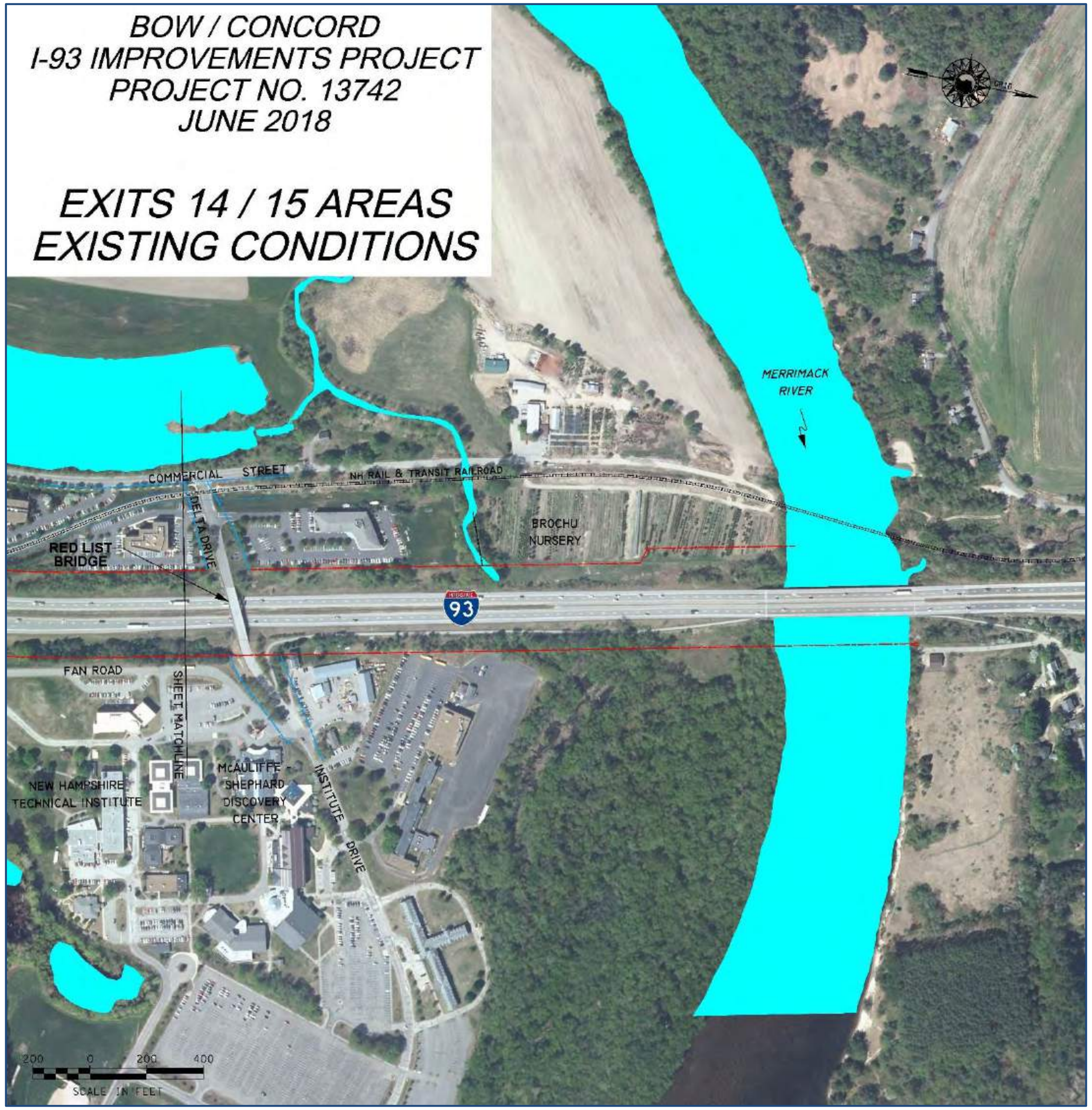


Figure 2.14c I-393 Exit 1 Existing Conditions

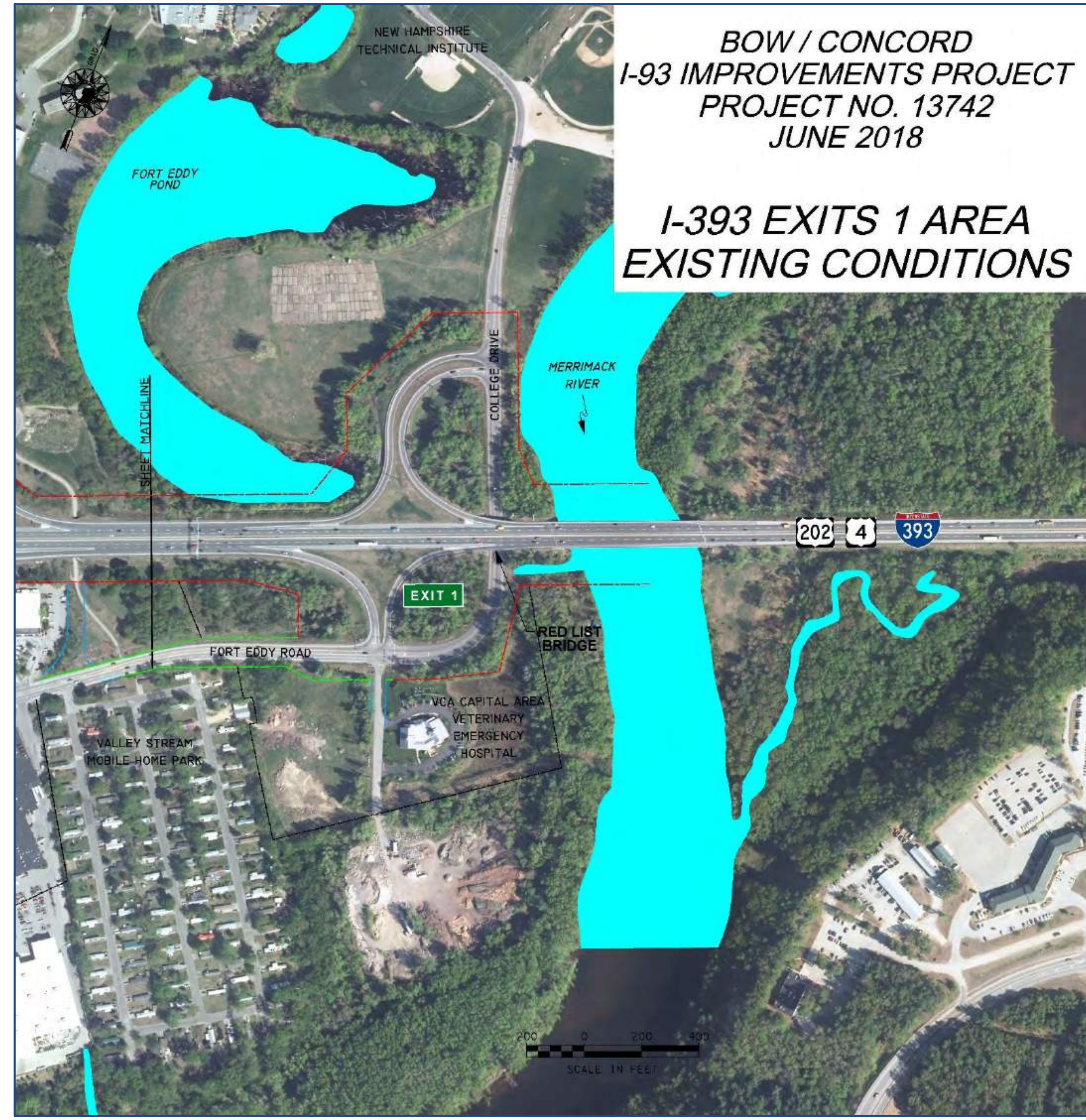


Figure 2.15a Exit 14/15 Concept D2

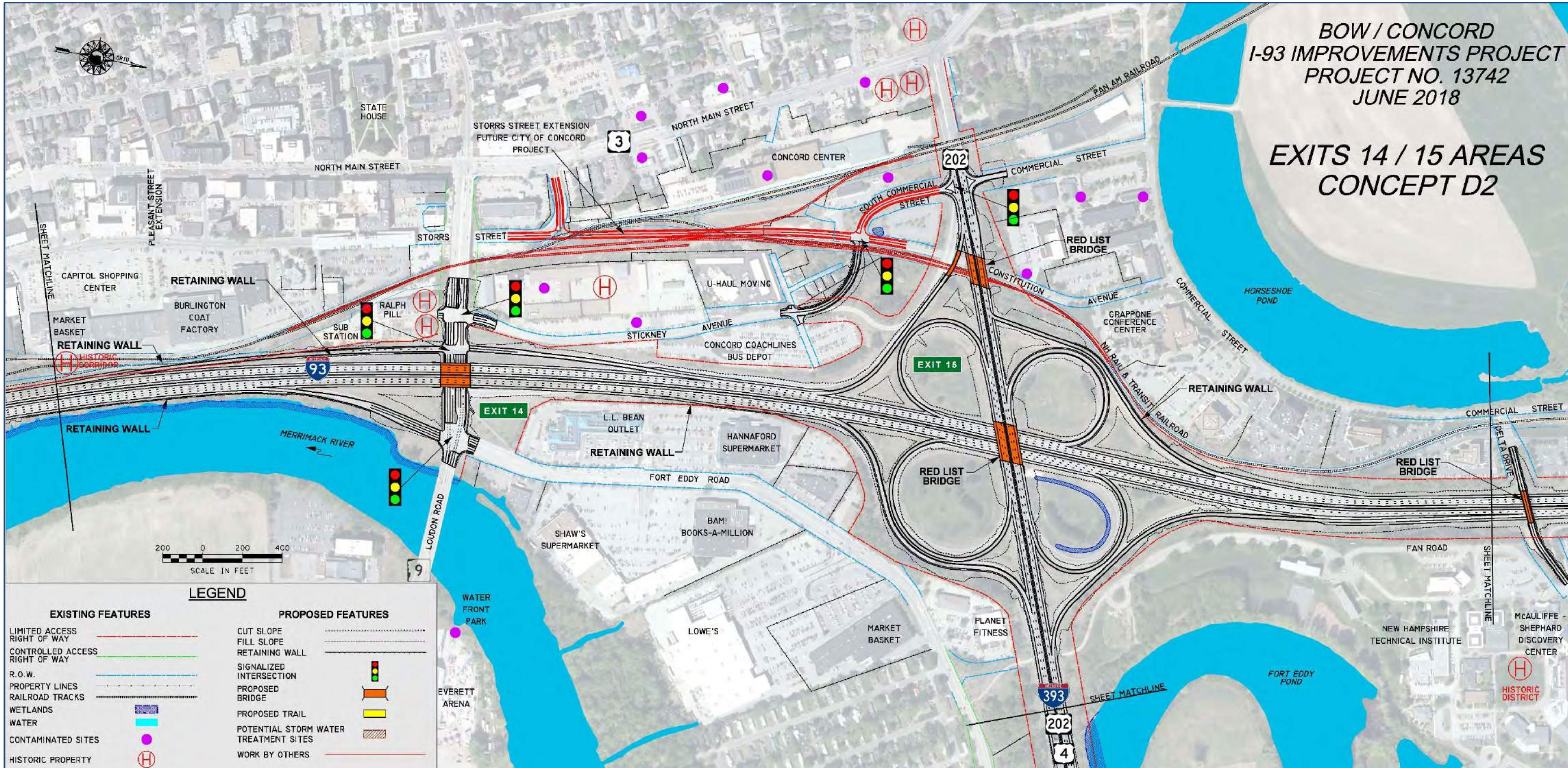


Figure 2.15bI-93 North Concept D2

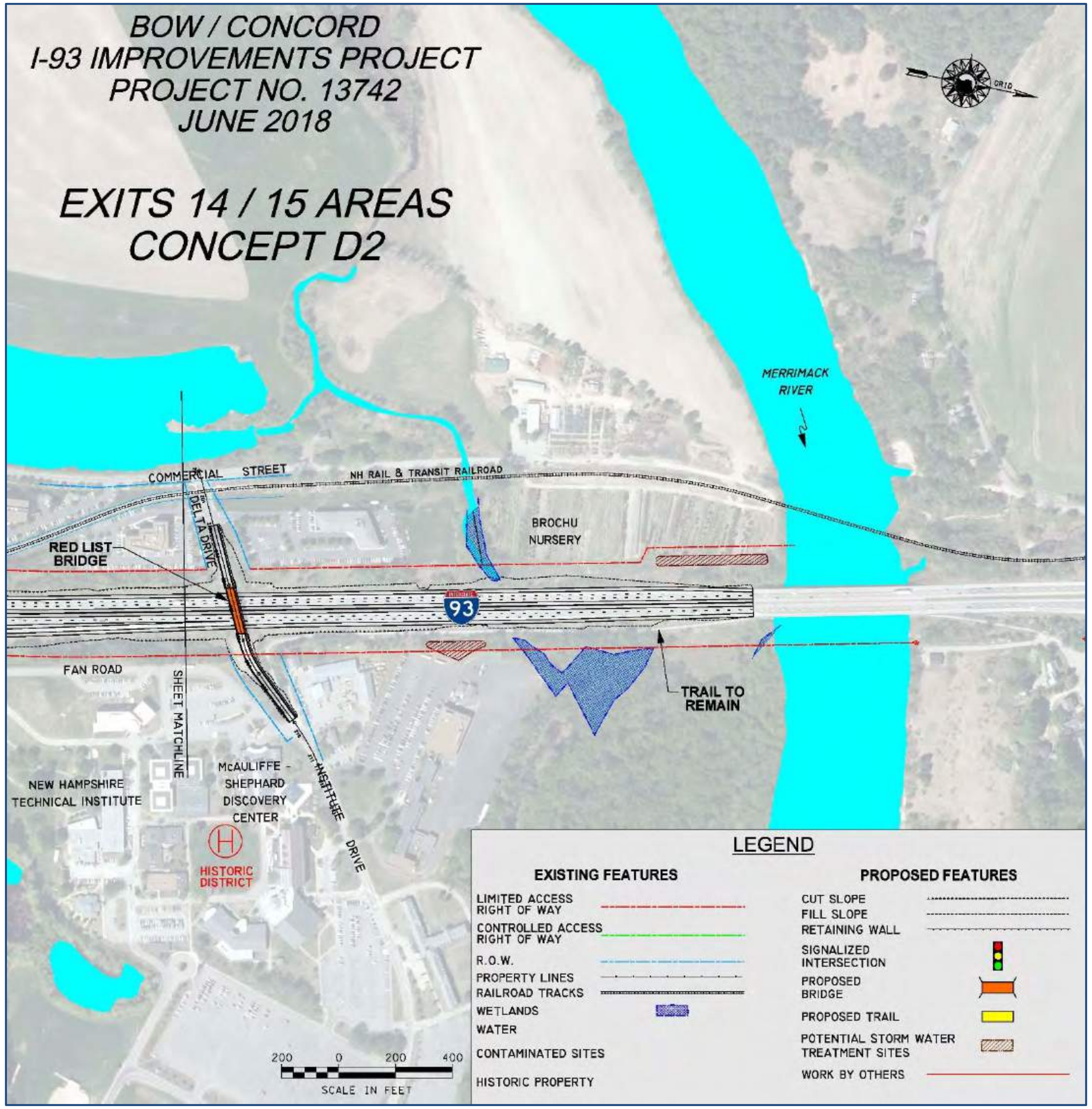


Figure 2.15c I-393 Concept D2

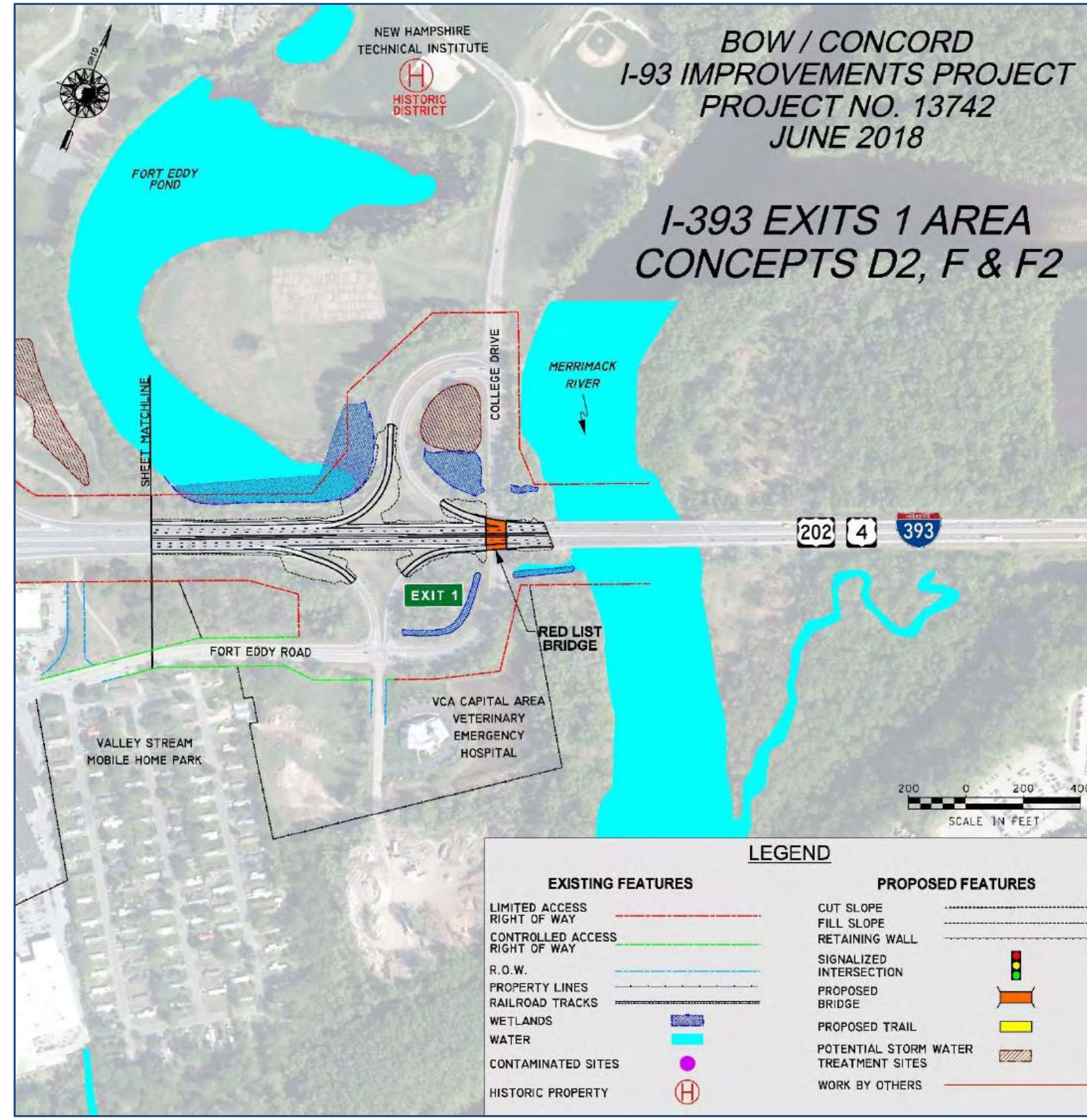


Figure 2.16a Exit 14/15 Concept F

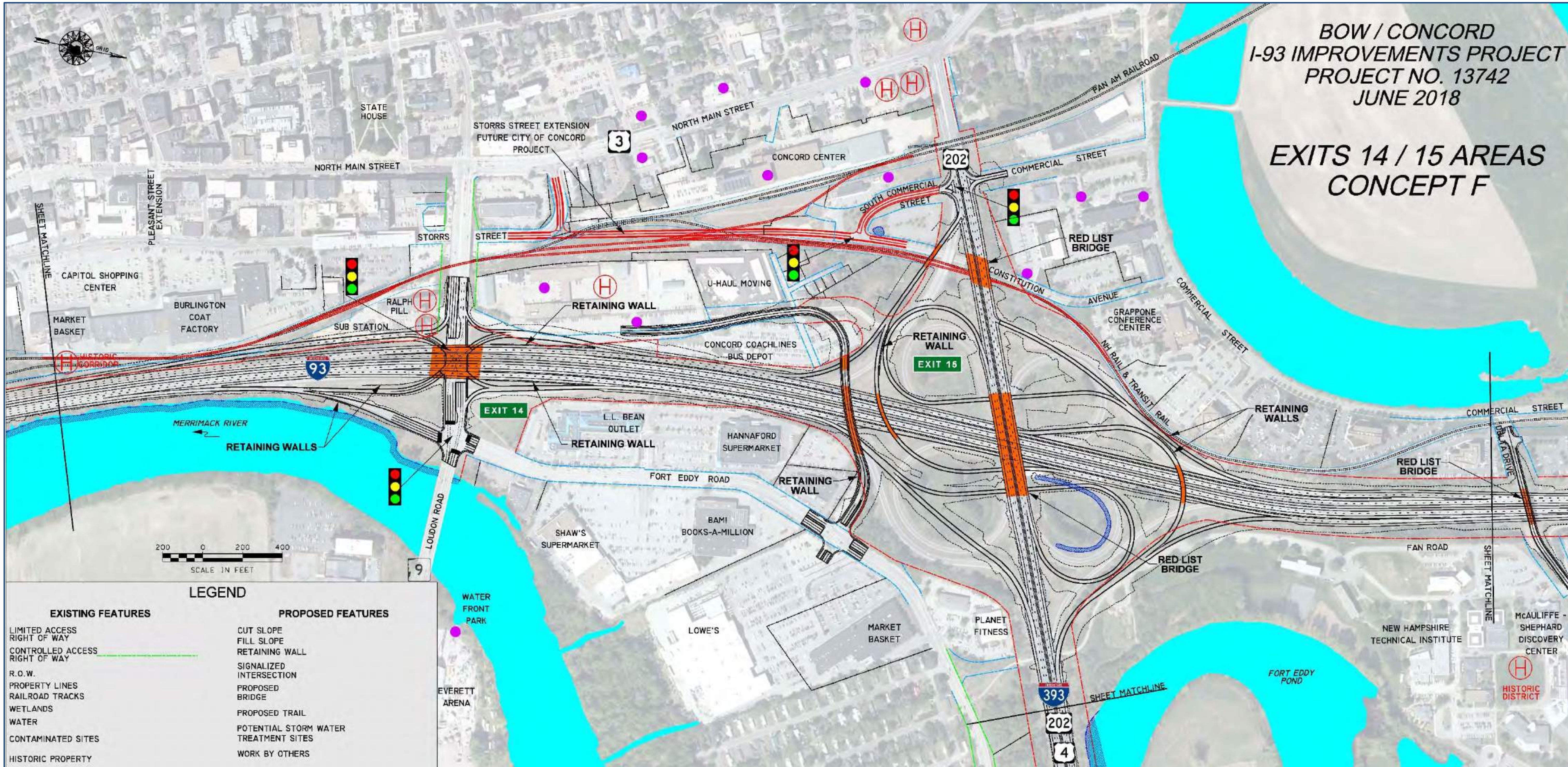


Figure 2.16b I-93 North Concept F

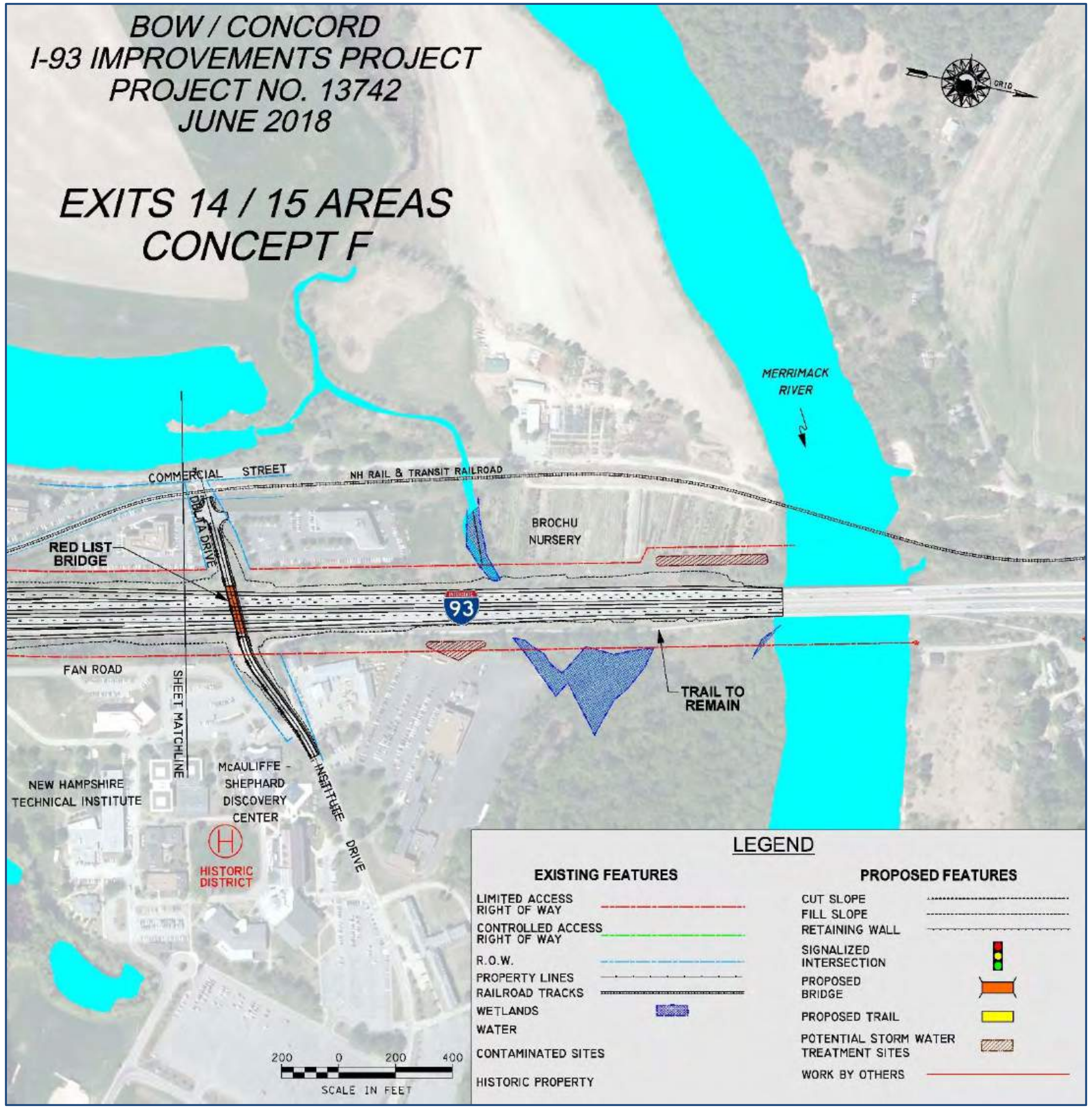


Figure 2.16c I-393 Concept F

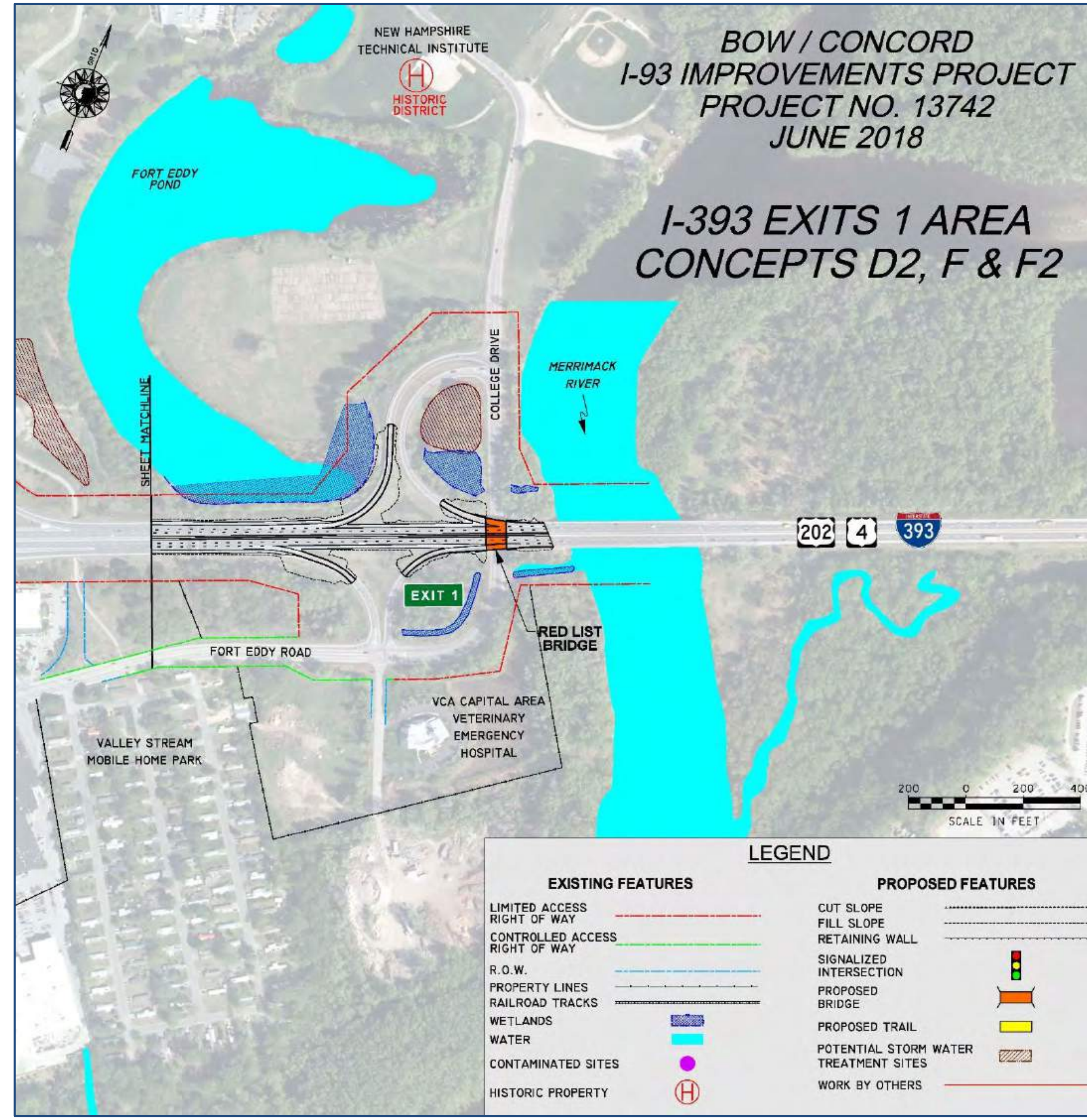


Figure 2.19a Exit 14/15 Concept F2

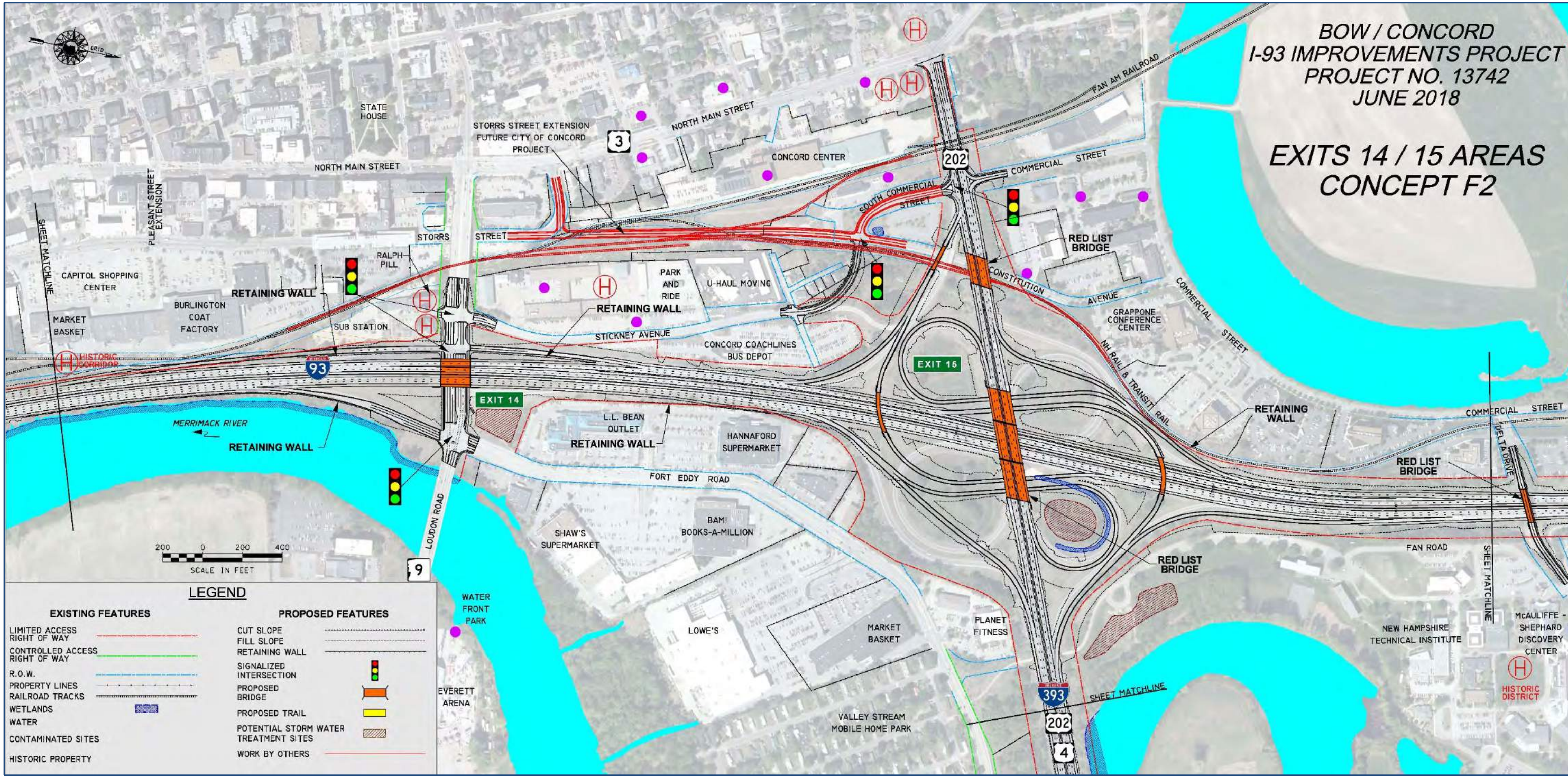


Figure 2.19b I-93 North Concept F2

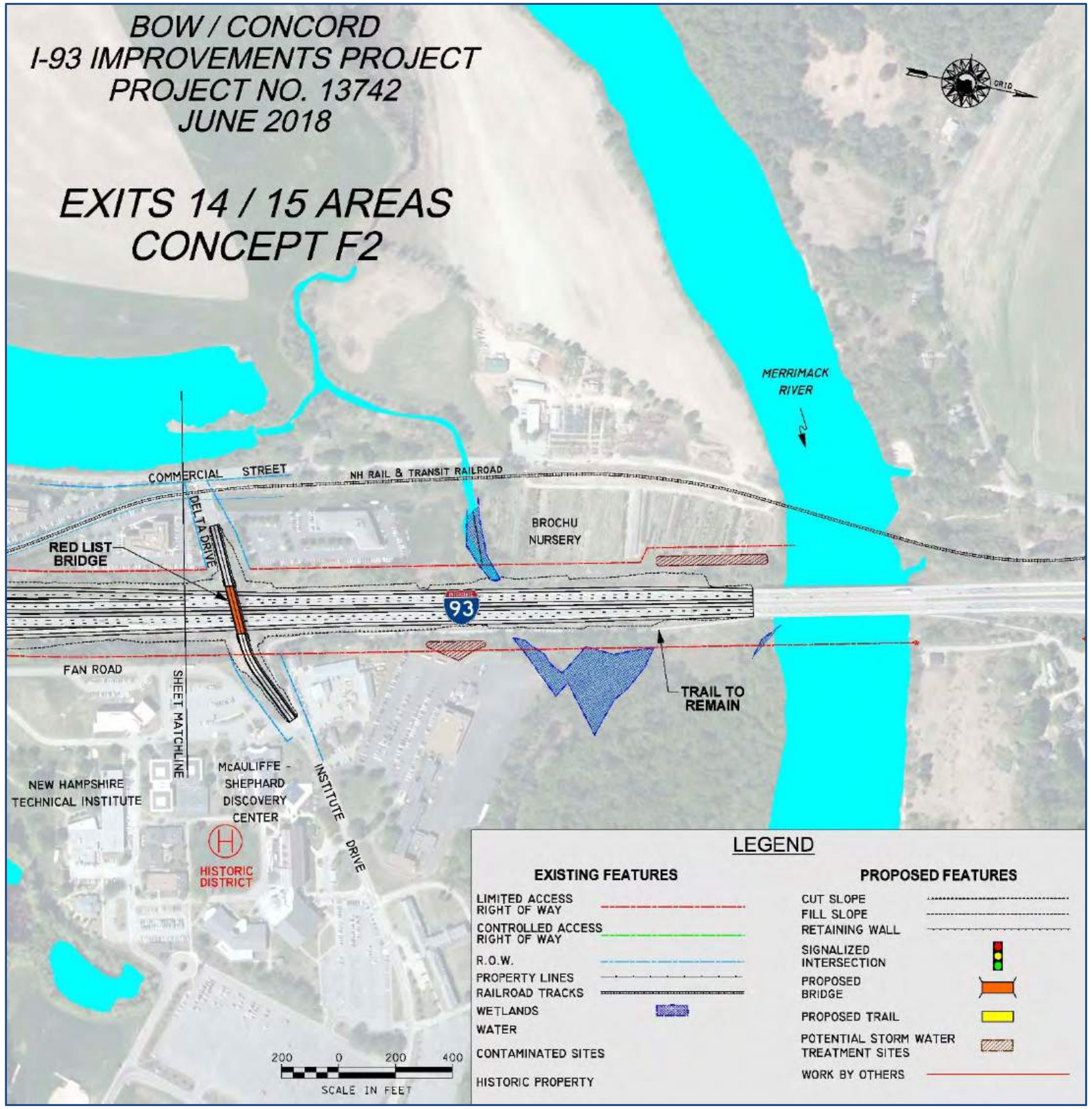


Figure 2.19c I-393 Concept F2

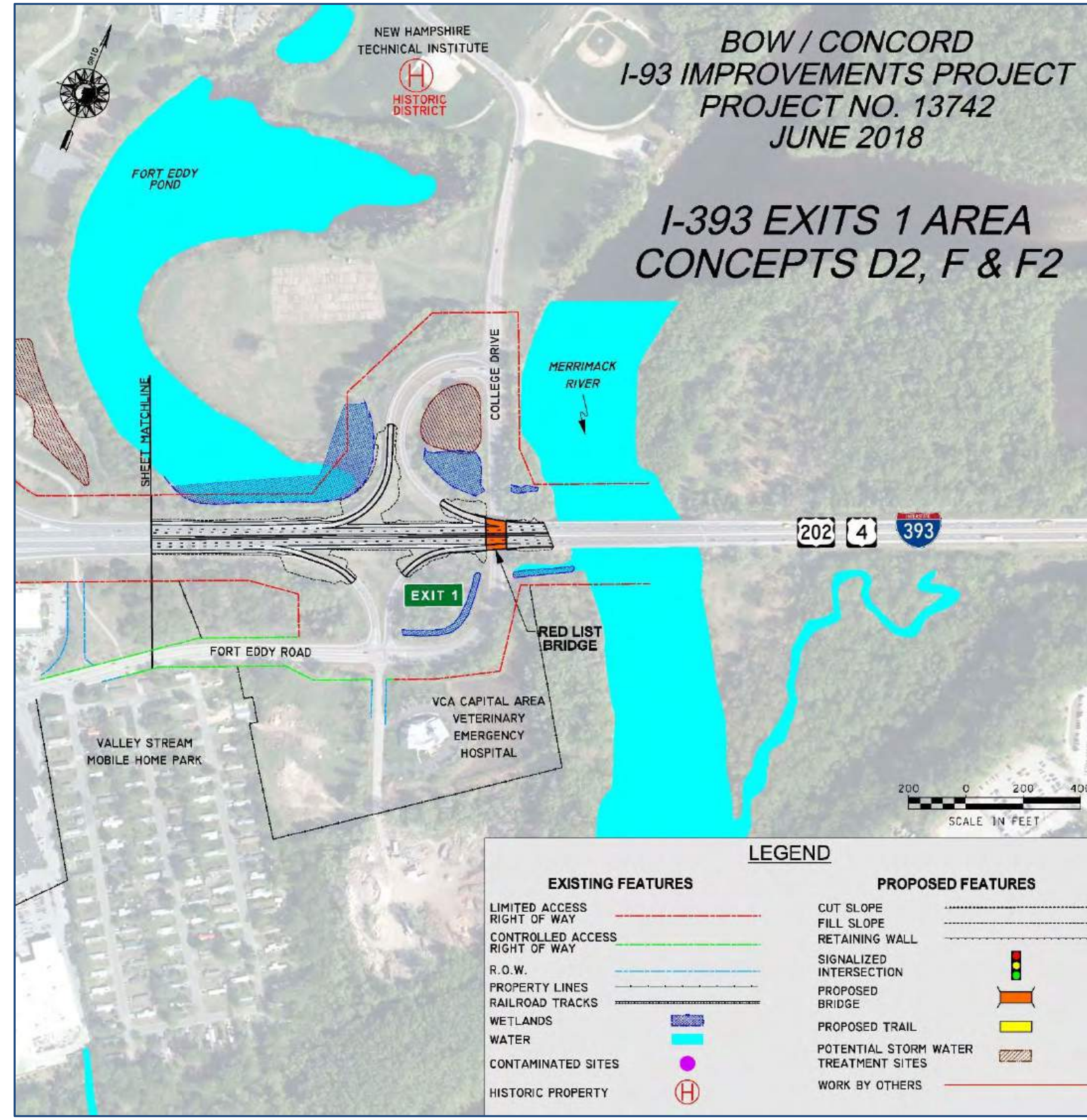


Figure 2.20a Exit 14/15 Concept O3

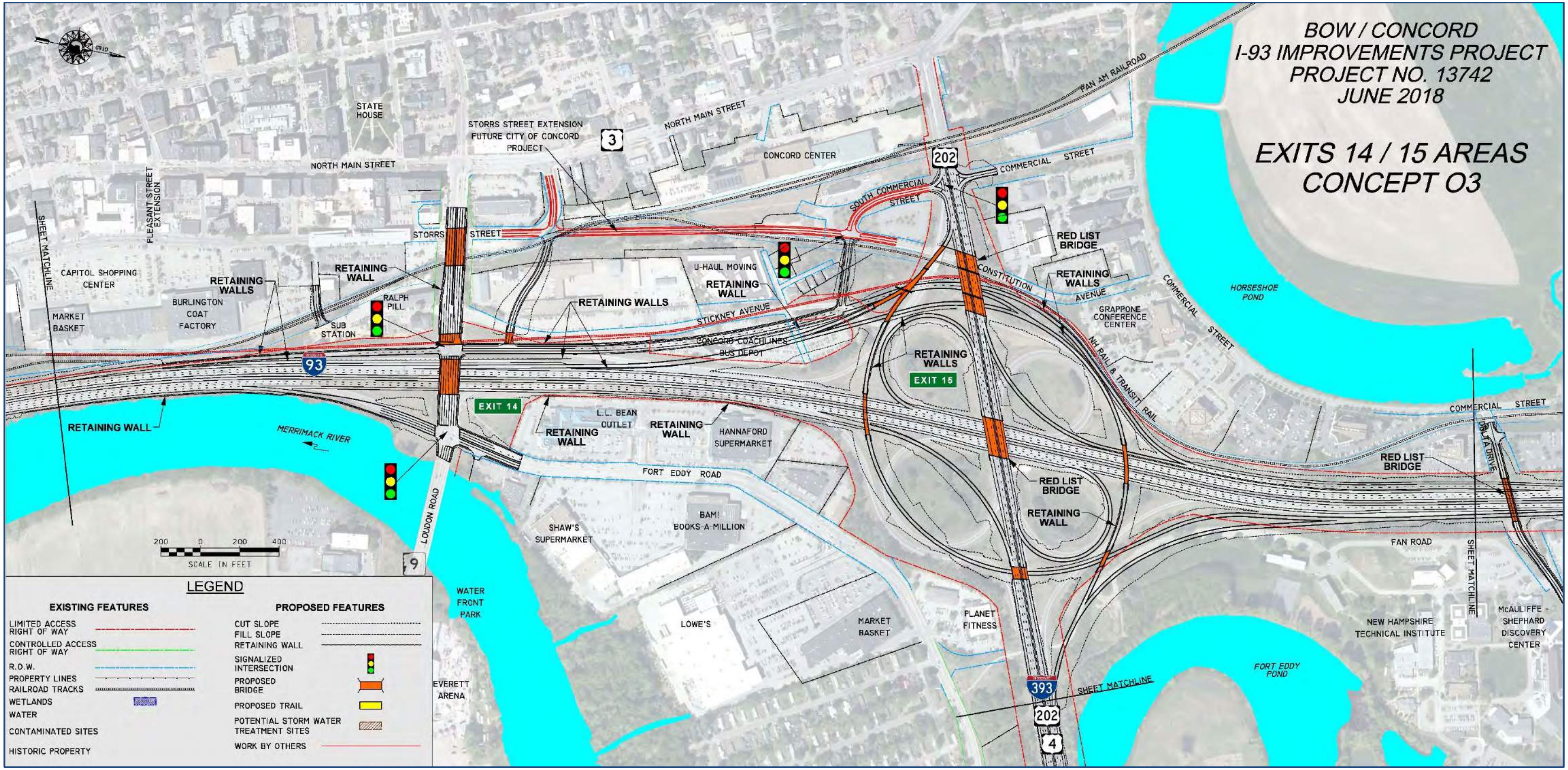


Figure 2.20b I-93 North Concept O3

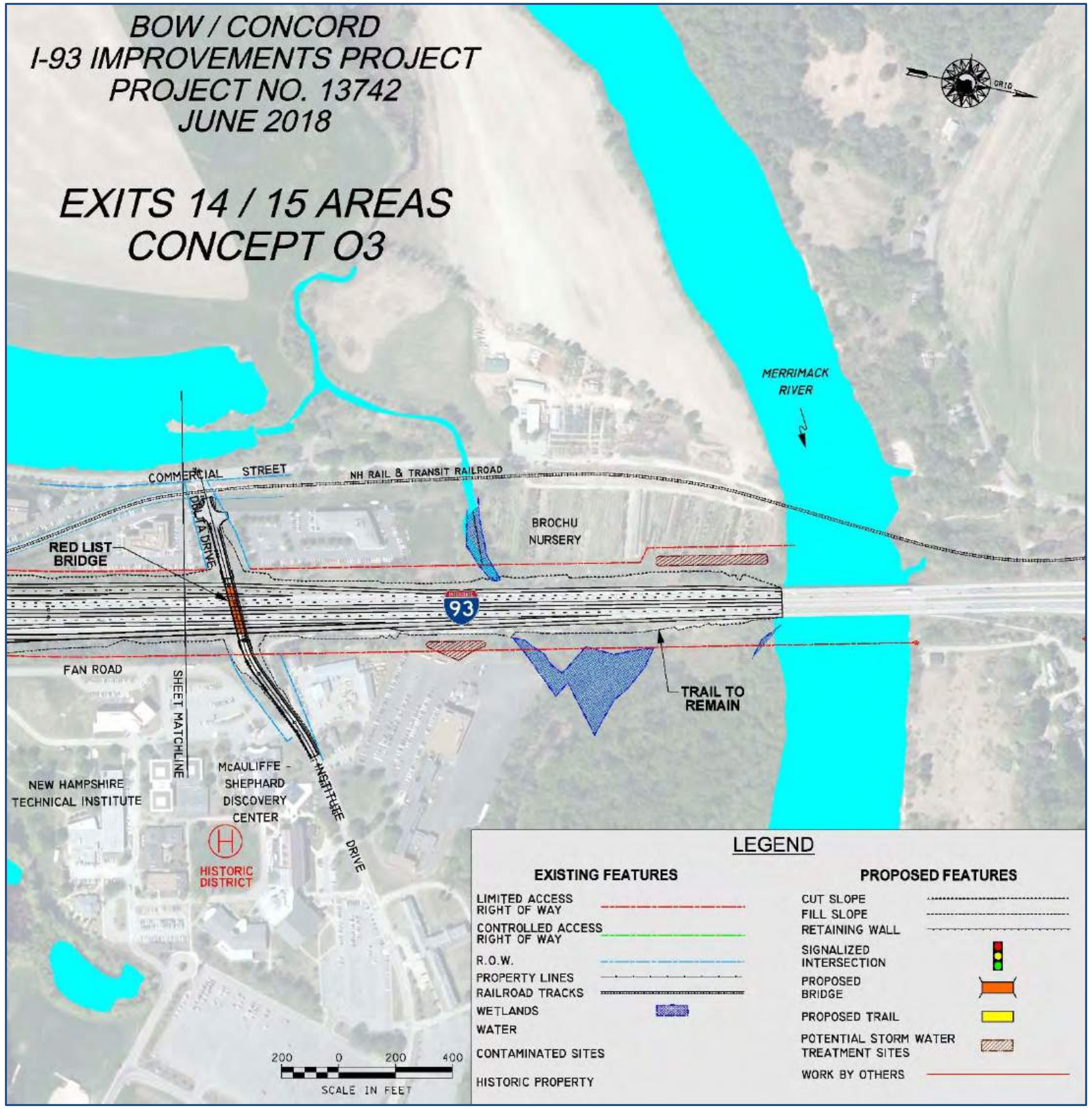


Figure 2.20c I-393 Exit 1 Concept O3

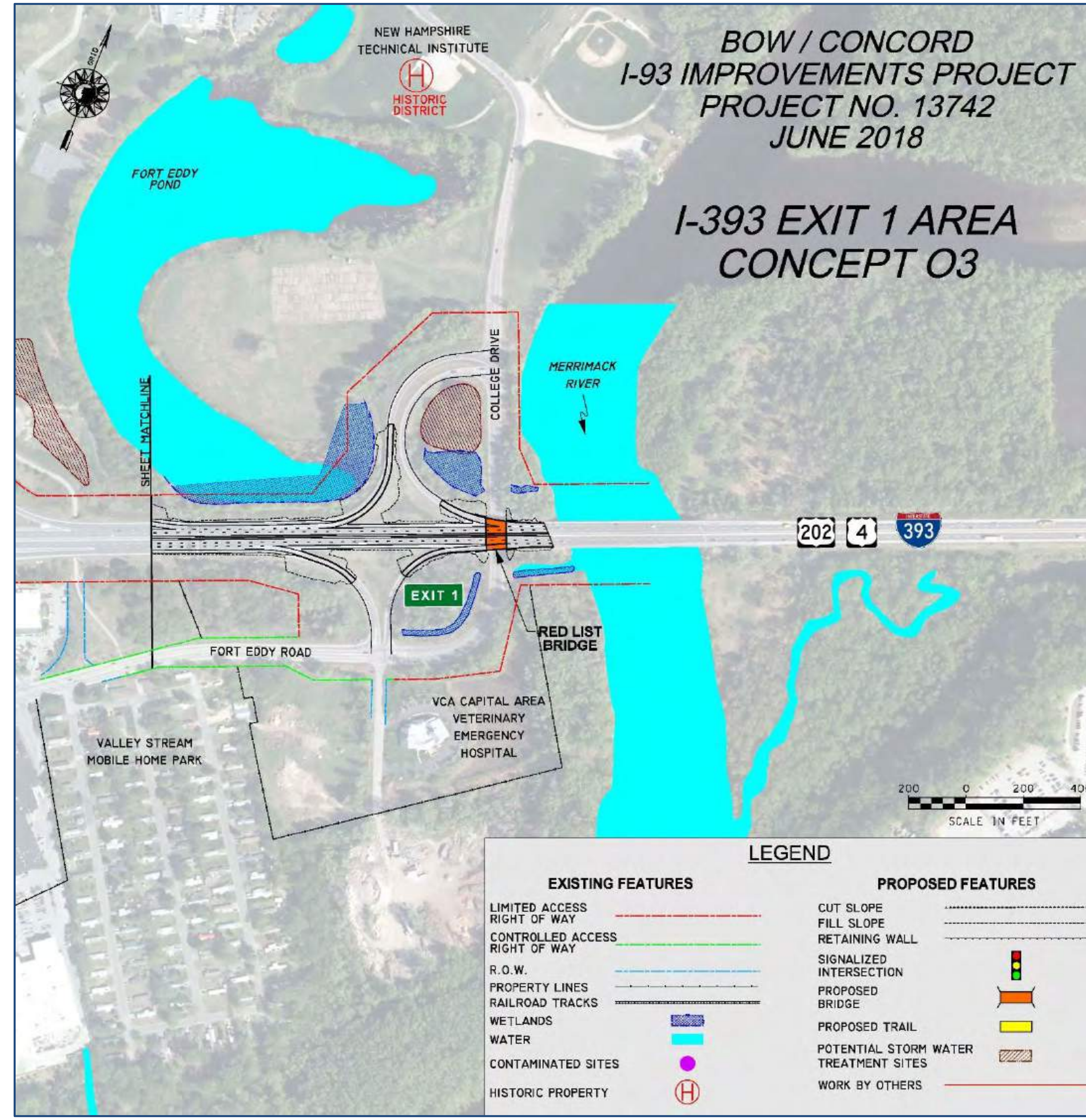
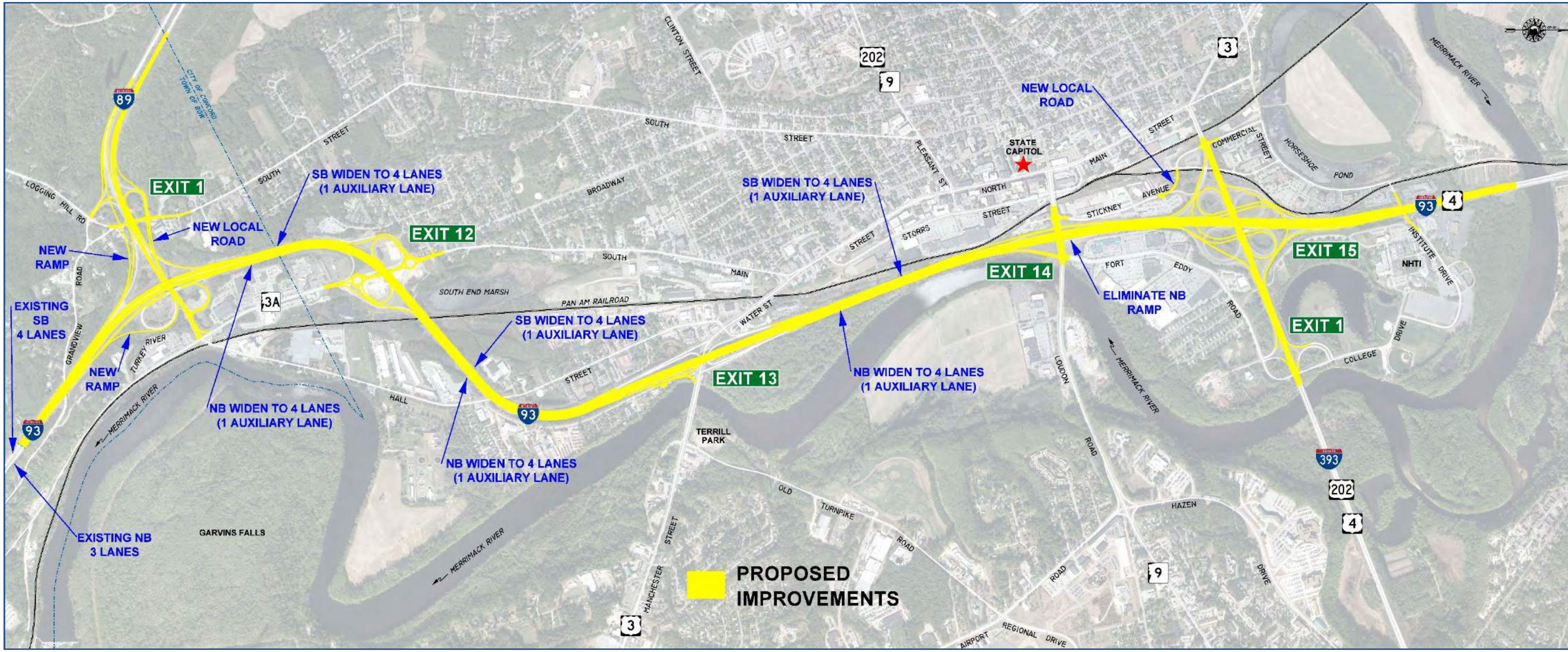


Figure 2.21 Preferred Alternative



Chapter 3
Affected Environment

3.1 Introduction

This chapter describes the existing social, economic, and environmental resources that could be affected by the various project alternatives. For resources that do not occur in the vicinity and could not be affected by the alternatives, documentation is provided and the resource is not included for further consideration. The impacts of the various project alternatives, including the preferred alternative, are evaluated against the affected environment in Chapter 4.

3.2 Traffic and Transportation

Interstate 93 (I-93) through Bow and Concord is a four-lane divided urban principal arterial highway with limited access. The 4.5-mile segment provides the primary north-south travel route for both regional and local traffic. It also facilitates key east-west travel by connecting I-89, I-393, US Route 4 and US Route 202. See **Figure 3.1 Project Transportation Elements** for an overview of the transportation elements of the project.

There are seven interchanges within the project limits, including two system interchanges connecting I-89 and I-393, and five service interchanges. The system interchanges connect I-93 to regional routes including I-89 and I-393. The service interchanges provide access to and from I-93 for the local roadway systems in Bow and Concord that provide access to key destinations, including the State capitol building and State office complexes.

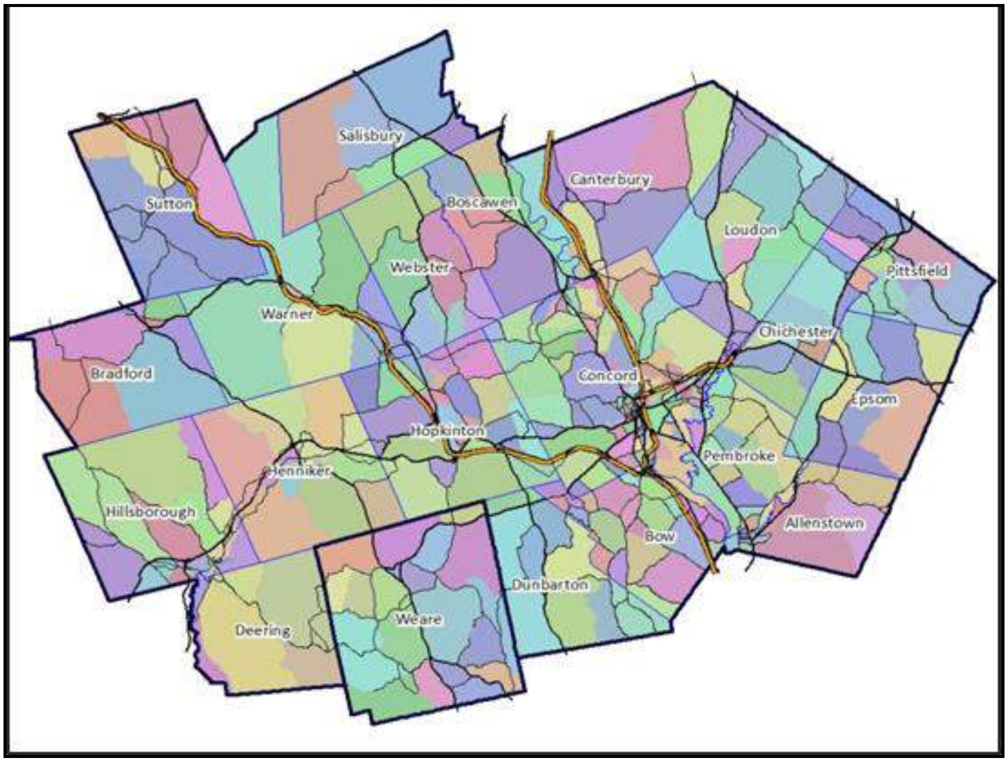
Other arterials within the project area that access I-93 include US Route 3, NH Route 3A, and NH Route 9. he Merrimack River runs along the east side of I-93 and there are crossings of the river at Exit 13 (US Route 3) and Exit 14 (NH Route 9).

This section summarizes the traffic data collection effort, existing operational conditions, vehicle crash research, and identifies existing infrastructure deficiencies along the I-93 project area.

3.2.1 Traffic Data Collection

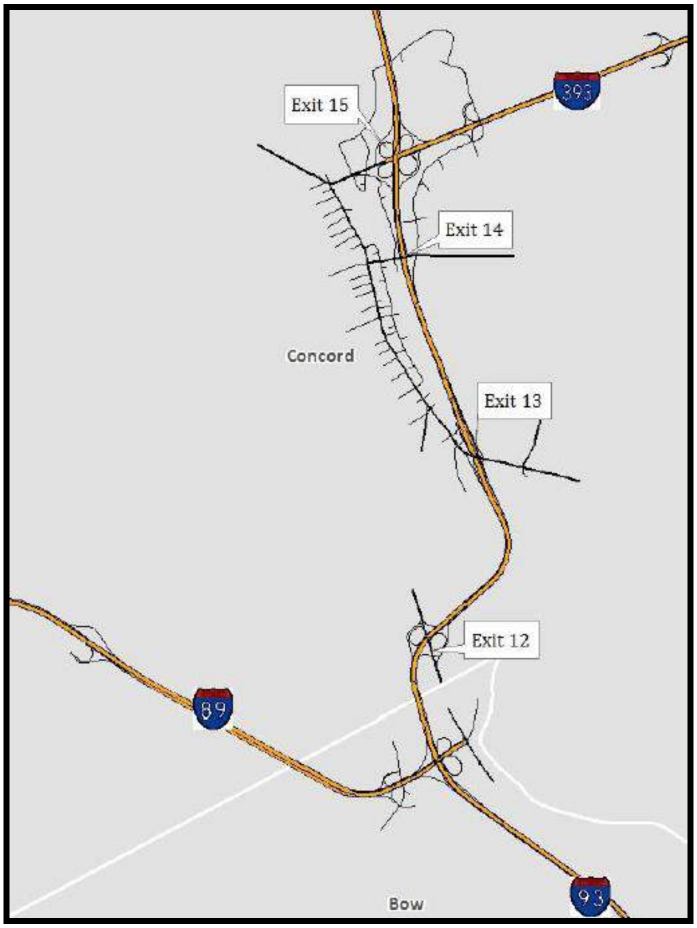
I-93 through Bow and Concord is a regionally significant corridor. Traffic data has been collected from both within the corridor and from outside the corridor. In cooperation with the Central New Hampshire Regional Planning Commission (CNHRPC), a regional del has been developed for the Central NH Region. The Regional Model includes the 20 communities that comprise the Central NH Region and the Town of Weare, which is part of the Southern NH region. The model was calibrated using actual traffic and land use data to emulate actual traffic conditions in the region. **Figure 3.2 Regional Model Limits** depicts the limits of the Regional Model.

Figure 3.2 Regional Model Limits



To appropriately evaluate the complex roadway network that comprises the I-93 corridor, a Microsimulation Model has also been developed for the project area. The Microsimulation Model is a detailed model of the corridor that provides more detailed information on the interaction of traffic between and within the interchanges. Information from the Regional Model is used to generate estimates for traffic entering and exiting the Microsimulation Model boundary. **Figure 3.3 Microsimulation Model Limits** depicts the limits of the Microsimulation Model. The roadways shown in the figure are those included in the Microsimulation Model, and include US 3, NH 3A, and NH 9, as well as local intersecting streets.

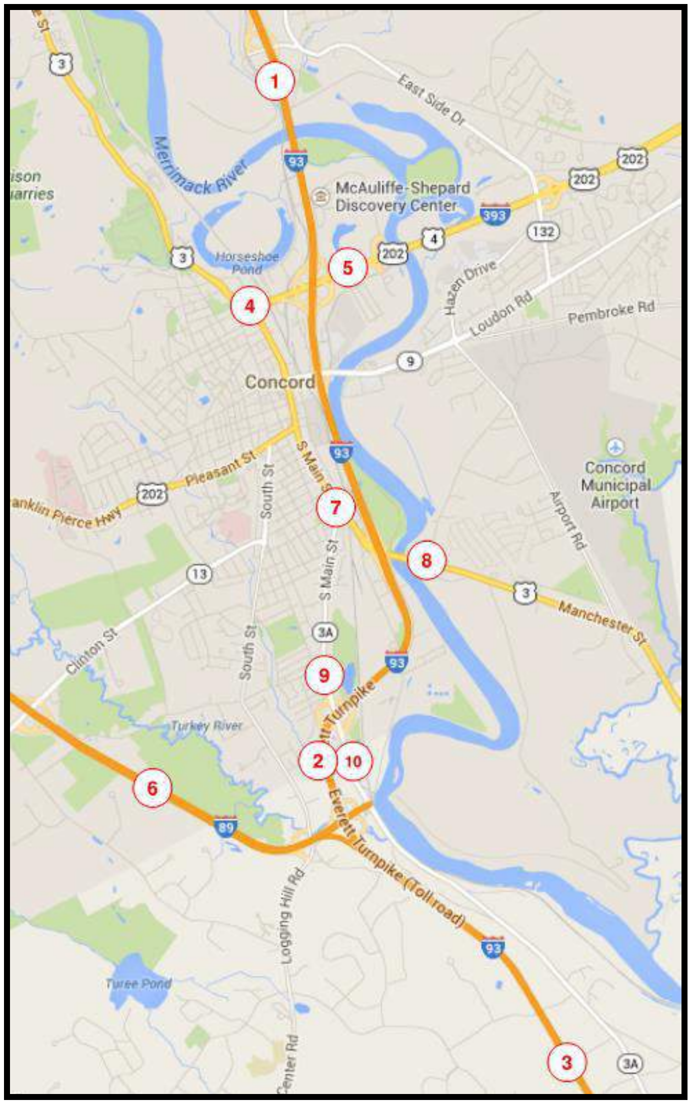
Figure 3.3: Microsimulation Model Limits



3.2.1.1 Origin-Destination Study

In addition to target traffic volumes, origin-destination data was collected along the I-93 corridor at the 10 locations shown below in **Figure 3.4 Bluetooth Monitoring Locations**, from April 30, 2014 through May 7, 2014. Unique and anonymous media access control identification numbers associated with passing Bluetooth devices were recorded at the Bluetooth monitoring stations shown in **Figure 3.4** and used to inform the distribution of traffic origin-destination pairs between interchanges. This origin-destination study was developed specifically for the project and was conducted to gain a better understanding of the traffic patterns in the project area, which aided in the calibration of the traffic models.

Figure 3.4: Bluetooth Monitoring Locations



3.2.1.2 Vehicle Classification

Vehicles are classified by their type (*e.g.* passenger car, single-unit truck, tractor-trailer, or bus) because different vehicles impact the environment in different ways. Air quality and noise, in particular, are influenced by the mix of vehicle types in the project area.

The percentage of trucks (vehicles with 6 or more axles) is higher on I-93 through Bow and Concord than on other classes of roadways in the area. A key function of the interstate system is to move goods and this is reflected in the high percentage of trucks observed. **Table 3.1 Percentage of trucks** outlines the percentage of trucks on I-93 and I-89 in the project area.

Table 3.1 Percentage of Trucks

Roadway	Direction	Percent Trucks	
		AM	PM
I-93	Northbound	12%	4%
I-93	Southbound	4%	5%
I-89	Northbound	12%	6%
I-89	Southbound	5%	6%

3.2.1.3 Commuting Patterns

The City of Concord is a major employment center in Central New Hampshire. As the State Capitol, the City is home to many government agencies, and the State of New Hampshire is the top employer in the City. In addition, the City supports major employers in the medical, retail, financial, educational, and industrial sectors. Therefore, during morning commute hours, traffic is heading into Concord from all directions. Two major commuter destinations are the state campuses near the NH Hospital Grounds in Central Concord and Hazen Drive on The Heights. During afternoon commute hours traffic is heading away from Concord as workers leave for the day.

Throughout the year, I-93 through Bow and Concord also serves as the dominant north-south corridor in New Hampshire for access to the White Mountains and the Lakes Region, both of which are major tourist and recreational destinations throughout the year. Refer to Section 3.2.3 for further details on the traffic conditions within the project area.

3.2.2 Traffic Volumes

This section presents the existing traffic conditions along I-93 through Bow and Concord. The volume of traffic counted, growth trends, and traffic operations along the corridor and at each interchange are presented and discussed.

3.2.2.1 Traffic Volumes

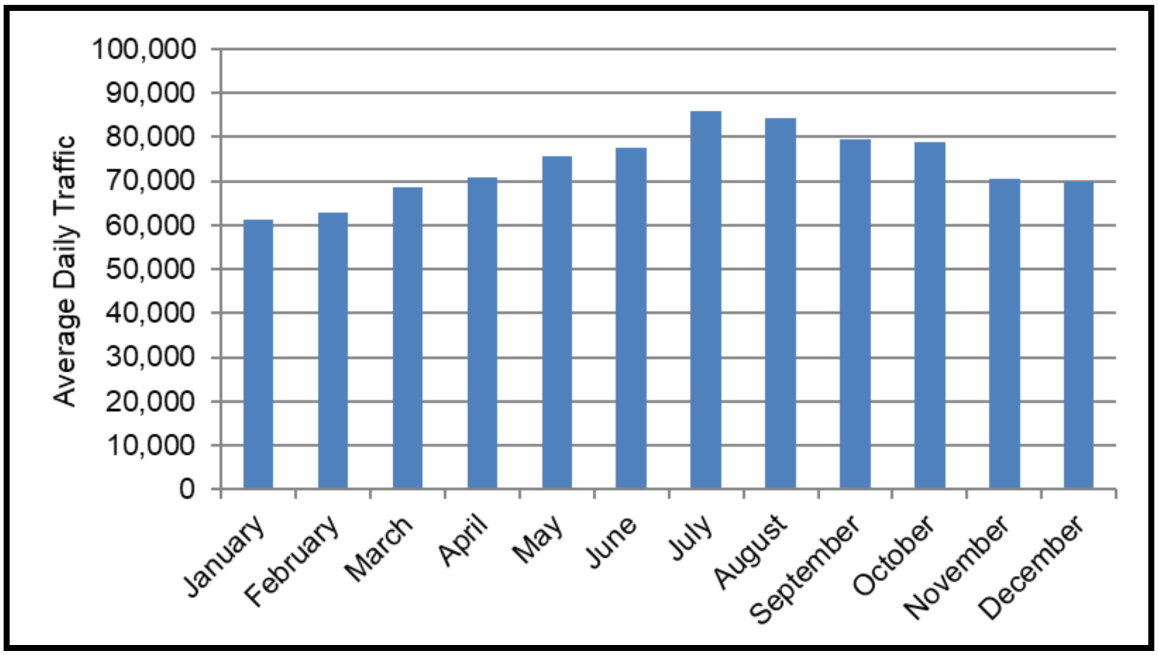
The automatic traffic volume recorder counts, NHDOT periodic counts, and counts conducted specifically for this project were used in the development of the Microsimulation Model discussed in Section 3.2.1. The Microsimulation Model is a peak hour model that uses a design hour for both morning (AM) and afternoon (PM) peak hour traffic. The design hour represents the average peak hour of the peak month. For this project, the peak AM month is September and peak PM month is

August. Therefore, the AM design hour represents the average AM peak hour condition for the month of September and the PM design hour represents the average PM peak hour for the month of August. **Figure 3.5 Base Year 2014 Peak Hour Traffic Volumes** depicts the Base Year 2014 AM and PM peak hour volumes within the project limits.

3.2.2.2 Traffic Volume Trends

The NHDOT maintains an automatic traffic volume recorder station along I-93 between Exits 12 and 13 (Station 1099011/1099012). This recorder station provides counts for every hour of the day, all year. **Figure 3.6 I-93 Monthly Variation between Exits 12 and 13 (2015)** below depicts the monthly variation in traffic volumes (adjusted average daily traffic) at this location.

Figure 3.6 I-93 Monthly Variation between Exits 12 and 13 (2015)

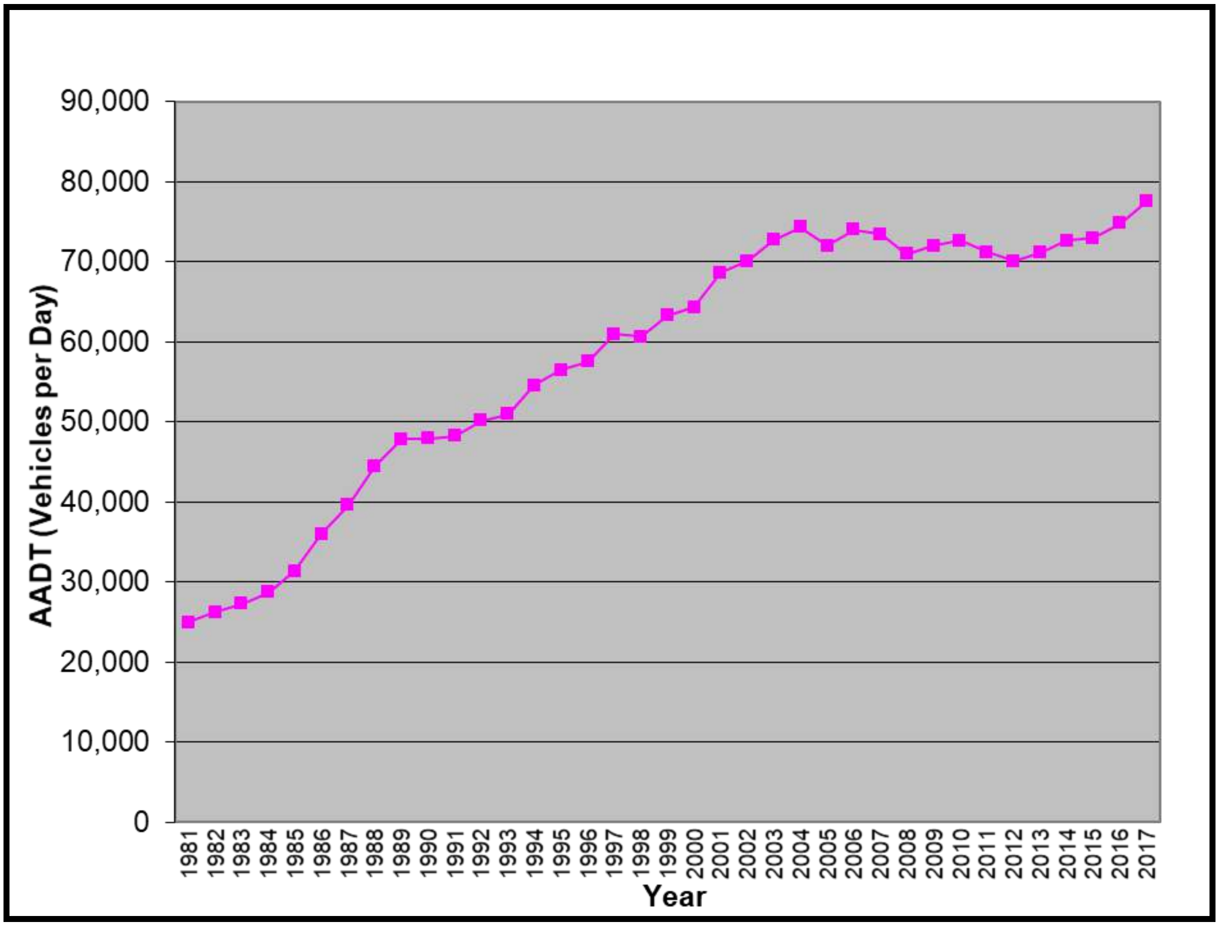


Source: NHDOT Traffic Volume Reports, 2015

In 2015, the peak month for traffic on I-93 was July with an adjusted average daily volume of 85,876 vehicles per day (vpd). The recently published volume for July 2016 shows a 1.36% increase over 2015 with an average of 87,046 vpd. July represents a full summer month with the July 4th holiday as a major travel event. On July 14, 2017 the total volume on I-93 during that day surpassed 100,000 vehicles. July represents a 28% increase in traffic over the lowest month, which was December (61,257 vpd) in 2015. Although the winter months have peak traffic due to winter sport activities in the White Mountains and Lakes Region, it is important to note the fall months have higher traffic volumes due to Columbus Day and foliage season.

In addition to the monthly variation of traffic on I-93, the automatic traffic volume recorder station along I-93 between Exits 12 and 13 also provides data on the historic growth trends of traffic in the corridor. **Figure 3.7 I-93 AADT between Exits 12 and 13 (1981 to 2017)** below is a graph showing the AADT volumes between 1981 and 2017.

Figure 3.7 I-93 AADT between Exits 12 and 13 (1981 to 2017)



Source: NHDOT Traffic Volume Reports

Figure 3.7 illustrates that the growth of traffic on I-93 has steadily increased for more than 20 years before leveling off in 2004. The average annual growth rate was approximately 7.5% between 1981 and 1990, and approximately 3.2% between 1990 and 2004.Traffic volumes on I-93 have tripled since 1981. From 2004 until 2012, however, the average annual growth rate was slightly negative (-0.7%). From 2012 to 2017, traffic volumes increased with an average annual growth rate of 2.1%.

3.2.3 Existing Traffic Operations

The volume of traffic on a highway is not the only indicator of the quality of the flow of traffic. In the case of I-93 through Bow and Concord, the number and spacing of the interchanges has a definite impact on the quality of travel. The *Highway Capacity*

Manual, 6th Edition (HCM) contains procedures for estimating the operating conditions of a roadway based on level-of-service (LOS). LOS is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream.

The HCM divides freeway facilities into three types of segments:

1. Basic – sections with no ramps
2. Merge or Diverge – 1,500-foot sections with either an on-ramp or an off-ramp
3. Weaving – sections with an on-ramp followed within 2,500 feet or less by an off-ramp.

Freeway LOS for all three segment types is based on vehicle density per lane, which is calculated by dividing the number of vehicles by the number of lanes and the average speed of those vehicles. There are six levels of service (LOS A to F) defined by the flow of traffic. **Figure 3.8 LOS Examples for Basic Freeway Segments** illustrates the six levels of LOS for a basic freeway using photographs to show the various traffic conditions. **Table 3.2 LOS Criteria for Freeway Segments** shows the LOS Criteria for each segment type.

Figure 3.8 LOS Examples for Basic Freeway Segments

LOS A: Free Flow Operations

LOS B: Reasonably Free Flow Operations

LOS C: Flow with Speeds near Free Flow

LOS D: Declining Speeds with increased flow

LOS E: At or near capacity

LOS F: Unstable flow

Source: Highway Capacity Manual, 6th Edition

Table 3.2 LOS Criteria for Freeway Segments

LOS	Characteristics	Density (Passenger cars per mile per lane)		
		Basic	Weaving	Merge/Diverge
A	Free-flow operations	≤ 11	0-10	≤ 10
B	Reasonably free-flow	> 11-18	> 10-20	> 10-20
C	Speeds near free-flow	> 18-26	> 20-28	> 20-28
D	Speeds decline	> 26-35	> 28-35	> 28-35
E	Operation at capacity	> 35-45	> 35-43	> 35
F	Breakdown/Unstable flow	Demand Exceeds Capacity OR Density > 45	> 43, OR Demand Exceeds Capacity	Demand Exceeds Capacity

Freeway segments with LOS A to LOS C are considered acceptable. LOS D is considered acceptable during peak periods as the cost to make improvements to meet LOS C are typically unjustifiable. LOS E and LOS F are considered unacceptable with improvements necessary to provide an acceptable level of service.

I-93 within the project limits has few “Basic” freeway segments because the interchanges are close to one another. The 1,500-foot “Merge” and “Diverge” segments overlap between each interchange from I-89 to Exit 14. Between Exits 14 and 15, within Exit 15, and northbound at the I-93/I-89 interchange, there are “Weaving” segments as auxiliary lanes exist. The “Basic” segments exist within the interchanges, Exit 12, 13 and 14, and southbound at the I-93/I-89 interchange.

The traffic operations analyses for this project were developed using the project Microsimulation Model. The results of the freeway analyses are summarized in **Table 3.3a and 3.3b 2014 Existing Conditions I-93 Freeway Segments for AM/PM Peak Period (Northbound and Southbound)**. Those segments with LOS E or F are highlighted in red, indicating that improvements are necessary. A CD Road is a “Collector Distributor” Road, which is a roadway that runs parallel to the freeway.

Table 3.3a 2014 Existing Conditions I-93 Freeway Segments for AM/PM Peak Period (Northbound)

			AM/PM Peak Period		
I-93 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
I-89 Off ramp	Northbound	Diverge	18/21	65/64	B/C
At I-89	Northbound	Basic	24/26	52/52	C/D
I-93/I-89 Weave	Northbound	CD Weaving	41/38	30/31	E/E
I-89 On ramp	Northbound	Merge	44/41	35/40	E/E
Exit 12 Off ramp S	Northbound	Diverge	44/41	44/45	E/E
Exit 12 Off ramp N	Northbound	Diverge	42/39	46/49	E/E
Exit 12 On ramp	Northbound	Merge	49/43	39/44	F/E
Exit 13 Off ramp	Northbound	Diverge	60/44	34/48	F/E
Between Exit 13 Ramps	Northbound	Basic	27/35	54/51	D/E
Exit 13 On ramp	Northbound	Merge	33/54	46/31	D/F
Exit 14 Off ramp	Northbound	Diverge	36/51	47/42	E/F
Between Exit 14 Ramps	Northbound	Basic	20/34	54/51	C/D
Between Exit 14 & 15	Northbound	Weaving	23/44	52/45	C/E
Exit 15 Weave	Northbound	Weaving	21/37	48/46	C/E
Exit 15 On ramp	Northbound	Merge	11/29	59/53	B/D
North of Exit 15	Northbound	Basic	13/31	58/53	B/D

Table 3.3b 2014 Existing Conditions I-93 Freeway Segments for AM/PM Peak Period (Southbound)

			AM/PM Peak Period		
I-93 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
North of Exit 15	Southbound	Basic	34/19	52/57	D/C
Exit 15 Off ramp	Southbound	Diverge	45/20	41/55	F/C
Exit 15 Weave	Southbound	Weaving	59/37	35/42	F/E
Between Exit 14 & 15	Southbound	Weaving	45/33	48/52	F/D
Between Exit 14 Ramps	Southbound	Basic	32/27	54/55	D/D
Exit 14 On Ramp	Southbound	Merge	33/34	50/46	D/D
Exit 13 Off ramp	Southbound	Diverge	36/35	52/51	E/E
Between Exit 13 Ramps	Southbound	Basic	26/27	55/53	C/D
Exit 13 On ramp	Southbound	Merge	29/45	50/34	D/F
Exit 12 Off ramp N	Southbound	Diverge	32/43	52/45	D/E
Exit 12 Off ramp S	Southbound	Diverge	34/42	49/47	D/E
Exit 12 On ramp	Southbound	Merge	13/24	56/53	B/C
At I-89	Southbound	Basic	13/15	59/59	B/B
I-89 On ramp	Southbound	Merge	11/11	66/66	B/B
South of I-89	Southbound	Basic	18/20	63/63	C/C

I-89 and I-393 are included in the project because of their proximity to I-93. The segments of I-89 and I-393 between I-93 are “Weaving” segments as auxiliary lanes exist. “Basic” segments exist within Exit 1 on both I-89 and I-393. The results of the traffic operations analyses are summarized in **Table 3.4 2014 Existing Conditions I-89 Freeway Segments for AM/PM Peak Period and Table 3.5 2014 Existing Conditions I-393 Freeway Segments for AM/PM Peak Period**. Those segments with LOS E or F are highlighted in red, indicating that improvements are necessary.

Table 3.4 2014 Existing Conditions I-89 Freeway Segments for AM/PM Peak Period

			AM/PM Peak Period		
I-89 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
North of Exit 1	Southbound	Basic	26/21	52/52	D/C
Exit 1 Off ramp	Southbound	Diverge	30/24	39/39	D/C
Between Exit 1 Ramps	Southbound	Basic	39/31	35/36	E/D
Between Exit 1 & I-93	Southbound	Weaving	43/34	37/38	E/D
I-93 NB Off ramp	Southbound	Diverge	23/16	41/41	C/B
I-93 NB On ramp	Northbound	Merge	10/15	52/48	B/B
Between Exit 1 & I-93	Northbound	Weaving	18/36	51/42	B/E
Between Exit 1 Ramps	Northbound	Basic	12/21	64/60	B/C
Exit 1 On ramp	Northbound	Merge	11/19	69/67	B/B

Table 3.5 2014 Existing Conditions I-393 Freeway Segments for AM/PM Peak Period

			AM/PM Peak Period		
I-393 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
At I-93 Exit 15	Eastbound	Weaving	7/16	49/48	A/B
Between I-93 and Exit 1	Eastbound	Weaving	10/20	55/51	B/B
Between Exit 1 Ramps	Eastbound	Basic	11/23	57/54	A/C
Exit 1 On ramp	Eastbound	Merge	11/27	56/48	B/C
East of Exit 1	Eastbound	Basic	11/27	56/53	B/D
East of Exit 1	Westbound	Basic	25/20	51/49	C/C
Exit 1 Off ramp	Westbound	Diverge	22/18	53/53	C/B
Between Exit 1 Ramps	Westbound	Basic	23/17	52/51	C/B
Between I-93 and Exit 1	Westbound	Weaving	16/16	53/48	B/B
At I-93 Exit 15	Westbound	Weaving	25/19	39/40	C/B

3.2.4 Crash Statistics

For the ten-year period from January 2007 to December 2016, a total of 2,195 crashes were reported to the NHDOT within the study area limits. hese crashes occurred on I-93, I-89, I-393, the on and off ramps to each interstate, the intersections where the ramps terminate with other roadways, and these other roadways, all within the project limits. This data is only as accurate as the crashes that are reported. **Table 3.6 Crashes within Study Limits (2007 – 2016)** below provides an approximate summary of the crashes per project segment.

Table 3.6 Crashes within Study Limits (2007 – 2016)

Location	Total Number of Crashes	Injury Crashes	Fatalities
I-89 / I-93 Area	482	126	2
Exit 12 Area	237	48	0
Exit 13 Area	329	90	0
Exit 14 / 15 Area	1,147	248	4
Totals	**2,195**	**512**	**6**

The highest number of crashes (52%) were reported for the Exit 14/15 Area where six weaving segments exist. Of the four fatalities in the Exit 14/15 Area, two occurred on I-93 between the two exits, one on I-393 at its river crossing, and one on Fort Eddy Road.

The majority of crashes occurred under normal conditions as can be seen in **Table 3.7 Crashes by Weather Conditions (2007 – 2016) and Table 3.8 Crashes by Roadway Conditions (2007 – 2016)** that provide the summary of crashes by weather and roadway conditions.

Table 3.7 Crashes by Weather Conditions (2007 – 2016)

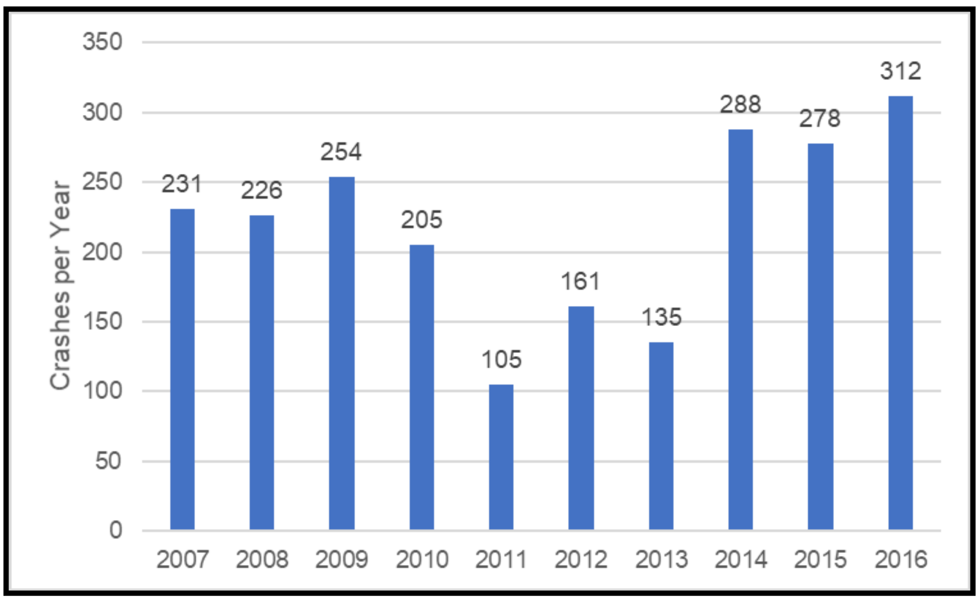
Weather Conditions	Total Number of Crashes	Percentage
Clear or Cloudy	1,762	80.3%
Rain	190	8.7%
Snow or Sleet	196	8.9%
Other or Unknown	47	2.1%
Totals	**2,195**	

Table 3.8 Crashes by Roadway Conditions (2007 – 2016)

Roadway Conditions	Total Number of Crashes	Percentage
Dry	1,571	71.6%
Wet	310	14.1%
Snow or Slush	188	8.6%
Ice	92	4.1%
Unknown	34	1.6%
Totals	**2,195**	

Table 3.9 Crashes by Year (2007 – 2016) below presents the number of crashes within the project limits for each year between 2007 and 2016. The lower number of crashes between 2011 and 2013 do not necessarily meant there were fewer crashes, but rather that fewer were reported.

Table 3.9 Crashes by Year (2007 – 2016)



3.2.5 Geometric Deficiencies

There are several geometric deficiencies that exist along I-93 within the project limits. These were identified by comparing the existing geometry against the standards set forth in the NHDOT *Highway Design Manual* and *A Policy on Geometric Design of Highways and Streets* from the American Association of State Highway and Transportation Officials (AASHTO), commonly referred to as the "Green Book".

Many of the geometric deficiencies are expected with a transportation system that is approaching 60 years of age. There are two main types of deficiencies present: inadequate weaving lengths and inadequate deceleration distances at exit ramps.

Inadequate weaving lengths occur in several places and are a result of interchanges being located too close to one another. The term weaving refers to the segment of highway between critical points where traffic is entering and exiting and the vehicle paths must cross each other. Inadequate deceleration occurs when the exit ramp leading to a horizontal curve is not of sufficient length for vehicles to comfortably decelerate outside the main flow of traffic. See **Table 3.10 Table 3.10 Existing Geometric Deficiencies** below for a list of the geometric deficiencies in the project area.

Table 3.10 Existing Geometric Deficiencies

Deficiency	Location
Weaving	I-89 southbound between Exit 1 entrance ramp and the I-93 southbound exit ramp
Weaving	I-89 northbound between the I-93 southbound entrance ramp and the Exit 1 northbound exit ramp
Weaving	I-93 southbound between Exits 14 and 15
Weaving	I-93 northbound between Exits 14 and 15
Weaving	I-93 southbound between Exit 15 loop ramps
Weaving	I-93 northbound between Exit 15 loop ramps
Weaving	I-393 eastbound between Exit 15 loop ramps
Weaving	I-393 westbound between Exit 15 loop ramps
Weaving	I-393 eastbound between Exit 15 and Exit 1 on I-393
Weaving	I-393 westbound between Exit 1 on I-393 and Exit 15
Deceleration	I-93 northbound exit ramp to southbound Route 3A at Exit 12
Deceleration	I-93 northbound exit ramp to northbound Route 3A at Exit 12
Deceleration	I-93 southbound exit ramp to northbound Route 3A at Exit 12
Deceleration	I-93 southbound exit ramp to southbound Route 3A at Exit 12

The inadequate deceleration distances at the four Exit 12 exit ramps exist because the ramps have curved geometry with posted speeds of 25 mph and the exit ramps leading to these curves are not of sufficient length for vehicles to comfortably decelerate from 55 mph to 25 mph.

3.2.6 Infrastructure Deficiencies

I-93 through Bow and Concord was originally constructed in the late 1950s and early 1960s but has seen improvements over the years. In the last several years, many of the Red List bridges in the corridor have been rehabilitated or replaced and the median barriers and guardrail have been upgraded. However, deficiencies remain, including six Red List bridges. Specific infrastructure deficiencies and concerns within the 4.5-mile project area are listed below in **Table 3.11 Existing Infrastructure Deficiencies**.

Table 3.11 Existing Infrastructure Deficiencies

Deficiency	Location
Red List Bridge (State Priority #7)	I-393 over I-93 Bridge
Red List Bridge (State Priority #13)	I-93 SB over Hall Street
Red List Bridge (State Priority #15)	Route 202 over NHRR and Constitution Avenue
Red List Bridge (State Priority #26)	I-89 over South Street
Red List Bridge (State Priority #34)	I-393 over Fort Eddy Road
Red List Bridge (State Priority #99)	Delta Drive over I-93
Culvert	Culvert failure resulted in a sink hole that closed I-93 for ten hours
Flooding	Flooding around Exit 15 occurs periodically
Vertical Clearance	Hall Street under I-93 limited to 13’-6” of clearance. Bridge has been hit several times.

3.2.7 Transportation Demand Management

Transportation Demand Management (TDM) strategies are designed to reduce the demand for travel rather than increase capacity to accommodate increased demand. These strategies require changing travel behavior to reduce the number of vehicles on the road during peak periods. This is accomplished by eliminating trips, shortening trips, or shifting trips out of the peak congestion periods. Below are the TDM elements that currently exist in the region.

3.2.7.1 Park-and-Ride Lots

Park-and-Ride Lots support those who travel by carpool, vanpool or bus. Within the project area there are three Park-and-Ride Lots owned and operated by NHDOT. These include the following:

- Bow: NH Route 3A at the intersection of I-89 and Hall Street (60 space capacity).
- Concord: Iron Works Road at I-89 Exit 2 (100 space capacity)
- Concord: Stickney Avenue at I-93 Exit 14 (340 space capacity)

The lot at Stickney Avenue also serves the Concord Transportation Center Bus Terminal, as described below in Section 3.2.7.3.

3.2.7.2 Ride-Matching / Employer Measures / Congestion Pricing

NHDOT provides a free service, *NH Rideshare*, which works with the state's Regional Planning Commissions and employers to provide information to commuters on ways to access alternative transportation opportunities. *NH Rideshare* offers a Ride Match service whereby commuters with similar commutes are matched for carpooling. They also provide information to employers on the benefits of carpooling, vanpooling, and telecommuting. There is currently no congestion pricing in New Hampshire.

3.2.7.3 Bus Transit Services

Concord Area Transit (CAT) provides a fixed-route bus service in the City of Concord. CAT has three routes that run throughout the City Monday through Friday from 6:00 AM to 6:30 PM. None of the routes utilize I-93 but two routes use Loudon Road (NH Route 9) to cross I-93 and the Merrimack River, providing access from the downtown area to the east side of Concord. Each route has 12 scheduled runs during the day.

Manchester Transit Authority (MTA) runs a Manchester to Concord bus service Monday through Saturday from 6:30 AM to 6:30 PM. This service runs from downtown Manchester and stops at the Concord Transportation Center on Stickney Avenue and the State House located on Main Street in downtown Concord.

Concord Coach Lines runs several services connecting central and northern NH to downtown Boston and Logan International Airport. All of the routes pass through the Concord Transportation Center on Stickney Avenue, which is operated by Concord Coach Lines. Their service is seven days a week.

Greyhound Lines also use the Concord Transportation Center as a stop for their inter-city bus services with daily trips.

3.2.7.4 Rail Transit Services

There is no passenger rail service in the vicinity of the project. The nearest passenger rail is located in Lowell, Massachusetts, over 50 miles south of the project area. However, studies to bring passenger rail to New Hampshire and Concord have proposed extending the existing service in Lowell north through Nashua, Manchester, and then to Concord.

3.2.8 Transportation System Management

Transportation System Management (TSM) refers to low cost, short term measures to address congestion and safety concerns. These measures typically can be implemented with no new pavement or right-of-way acquisition required. Measures include:

- Intelligent Transportation Systems (ITS)
- Ramp Metering
- New and Re-timed Traffic Signals
- Striping Modifications Signage

Within the project limits, TSM measures have been implemented, such as:

- Additional signage along I-89 from Exit 2 eastbound to reinforce the speed reduction at the terminus of I-89 and the I-93/I-89 interchange.
- Intelligent Transportation System (ITS) elements have been installed on the I-93 corridor for additional camera surveillance that is used by the NH Transportation Management Center (TMC) for congestion monitoring and incident management.

3.3 Air Quality

The Federal Clean Air Act requires that the U.S. Environmental Protection Agency (EPA) establish health-based National Ambient Air Quality Standards (NAAQS). The EPA has identified “criteria” pollutants for which NAAQS have been promulgated. The management of criteria pollutants is largely accomplished through control measures tailored by state, local, and tribal governments in their State Implementation Plans (SIP). The process of determining the classification of the SIP begins with State and Local Air Monitoring Stations (SLAMS) indicating Ambient Air Pollutants. The EPA monitors these stations and revises the ambient air standards every 5 years based on new scientific findings. The EPA then classifies state regions according to recent standards. This classification indicates “attainment” or meeting NAAQS, “non-attainment” or not meeting NAAQS, and “maintenance” or in remediation from previous non-attainment classification. The states amend or cater SIPs to meet the current standards pending EPA approval.

On July 18, 1997, the EPA adopted a new NAAQS for ozone and fine particulate matter. Under the 1997 NAAQS the New Hampshire Counties of Merrimack, Hillsborough, Rockingham, and Strafford were classified as either serious or marginal nonattainment. On July 20, 2013, all of New Hampshire was re-classified as unclassifiable/attainment under the 2008 8-hour Ozone NAAQS, also known as the 2008 ozone standard, and the 1997 8-Hour Ozone NAAQS was revoked for transportation conformity purposes in the Boston-Manchester-Portsmouth (SE) NH area.

On April 23, 2018, the FHWA sent out the memorandum “Interim Guidance on Conformity Requirements for the 1997 Ozone NAAQS” that states recent court proceedings struck down portions of the 2008 Ozone NAAQS and reinstituted the 1997 8-Hour Ozone NAAQS. It should be noted that the project is not located within the 1997 Boston-Manchester-Portsmouth (SE) NH area. On March 10, 2014, EPA approved maintenance plans, known as “limited maintenance plans,” for the City of Manchester and City of Nashua. These limited maintenance plans have a 2021 horizon year. (The second ten-year carbon monoxide (CO) maintenance period terminates on January 29, 2021.)

On June 2, 2010 the EPA issued a final rule revising the primary sulfur dioxide (SO2) NAAQS, and simultaneously revoked both the existing 24-hour and annual primary SO2 standard redesignating parts of central New Hampshire under Non-attainment.

Section 176(c) of the Clean Air Act prohibits Federal agencies from funding or approving activities that do not conform to an applicable SIP for achieving compliance with the NAAQS. A conformity determination may involve analysis of both regional and project level air quality effects.

This proposed project is included in the latest Statewide Transportation Improvement Program (STIP) plan (amended 02/05/2018) and is listed as a regionally significant project. The 2017 – 2020 NH STIP has been developed through a statewide and metropolitan planning process that is consistent with the requirements of 23 CFR Part 450.216. All projects designated as regionally significant by the Metropolitan Planning Organizations (MPO) and Interagency Consultation (IAC), regardless of the funding source, are included in the STIP. The proposed widening of I-93 to 3 travel lanes and one auxiliary lane in each direction, as embodied in the proposed alternative, was included as part of this conformity determination. Therefore, a regional analysis outside of that completed for the STIP conformity determination is not necessary.

Refer to Chapter 4, Section 4.3 for further details on the methods and results of the microscale air quality analysis that was completed for the proposed project. Refer to Appendix E (Volume 2) for a complete copy of the air quality report.

3.4 Noise

3.4.1 Introduction

This section documents the results of a traffic noise analysis conducted for the proposed project. This analysis was prepared according to federal noise regulations, 23 CFR 772 (*Procedures for Abatement of Highway Traffic and Construction Noise*), and the *New Hampshire Department of Transportation Policy and Procedural Guidelines for the Assessment and Abatement of Highway Traffic Noise for Type I & II Highway Projects* (2016). Under the guidelines, Type I projects are defined as those involving the construction of new highways and/or the alteration of existing highways (e.g., realignment or addition of travel lanes). The alternatives addressed in this analysis are those that are considered Type I.

3.4.2 Methodology

The noise analysis included the following steps, in accordance with FHWA and NHDOT policy:

1. Identification of existing activities and developed lands along the proposed alignment that may be impacted by highway noise.

2. Measurement of existing noise levels in the project area.

3. Determination of existing and future traffic noise levels for the project area, based on the field measurement data and the FHWA Traffic Noise Prediction Model (TNM 2.5).

4. Determination of existing and future traffic noise impacts. Impacts occur when traffic noise levels approach (within 1 decibel) or exceed the FHWA Noise Abatement Criteria, or when the predicted future traffic noise levels exceed the existing noise levels by 15 decibels or more.

5. Evaluation of traffic noise abatement measures at impacted locations.

6. Consideration of construction noise.

3.4.2.1 Criteria for Determining Impacts

Traffic Noise Terminology

Traffic noise levels are expressed in terms of the A-weighted sound level in decibels (dBA). The A-weighting scale approximates the frequency response of the human ear. Generally, when sound levels exceed the mid-60 dBA range, an outdoor conversation with a person approximately one meter (three feet) away becomes difficult to hear. A 10-decibel increase in sound levels is typically judged by the listener to be twice as loud as the original sound and a 10-decibel reduction is typically perceived as half as loud. A doubling of traffic volumes will increase the sound level by approximately 3 dB, which is considered to be the smallest change to the A-weighted sound level that people, without specifically listening for a change, could notice.

Most environmental noise fluctuates from moment to moment, so it is customary to condense sound-level data from measurement periods into a single level called the equivalent sound level (Leq). The Leq is the value of a steady sound level that contains the same amount of energy as the actual time varying sound evaluated over the same period. Typically, the A-weighted Leq for traffic-noise analysis is evaluated during a one-hour period when the traffic volume and noise levels are at a daily high. The notation for this daily high Leq is LAeq1h.

Noise Abatement Criteria (NAC) and Determination of Impact

23 CFR 772 identifies Noise Abatement Criteria (NAC) for various land uses (See **Table 3.12**). The NAC defines thresholds which, when approached or exceeded, indicate when noise abatement must be considered. By NHDOT policy, "approach" is defined as within 1 dBA of the NAC. Thus, impacts were determined to occur at properties where exterior sound levels were 66 dBA or higher for Activity Category B. Impacts were also determined for properties within Category C and Category E.

Noise impacts also occur, and consideration of abatement measures is also required, when the predicted future traffic noise is substantially higher than the existing noise levels. NHDOT policy defines "substantial" as an increase of 15 dB or more.

In determining traffic noise impacts and abatement measures, the primary consideration is given to exterior areas where a lowered noise level will be beneficial to "frequent human use" areas. Areas of "frequent human use" in residential areas are evidenced by the presence of patio furniture, picnic equipment, play equipment, gardens, etc. The entire outdoor area of a residential lot would be unlikely to be defined as an area of 'frequent human use', instead those areas with evidence of regular outdoor use would be considered. Field reviews are conducted to identify areas where frequent human use occurs and a lowered noise level would be of benefit. Locations where "lowered noise levels will be beneficial" do not normally include areas such as parking lots, athletic fields, or farm property.

3.4.2.2 Existing Land Use and Noise Sensitive Areas

Existing land use in the project area was identified by reviewing maps and aerial photography and conducting field investigations.

Noise Sensitive Areas (NSAs) are areas that represent logical groupings of receptors for the purposes of noise prediction and abatement analysis. The groupings can be based on a number of factors, including land use characteristics, the proximity of individual houses or structures to existing and proposed roadways, the terrain, and the location of the area. Three NSAs were identified within the 4.5 mile project area. *Receptors* are individual sites or properties (e.g., a residence or playground). For this project, receptor locations for each NSA were selected to include the range of receptors that could be impacted or benefitted by the project.

Based on field review, 15 sites were selected within the three NSAs and noise measurements were conducted. A description of the three NSAs and the location of the noise readings within each follows:

Noise Sensitive Area 1 (NSA 1) is located within the southern terminus of the project area in the I-89/Exit 1 area. Within NSA 1, four noise readings were collected (1-1, 1-2, 1-3, and 1-4). The land use within this area is primarily residential with a few commercial businesses, located on both the east and west sides of I-93. The four noise reading locations include the following:

- NSA 1-1 is located at 6 Logging Hill Road (residential)
- NSA 1-2 at 3 Everett Avenue (residential)
- NSA 1-3 at 28 Grandview Road (residential)
- NSA 1-4 at 25 Grandview Road (residential)

Noise Sensitive Area 2 (NSA 2) is located in the center of the project area and encompasses both I-93 Exit 12 and Exit 13. Seven noise readings were collected within NSA 2. The primary land use within NSA 2 is a mixture of residential and commercial, including Reed Playground, multiple hotel complexes and part of Healy Park. The seven noise reading locations include the following:

- NSA 2-1 is located at 49 Heather Lane (residential)
- NSA 2-2 is located at 37 Nivelle Street (residential)
- NSA 2-3 at 14 Haig Street (residential)
- NSA 2-4 at 7 Longmeadow Drive (residential)
- NSA 2-5 at 406 S Main Street (Day's Inn Hotel)
- NSA 2-6 at Reed Playground on Hall Street
- NSA 2-7 at 71 Hall Street (Comfort Inn Hotel)

Noise Sensitive Area 3 (NSA 3) is located along the northern portion of the project area and encompasses I-93 Exits 14 and 15. Four noise readings were collected within NSA 3. Within the vicinity of NSA 3, land use can be described as primarily commercial with residential structures throughout and the NHTI, Community College complex. The four noise reading locations include the following:

- NSA 3-1 is located at 266 North Main Street (Kimball Jenkins School of Art)
- NSA 3-2 at 6 Herbert Street (residential)
- NSA 3-3 at 3 Stevens Drive (residential)
- NSA 3-4 at 31 College Drive (NHTI Community College)

These three NSAs were further broken down into 20 smaller NSAs to reflect neighborhood areas or logical groupings of receptors for the purposes of noise prediction and abatement analysis. The groupings were based upon a number of factors, including land use characteristics, the proximity of individual house or structures to existing and propose roadways, the terrain, and the location of the area. Receptors are individual sites or properties (e.g., a residence or playground). For this project, receptor locations for each NSA were selected to include a range of receptors that could be impacted or benefitted by the project.

Refer to **Table 3.13** for the details on the 20 NSAs including the estimated number of receptors within each. Refer to **Figures 3.23-1 and 3.23-2 Noise Sensitive Areas** for the location of each of the 20 NSAs within the project corridor.

Table 3.12 Noise Abatement Criteria

Activity Category	LAeq1h *	Description of Activity
A	57 (Ext.)	Land on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Ext.)	Residential.
C	67(Ext.)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52(Int.)	Auditoriums, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, television studios.
E	72 (Int.)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	-	Undeveloped lands that are not permitted

Hourly A-weighted sound level in decibels (DBA). Ext. = Exterior; Int. = Interior.

Table 3.13 Noise Sensitive Area Locations (NSAs)

NSA	Description	Activity Category	Approx. # of Receptors	Noise Measurement Location
1-A	Residential area along southbound/south side of I-89. (Wilderness Lane)	B	3	NA
1-B	Residential area along southbound/south side of I-89. (Logging Hill Road, South Street, Everett Avenue, Valley Road)	B	14	1-1, 1-2
1-C	Residential area along southbound/west side of I-93. (Grandview Road)	B	13	1-3
1-D	Residential area along northbound/east side of I-93. (Grandview Road, Carriage Road)	B	20	1-4
1-E	Residential area along northbound/north side of I-89. (South Street)	B	2	NA
2-A	Residential area along southbound/west side of I-93. (Heather Lane, Gabby Lane)	B	2	2-1
2-B	Residential area along southbound/west side of I-93 at Exit 12. (S. Main Street, Haig Street, Broadway Street, Joffre Street, Donovan Street, Rockingham Street, Hope Avenue, Wood Avenue)	B	60	2-2, 2-3
2-C	Residential area along northbound/east side of I-93. (off of Basin Street)	B	60	2-4
2-D	Hotel along northbound/east side of I-93. (NH Route 3A)	E	1	2-5
2-E	Recreational area/hotel along the southbound/west side of I-93. (Hall Street)	C/E	25	2-6, 2-7
2-F	Recreational site along northbound/east side of I-93. (Basin Street)	C	1	NA
2-G	Recreational site along northbound/east side of I-93. (Healy Park)	B	1	NA
2-H	Outdoor seating area along southbound/west side of I-93. (Gulf Street, Water Street, PAR Railroad)	E	2	2-6, 2-7
3-A	Outdoor seating area along northbound/east side of I-93. (Fort Eddy Road)	E	1	3-3

3-B	Residential area along westbound/north side of I-393/202/4 intersection with Main Street. (Main Street, PAR Railroad)	B	10	3-1
3-C	Residential area along southbound/south side of on-ramp to I-93 from I-393/202/4. (Stickney Avenue)	B	10	3-2
3-D	Residential area along Fort Eddy Road near eastbound/south side of I-393/202/4. (Grappone Drive, Stevens Drive, McKee Drive	B	20	3-3
3-E	Hotel along southbound/west side of off-ramp from I-93 to I-393/202/4. (Constitution Avenue, Commercial Avenue)	E	1	NA
3-F	NHTI Campus along northbound/east side of I-93. (Fan Road, Institute Drive)	B/C/D	60	3-4
3-G	Recreational field along southbound/west side of I-93. (Commercial Street)	C	1	NA

3.4.2.3 Noise Measurement Procedures

Field noise measurement data were collected at the 15 Noise Measurement Sites on May 16 and 17, 2017. A 3M SoundPro DL-2 sound level meter was used to measure sound levels at each measurement site over one 15-minute period. One measurement was taken at each site. Measurements were taken during daytime hours, including some AM and PM peak traffic hour periods. Vehicle classification counts were taken during each measurement period to record the volume of cars, medium trucks, heavy trucks, buses, and motorcycles for the 15-minute period when the noise measurement was taken.

3.4.2.4 Traffic Analysis

The noise analysis uses peak traffic volumes, when traffic volumes are at or near their highest levels and noise conditions are most likely to be at their highest levels, to determine noise levels in the project area. Traffic is broken down into autos/light trucks, medium trucks, heavy trucks and motorcycles.

3.4.2.5 Prediction of Noise Levels

The FHWA traffic noise prediction model, TNM 2.5, was used to predict traffic noise levels expected to occur with implementation of the proposed project. Peak-hour traffic projections were developed for existing (2017) and Design Year (2035) conditions, for both the No Build and the Preferred Alternative, including vehicle-mix information.

As a first step in the prediction process, the noise model was set up and run using the traffic volumes and classifications recorded during the 15-minute measurement periods. The noise levels predicted by the model were then compared to the measured noise levels. The measured noise levels and modeled noise levels were found to be within 1-3 decibels of each other at all measurement sites. This variation is considered acceptable and indicates that the overall model setup in terms of input variables (roadway and receiver geometry, traffic volumes, traffic mix and speeds, etc.) produces results that reflect actual conditions.

The year 2017 peak hour traffic volumes were then modeled, with the existing roadway configuration, to establish a baseline LAeq1h. Year 2035 (Design Year) noise levels for the No-Build and Build conditions were then predicted using the model. The predicted Year 2035 noise levels were compared to the Noise Abatement Criteria and the 2017 modeled baseline LAeq1h (not to the 2017 measured noise levels) to determine the noise impacts associated with the project.

3.4.2.6 Noise Impact Analysis

Noise levels in the project area were evaluated in accordance with the noise impact analysis methodology described above. The existing and predicted noise levels were calculated for the receptors within each NSA location that could be impacted by project noise. The calculated noise levels were compared to the appropriate Noise Abatement Criteria. The abatement analysis (Chapter 4) considered the receptors at each location which could benefit from noise abatement. Future noise levels and impacts along with an analysis of abatement measures are in Chapter 4.

3.5 Water Resources

This section describes the water resources located within the study area including groundwater, surface water, floodplains, wetlands, water quality, drinking water supplies, and applicable state and federal regulatory programs.

3.5.1 Groundwater

Groundwater and drinking water are regulated principally under two New Hampshire laws. The Groundwater Protection Act (RSA 485-C) provides for groundwater classification according to groundwater quality and yields. The New Hampshire Safe Drinking Water Act (RSA 485) regulates water systems according to the type and size of population they serve.

RSA 485-C, the Groundwater Protection Act, authorizes municipalities and public water suppliers to develop local groundwater protection programs and establishes best management practices for regulated substances to help protect water quality. The law recognizes four classes of groundwater:

- GAA: Delineated Wellhead Protection Areas
- GA1: Groundwater of high value for present or future drinking water
- GA2: Potentially valuable stratified drift aquifers
- GB: All groundwater not assigned to a higher class

Areas classified as GAA are the most stringently regulated groundwater sources, and are, by definition, within delineated wellhead protection areas (WHPAs). A WHPA is defined as the area under which groundwater flows to a producing well. For bedrock wells, the WHPA is a circle whose radius depends on the maximum daily amount of water withdrawn from the well. For till and gravel wells, the WHPA is calculated based on existing hydrogeologic information. Class GA1 is "assigned to groundwater in a defined zone of high value for present or future drinking water supply" (RSA 485-C:5). There are no groundwater resources within the project corridor that have been reclassified to GAA or GA1.

Class GA2 is assigned to groundwater within aquifers identified as highly productive for potential use as a public water supply by the U.S. Geological Survey (USGS) regional groundwater studies, or other regional studies. Zones of stratified drift with a saturated thickness greater than 20 feet, and a transmissivity (the rate at which groundwater flows horizontally through an aquifer) greater than 1,000 feet squared per day (ft^2/day) are designated as class GA2. Zones of bedrock with average well yields greater than 50 gallons per minute are also designated as class GA2. All other areas, by default, are classified as GB.

3.5.1.1 Aquifers

The majority of the study area is underlain by an aquifer that has a transmissivity ranging from 0 - 1,000 ft^2/day; therefore, it is classified as GB. This aquifer is not a Sole Source Aquifer regulated by the U.S. EPA. There is a small area adjacent to the Merrimack River and I-393 that is classified as a GA2 aquifer.

The Town of Bow has an Aquifer Protection Overlay District Ordinance (Article 10.03 of the Zoning Ordinance). The Town of Bow Aquifer Overlay District is located in the vicinity of the I-89 interchange to the Concord City Line, and south along the Merrimack River. Refer to **Figure 3.9 Groundwater Resources Overview**, for the location of the Aquifer Overlay District. There is also a proposed Aquifer Overlay District west of and adjacent to the existing one, on the northern side of I-89.

The City of Concord has seven Aquifer Protection Districts (APs). The closest AP to the study area is located in the vicinity of Horseshoe Pond and continues north along the Merrimack River. However, this district is outside the project study area.

3.5.1.2 Public Drinking Water Systems

Under RSA 485, the New Hampshire Safe Drinking Water Act, water systems are regulated according to the type and size of population they serve, as follows:

Public Water System: This is a system that consists of a "piped water system for human consumption, serving 15 or more services or 25 or more people for at least 60 days per year." Public water systems are classified into the following types:

***Community Water System**:* This is public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Transient Non-Community Water System: This is a system that is not a community water system, such as a restaurant or hotel. These are sometimes referred to as "Transient" water systems.

Non-Transient Non-Community Water System: This is a system that is not a community water system and that serves the same 25 people, or more, over 6 months per year (for example, a school or workplace).

There are 23 public water systems that occur within 1,000 feet of the study area. NHDES recommends that construction materials and equipment not be stored within 400 feet of public water systems. Public water systems are depicted on **Figure 3.10 Public Water Supply Overview.** All public well locations along the I-93 will have to be confirmed prior to construction.

Drinking water Administrative Rules Env-Dw 406.11(c) state that non-community water system wells shall be kept at least 50 feet from the edge of the road right-of-way. As the project progresses, coordination with NHDES will occur regarding potential impacts to the public water supply wells and their associated WHPAs.

3.5.1.3 Wellhead Protection Areas

Under New Hampshire RSA 485-C, a WHPA "means the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The wellhead protection program commits public water suppliers to regular inspections within the delineated WHPA to ensure that best management practices are being followed. Private domestic wells do not have delineated WHPAs.

All 23 public water supply wells located within 1,000 feet of the study area are bedrock wells. These wells are concentrated around the southern end of the study area in Bow near the I-89 interchange. This area also coincides with the Town of Bow Aquifer Overlay District. Groundwater Resources are shown on **Figure 3.9.** The radius of WHPAs for bedrock wells is based on the maximum daily amount of water withdrawn from the well. A total of 11 WHPAs are located within the study area, many of which are overlapping. In addition to the WHPAs, a 400-foot Sanitary Protection Radius is applicable to the both Transient wells and the Non-Transient Non-Community wells, as per State regulations. Roadway projects within WHPAs should follow DES recommendations for stormwater treatment to the extent practicable. [1]

Community systems have a Sanitary Protective Radius (SPR) that varies by well from 75 to 400 feet depending on the output of the well. Under the law, land use within this radius must be controlled by the supplier, either through ownership or easement. NHDES has provided recommendations with respect to community and non-transient non-community wells that address issues specific to roadways, such as stormwater treatment, snow storage, and salt application.[2]

3.5.2 Surface Waters

Surface water resources within the study area consist of rivers, streams and ponds. Surface waters are regulated under the federal Clean Water Act (33 U.S.C. 1251 – 1376) and the New Hampshire Dredge and Fill Law (NH RSA 482-A). State surface water regulations are administered by the New Hampshire Department of Environmental Services, Water Division. **Figure 3.11 Surface Water Overview** depicts an overview of the surface waters and watersheds in and around the study area.

3.5.2.1 Lakes and Ponds

Horseshoe Pond

Horseshoe Pond, is a broad oxbow pond approximately 45 acres in size. The pond is a remnant feature of the Merrimack River, created by a historic meander in the river channel that has since been abandoned. The pond is located northwest of Exit 15 and is outside the study area. Wattanummon Brook is a small stream that flows through the project area from Horseshoe Pond to the east, in box culvert under I-93 and is hydrologically connected to the Merrimack River. The pond is classified as L1UBH, or lacustrine, limnetic (deepwater), with an unconsolidated bottom and permanently flooded. Both the north and south ends of the pond are shallower than in the middle and support aquatic emergent vegetation around the perimeter. A cornfield is located on the peninsula of land surrounded by the pond.

Fort Eddy Pond

Fort Eddy Pond is located east of I-93 and just north of I-393, near the northern end of the study area. Like Horseshoe Pond, it was created from a historic oxbow of the Merrimack River. The pond is approximately 20 acres is size, and is also classified as L1UBH. The pond drains from the southern end to the east, and is hydrologically connected to the Merrimack River through a series of culverts and wetlands

1 *Recommendations for Implementing Groundwater Protection Measures When Siting or Improving Roadways* NHDES, 1995

2 *Recommendations for Implementing Groundwater Protection Measures When Siting or Improving Roadways* NHDES, 1995

(Wetland CC and DD) that flow under the I-393 Exit 1 ramps and College Drive before outletting into the Merrimack River.

South End Marsh

The South End Marsh is located just north of the Exit 12 interchange. This wetland complex has a large area of open water with a palustrine emergent wetland fringe around the perimeter. The entire area is approximately 26 acres. This area drains to the south, underneath I-93, and into another large wetland complex (Wetland Q). This area continues to drain to the south and is hydrologically connected to the Merrimack River.

3.5.2.2 Rivers and Streams

Merrimack River

The Merrimack River is the largest and most prominent surface water feature in the study area. The Merrimack River begins at the confluence of the Pemigewasset and Winnipesaukee Rivers in Franklin, NH, and flows south before turning east in northern Massachusetts, and flowing into the Atlantic Ocean in Newburyport, MA. The entire river is approximately 116 miles in length. The watershed originates in the White Mountains of New Hampshire and has a total area of approximately 5,000 square miles. At the location of the I-393 crossing in Concord, NH, the Merrimack is a fourth order river with a watershed size of approximately 2,383 square miles. It is fed by several tributaries, including the Pemigewasset River, Winnipesaukee River, Contoocook River, and the Turkey River, which joins the Merrimack in the southern part of the study area (near the I-93 and I-89 interchange) in Bow.

In the study area, I-93 roughly parallels the Merrimack River to the west and spans the river just north of the study area. North of Loudon Road, the river is a riverine system classified as R2UBH, or lower perennial with an unconsolidated bottom, and permanently flooded. South of the Loudon Road Bridge, the Merrimack River transitions to a lacustrine (lake) system with a classification of L1UBHh, limnetic (deepwater), with an unconsolidated bottom, permanently flooded, and impounded. The impoundment is created by the dam at Garvin Falls in Bow, approximately 0.6 miles south of the study area.

Despite flowing through the relatively urban and developed study area, the river retains much of its riparian buffer and floodplains. In some areas, development has encroached upon the banks of the river, including the I-89 and I-93 interchange at NH Route 3A (Bow Junction), the area south of Exit 13, and in the vicinity of Exit 14. Agricultural fields are found within the River’s floodplain, scattered throughout the study area, and patches of floodplain forest are located adjacent to the river, especially in the northern half of the study area and along the eastern bank. The banks are vegetated with silver maple, red maple, green ash, basswood, and gray birch.

The Merrimack River is an important resource for fish and wildlife, plant communities, and for recreation, including boating, fishing, and swimming. Historically, the river was a major source of industrial power and water quality was negatively impacted by associated discharges. However, water quality has improved in recent years through state and local protection measures that have limited point source pollution.

Turkey River

The Turkey River is a tributary of the Merrimack River, originating from Turkey Pond in Concord, west of the study area. The Turkey River flows southeast, north of I-89, before entering the study area at Exit 1. It continues through the I-89 and I-93 interchange under five separate crossings before flowing into the Merrimack River. The Turkey River is a perennial stream with a watershed size of approximately 35 square miles.

Bow Brook

Bow Brook is a perennial stream and a tributary to the Turkey River. Bow Brook begins in central Concord and flows south for approximately 3.8 miles to its confluence with the Turkey River at the I-89 and I-93 interchange. The total watershed size is approximately 1.6 square miles. The headwaters of this stream originate in a large forested area; however, as the stream flows south, the watershed becomes increasingly more residential and urban, with the stream flowing through numerous culverts through the City of Concord.

Unnamed Streams

I-89 Area – There are two intermittent streams that flow from the south, under I-89 and drain to the north into the Turkey River. The westernmost stream crossing has a watershed size of approximately 154 acres. The next stream crossing to the east has a watershed size of approximately 25 acres.

I-93 Southern Terminus of Project Area – There are two small, unnamed streams near the southern end of the project area that flow from the west to the east, under I-93. One stream drains into the Turkey River before ultimately reaching the Merrimack River, and the other stream flows directly into the Merrimack River near the southern limits of the study area. The channels of these streams have been modified by previous highway construction activities including the placement of stone riprap in the channel, channelization, and the installation of culverts. The southernmost stream is located south of the Grandview Road overpass, and has a watershed size of approximately 52 acres. This stream drains directly into the Merrimack River. The next stream north of the Grandview Road overpass has a watershed size of approximately 375 acres and drains into the Turkey River, just west of its confluence with the Merrimack River.

There is a small, unnamed stream with a watershed size of approximately 44 acres, located south of Exit 14.

There is an unnamed stream located just south of Exit 15 with a watershed size of approximately 377 acres.

Wattanummon Brook is a perennial stream near the northern end of the study area that drains from Horseshoe Pond and flows east under I-93 before draining into the Merrimack River.

3.5.2.3 Federal and State Regulatory Jurisdiction

National Wild and Scenic River Program

The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. In order to be designated a Wild and Scenic River, a river must be found both eligible and suitable. In 1999, the National Park Service determined that the Upper Merrimack River from Franklin to Concord was eligible for the National Wild and Scenic River system. However, the river did not meet all of the suitability criteria, specifically, there was a lack of local support for designation, and so, the National Park Service recommended against national designation. Therefore, there are no rivers in the study area currently listed within the National Wild and Scenic Rivers Program.

New Hampshire Designated Rivers

The section of the Merrimack River that flows through the project area is designated for protection under the New Hampshire Rivers Management and Protection Act (RSA 483). This program was established in 1988 to protect certain rivers for their outstanding natural and cultural resources. The Upper Merrimack Designated River segment begins at the confluence of the Pemigewasset and Winnipesaukee Rivers in Franklin and flows south for approximately 30 miles to the Garvin Falls Dam in Bow. The Upper Merrimack River was designated in 1990.

The Rivers Management and Protection Act classifies the entire length of designated rivers using four categories: Natural, Rural, Rural-Community, and Community. Protection measures apply to each of these categories. The segment of the Upper Merrimack River within the project area is classified as Rural. Rural rivers are those adjacent to lands which are partially or predominantly used for agriculture, forest management, and dispersed or clustered residential development. Some instream structures may exist, including low dams, diversion works and other minor modifications. Management of rural rivers and segments shall maintain and enhance the natural, scenic, and recreational value of the river and shall consider, protect, and ensure the rights of riparian owners to use the river for agriculture, forest management, public water supply, and other purposes which are compatible with the instream public uses of the river and the management and protection of the resources for which the river segment is designated. Designated Rivers have a river corridor associated with them. The Designated River corridor is defined as the river and the land area located within a distance of 1,320 feet (¼ mile) of the normal high-water mark or to the landward extent of the 100-year floodplain as designated by the Federal Emergency Management Agency (FEMA), whichever distance is larger.

Each Designated River has a Local River Management Advisory Committee (LAC). The LAC develops and implements a River Management Plan and coordinates activities affecting the river on a regional basis. At the state level, the NHDES assists with the development and implementation of the management plan and enforces regulations concerning the quality and quantity of flow in protected river segments. Through the City of Concord, Interstate 93 roughly parallels the Designated Upper Merrimack River to the west, and much of the project corridor occurs within the protected river corridor. Since the project falls within the Designated River corridor, coordination will occur with the Upper Merrimack River LAC regarding the proposed project.

Navigable Waters

Under Section 9 of the Rivers and Harbors Act of 1899, and the General Bridge Act of 1946, the US Coast Guard has the authority to approve proposed bridge and/or causeway locations and plans. The primary purpose of these Acts is to preserve the public right of navigation and to prevent interference with interstate and international commerce. The Merrimack River is a Federally-designated navigable water from the Massachusetts state line to Concord, NH. Work within the river will require coordination with the US Coast Guard.

New Hampshire Stream Crossing Rules

The NHDES Stream Crossing Rules (Env-Wt 900) classify stream crossings as Tier 1, Tier 2, or Tier 3 based on watershed size. A Tier 1 stream crossing has a watershed of less than or equal to 200 acres, a Tier 2 stream crossing has a watershed size greater than 200 acres and less than 640 acres, and a Tier 3 stream crossing has a watershed size of 640 acres or greater.

The Stream Crossing Rules also allow for a Tier 1 or 2 stream crossing to be upgraded to a Tier 3 stream crossing if any of the following conditions are met: the stream crossing is located within ¼ mile of a designated river; the stream crossing is located within 100 feet of a prime wetland unless a prime wetland buffer waiver has been granted; the stream crossing is in a jurisdictional area that contains a protected species or habitat; the stream crossing is located within a 100-year floodplain or fluvial erosion hazard zone; or the stream crossing carries a watercourse that is listed as not attaining surface water quality standards based on benthic macroinvertebrate index, fish assemblage index, habitat assessment, or stream channel stability on the current Clean Water Act 305(b) Report (see section *3.5.2.4 Surface Water Quality*) .

A stream crossing that is classified as Tier 3 based solely on the presence of protected species or habitat can be downgraded to a Tier 1 or Tier 2, based on watershed size, with the concurrence of NH Natural Heritage Bureau (NHB), and/or NH Fish and Game Department (NHF&G) that impacts to the protected species or habitat will be avoided or mitigated.

There are a total of six Tier 1 stream crossings, two Tier 2 stream crossings, and six Tier 3 stream crossings located in the project area. The Tier 3 crossings include: I-393 over the Merrimack River; I-93 over Bow Brook, and four crossings over the Turkey River associated with the I-89/I-93 interchange. The Tier 1 and 2 crossings are made up of the smaller unnamed intermittent and perennial streams that flow through the project area.

Shoreland Water Quality Protection Act

The Shoreland Water Quality Protection Act (SWQPA) (NH RSA 483-B) was enacted in 1991 to establish minimum standards for use and development of lands adjacent to New Hampshire’s public waterbodies. Public waters include all fourth order and greater streams and rivers, lakes and ponds larger than ten acres, as well as rivers designated under RSA 483. Protected Shoreland includes all land located within 250 feet from the reference line of protected waterbodies. The reference line for lakes and ponds is defined by the surface elevation listed on the *Consolidated List of Waterbodies subject to the Shoreland Water Quality Protection Act*, as maintained by NHDES. The reference line for rivers and streams is the ordinary high-water mark.

Streams can be classified by size based on a hierarchy of tributaries, known as the Strahler stream order system. First order streams are the smallest tributaries at the headwaters located in the upper reaches of a watershed. The stream order increases when two streams of the same order meet. For example, a second order stream begins at the confluence of two first order streams, and a third order stream begins at the confluence of two second order streams.

The Merrimack River and Turkey River are seventh and fourth order streams, respectively, and so, are subject to the SWQPA. Fort Eddy Pond and Horseshoe Pond in Concord are 20.0 and 44.9 acres respectively, and are also subject to the SWQPA.

A permit from NHDES will be required for any earth disturbance, filling, and/or tree clearing within the Protected Shorelands.

3.5.2.4 Surface Water Quality

Surface waters in New Hampshire are classified as A or B by NHDES. Class B is the default classification. Class A waters are the highest quality and are considered suitable for water supply after adequate treatment. Sewage discharges are prohibited in Class A water bodies. New Hampshire RSA 485-A:8, Water Pollution and Waste Disposal, and Administrative Rules Env-Wq 1700, provide thresholds for pollutants, dissolved oxygen, color, temperature, and other criteria that must be met. These standards differ for Class A and Class B waters. All the surface waters in the project area are considered Class B waters.

The Federal Water Pollution Control Act (33 U.S.C. 1251 – 1376), commonly called the Clean Water Act (CWA), as last reauthorized by the Water Quality Act of 1987, requires each state to submit two surface water quality documents to the U.S. Environmental Protection Agency (EPA) biennially. Section 305(b) of the CWA requires the submittal of a report that describes the quality of a state's surface waters, and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water.

Section 303(d) of the CWA requires each state to submit a list of impaired waters to the EPA every two years to identify surface waters that are impaired or threatened by pollutants, are not expected to meet water quality standards within a reasonable time, and that require the development and implementation of a Total Maximum Daily Load (TMDL) Study. A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as a starting point or planning tool to implement those reductions in order to restore the water quality. According to the NHDES 2016 303(d) List (most current list available, approved by EPA November 30, 2017), there are five waters in the project area listed as impaired. These are shown on **Figure 3.12 Impaired Waters Overview**, and the details of each are listed in **Table 3.14 Impaired Waters in Study Area.**

Table 3.14 Impaired Waters in Study Area

Assessment Unit ID	Use Description	Impairment(s)	TMDL Priority
Turkey River-Bow Brook	Aquatic Life	Benthic-Macroinvertebrate Bioassessment; Dissolved Oxygen Saturation; Oxygen, Dissolved; pH	Low
Turkey River	Aquatic Life	Aluminum	Low
Merrimack River-Garvins Falls Dam	Aquatic Life	pH	Low
Merrimack River	Aquatic Life	Aluminum; pH	Low
Horseshoe Pond	Aquatic Life Primary Contact Recreation	Chloride; pH; Chlorophyll-a	Low

Source: NHDES 2016 303(d) List

New Hampshire Water Quality regulations Env-Wq 1708 provide antidegradation standards to preserve and protect existing beneficial uses and minimize degradation of the state’s surface waters. Antidegradation applies to:

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

Impairments of Waters in the Study Area

Benthic macroinvertebrates are aquatic organisms that are found living along the substrate of a waterbody. Examples of benthic macroinvertebrates include insect larvae, adult aquatic insects, aquatic worms, shellfish, and crayfish. The composition and diversity of these species is an important indicator of overall water quality. Waters in the project area that do not meet the standards for benthic macroinvertebrates and which have been listed as impaired for this category include: Turkey River and Bow Brook.

The acidity, or pH, of freshwater streams can be influenced by bedrock composition, organic material in the water, and acid deposition. In New Hampshire, acid deposition, combined with the low prevalence of calcium-rich bedrock, results in lower pH in freshwater systems across large areas of the landscape. Waters impaired for pH include: Turkey River, Bow Brook, Horseshoe Pond, and Merrimack River.

All aquatic species require a certain range of dissolved oxygen for survival. Dissolved oxygen concentrations in freshwater will vary naturally by season, temperature, and water depth, but can also be influenced by ecosystem disturbances. Colder water can retain higher concentrations of dissolved oxygen than warmer water. Sources of dissolved oxygen include the atmosphere as well as aquatic plants and algae through the process of photosynthesis. Increased organic matter in a waterbody can lead to increased decomposition by microorganisms. This process consumes oxygen and can deplete dissolved oxygen the water. Waters impaired for dissolved oxygen include: Turkey River and Bow Brook.

Aluminum is an abundant metal in the earth’s crust, occurring in many different types of rocks. Aluminum ions in surface waters may result from industrial wastes or the wash water from drinking water treatment plants. High levels of aluminum in surface waters in the Northeastern United States are generally considered to be the result of acid deposition. As soil pH decreases, the solubility of aluminum increases, leading to its mobilization through the soil and its eventual accumulation in streams and ponds. Water containing high concentrations of aluminum can become toxic to aquatic life if the pH is lowered. Waters impaired for aluminum include: The Turkey River and the Merrimack River.

Chloride is found naturally in some surface waters and groundwater; however, high concentrations of chloride can become detrimental to water quality. The application of road salt and associated runoff is a common source of increased chloride levels in surface water and groundwater. Waters impaired for Chloride include: Horseshoe Pond.

Chlorophyll-a is an indicator of the abundance of algae in a body of water. High concentrations of chlorophyll-a correlates to high concentrations of algae. Concentrations of algae can increase when the concentrations of nutrients such as phosphorus and nitrogen increase in a body of water. Common sources of phosphorus and nitrogen include stormwater, residential, and agricultural runoff. Waters impaired for Chlorophyll-a include: Horseshoe Pond.

3.5.3 Floodplains

Federal regulations (23 CFR 650, 44 CFR 9) and Executive Order 11988 specify that federal projects must evaluate and address impacts to floodplains and floodways, and avoid to the extent possible, long and short term adverse impacts associated with the occupancy and modification of floodplains. For the purposes of federal regulations, the 100-year floodplain is the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year The Federal Emergency Management Agency (FEMA) defines Base Flood as “the flood having a one percent chance of being equaled or exceeded in any given year” (44 CFR 59.1). This term is used in the National Flood Insurance Program (NFIP) to indicate the minimum level of flooding to be used by a community in its floodplain management regulations.

The Regulatory Floodway is defined in FEMA’s regulations (44 CFR 59.1) as “…the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.” The floodway also holds waters traveling at the highest velocities during a flood event.

Floodplains and watercourse reaches with designated Regulatory Floodways within the study area are shown on **Figure 3.13 Flood Hazard Areas Overview**. The Town of Bow and City of Concord participate in the NFIP and have adopted local regulations governing development within the areas designated as special flood hazard areas on FEMA's Flood Insurance Rate Maps (FIRM). The local ordinances pertaining to floodplains are found in the Town of Bow’s Zoning Ordinance 10.02 Floodplain (F) District, and the City of Concord’s Zoning Ordinance 28-3-2 Flood Hazard (FH) District. State Executive Order 96-4 requires all NH state agencies to comply with the floodplain management regulations of communities that participate in the NFIP. Coordination with FEMA is necessary only if there are impacts to the regulatory floodway or changes to the boundary of the floodplain or floodway due to an increase in water surface elevation above what has been calculated in the Flood Insurance Study.

In the City of Concord, a Conditional Use Permit may be granted by the Planning Board for the construction of a structure, placement of fill, or other encroachment in the Regulatory Floodway, if the project proponent can demonstrate that a proposed action will meet the following conditions: there will be no adverse effect to the flood carrying capacity of the floodway or the flood heights along the floodway; there will be no increase in the base flood level or other adverse effect to the flood levels along the floodplain; and there will be no increased hazard to life and property.

In the Town of Bow, Conditional Use Permits are also administered by the Planning Board. Regulations in the Floodplain District along watercourses with a designated Regulatory Floodway prohibit encroachments within the Floodway that would result in an increase in flood levels during the base flood discharge. Along watercourses that do not have a designated Regulatory Floodway, no encroachment is permitted within Zones A and AE on the FIRM, unless it can be demonstrated that the cumulative effect of the proposed development, when combined with all existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community. Zones A and AE both comprise the 100-year floodplain. The difference between Zones A and AE is that base flood elevations have not been determined for Zone A, while in Zone AE base flood elevations have been determined.

Floodplain and floodway areas within the study area occur along the Turkey River through the I-89/I-93 interchange, along the Merrimack River on the east side of I-93 from Manchester Street (US Route 3) to Loudon Road (NH Route 9), along I-393 between the Merrimack River crossing at Exit 1 to I-93 Exit 15, at the northwestern quadrant of the Exit 15 interchange, and along the northern section of the study area just south of I-93 crossing over the Merrimack River.

3.5.4 Wetlands

Wetlands are regulated by the federal government under the Clean Water Act (CWA). Section 404 of the CWA provides that discharges of dredged or fill materials into waters of the United States require a permit from the Army Corps of Engineers (ACOE). Waters of the United States include any non-isolated wetlands that meet the three parameters (hydrology, soils, and vegetation) as defined in the *1987 Corps of Engineers Wetland Delineation Manual, Technical report Y-87-1 (*1987 *ACOE* Manual). The ACOE has issued General Permits (GP) for minimal impact work in New Hampshire, which expedite the ACOE permit review process for projects with up to three acres of jurisdictional impact. Projects or actions with greater than three acres of impacts or that do not satisfy the conditions of the GP, require that an Individual Section 404 permit be secured from the ACOE.

Federal Executive Order 11990, issued in 1977, is intended to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands". The Order, which applies to federal activities and programs affecting land use, requires federal agencies to consider alternatives to wetland impacts and to limit potential damage if an activity affecting a wetland cannot be avoided.

Wetlands are regulated in New Hampshire under RSA 482-A, Fill and Dredge in Wetlands. The law defines a wetland as “an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Under NHDES Administrative Rules, wetlands are delineated on the basis of the 1987 ACOE Manual. NH law also regulates surface waters and their banks. "Bank" is defined as "the transitional slope immediately adjacent to the edge of a surface water body, the upper limit of which is usually defined by a break in slope…." A permit is required from DES if the applicant proposes dredge or fill in jurisdictional areas (wetlands, banks, and channels).

Wetland boundaries within the study area were delineated in the summer and fall of 2014 and 2015, in accordance with the three-parameter approach as described in the 1987 ACOE Manual. The delineated wetlands were flagged and the flag locations were located using a handheld GPS system, see **Figure 3.14 Delineated Wetlands**. National Wetland Inventory (NWI) mapped wetlands were added outside the limits of the study area, see **Figure 3.15 NWI Wetlands.** The NWI was established by the U.S. Fish and Wildlife Service in order to conduct a nationwide inventory of wetlands in the U.S. The NWI maps and classifies wetlands based on aerial imagery. These maps are a useful tool for planning, management, protection and restoration.

The vegetative and hydrological characteristics of the wetlands were classified using the US Fish and Wildlife Services (USFWS) Cowardin methodology for the *Classification of Wetlands and Deepwater Habitats of the United States,* December 1979. The wetland classification codes are a series of letter and number codes that have been developed to correspond to the classification nomenclature that best describes the habitat (for example, PFO1E). A legend for this system describing each "code" is depicted in Appendix C Cowardin Classification.

The classification system uses a hierarchy broken into systems, subsystems, classes, and subclasses to categorize wetlands and deepwater habitats. Systems (marine, estuarine, riverine, lacustrine and palustrine) refer to the type of hydrologic setting in which the wetlands are found (or in relation to) *i.e.*, oceans, estuaries, rivers and streams, lakes, and other vegetated non-tidal wetlands. Palustrine, riverine, and lacustrine systems have been mapped along the study area. More specifically, the following wetland cover type classifications were identified: palustrine forested (PFO), palustrine emergent (PEM), palustrine scrub/shrub (PSS), palustrine open water (PUB), riverine lower perennial unconsolidated bottom (R2UB), riverine upper perennial unconsolidated bottom (R3UB), riverine intermittent streambed (R4SB), and lacustrine limnetic unconsolidated bottom (L1UB).

Wetlands are interspersed throughout much of the study area in Bow and Concord. Many of these wetlands are associated with the perennial rivers, streams, and small ponds that are found within the study area.

The Merrimack River is the most prominent feature in the study area, and wetlands associated with this system include the river itself, and extensive floodplain forests north of Manchester Street and Exit 13 in the area of West Terrill Park, and in the north of Exit 15, east of I-93 in the vicinity of the end of the study area. Historic oxbows of the Merrimack River have formed what are now Horseshoe Pond and Fort Eddy Pond. Both of these areas have extensive palustrine wetland systems associated with them.

The South End Marsh is a large wetland area just north of Exit 12. This large wetland complex drains south towards the Merrimack River and has several large associated wetlands on both sides of the I-93 corridor.

Several of the wetlands in the vicinity of the I-89 and I-93 interchange are associated with the Turkey River and Bow Brook. Highway construction in previous years along I-93 and I-89 has altered these areas and the hydrology. There are several small ditched wetlands and drainages along the highways, and wetland depressions within the interchanges themselves.

A more detailed description of the wetland areas that occur in the study area is included in the following sections.

3.5.4.1 New Hampshire Prime Wetlands

In New Hampshire, under RSA 482-A:15 and NHDES Administrative Rules Env-Wt 700, individual municipalities may choose to designate certain high-quality wetlands as “prime wetlands”. wetland may receive this designation based on its large size, pristine character, and presence of rare or threatened plant and animal species. Prime wetlands have a protected 100-foot buffer associated with them unless the municipality is granted a waiver of this buffer. The City of Concord does not have any designated prime wetlands. The Town of Bow contains prime wetlands; however, there are none in the vicinity of the study area.

3.5.4.2 Description of Wetlands Functions and Values

The NH Wetlands Law (RSA 482-A) and the ACOE recognize several functions and values provided by wetlands. The ACOE provides a method for identifying wetland functions in their *Highway Methodology Workbook* and the *Highway Methodology Workbook Supplement*[3]. The functions recognized by ACOE, excerpted from the Highway Methodology Workbook Supplement, are listed below.

Groundwater Recharge / Discharge**:** This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area.

Floodflow Alteration (Storage and Desynchronization): This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.

[3] The Highway Methodology Workbook, NAEEP-360-1-30a, 1999

***Fish and Shellfish Habitat**:* This function considers the effectiveness of seasonal or permanent waterbodies associated with the wetland in question for fish and shellfish habitat.

Sediment / Toxicant / Pathogen Retention: This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens.

Nutrient Removal / Retention / Transformation**:** This function relates to the effectiveness of the wetland to prevent adverse effects of excess nutrients entering aquifers or surface waters.

Production Export (Nutrient): This function relates to the effectiveness of the wetland to produce food or usable products for humans or other living organisms.

Sediment / Shoreline Stabilization: This function relates to the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.

Wildlife Habitat**:** This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge.

Recreation (Consumptive and Non-Consumptive)**:** This value considers the effectiveness of the wetland and associated watercourses to provide recreational opportunities such as canoeing, boating, fishing, hunting, and other active or passive recreational activities.

Educational / Scientific Value**:** This value considers the effectiveness of the wetland as a site for an "outdoor classroom" or as a location for scientific study or research.

Uniqueness / Heritage**:** This value relates to the effectiveness of the wetland or its associated waterbodies to produce certain special values.

Visual Quality / Aesthetics**:** This value relates to the visual and aesthetic qualities of the wetland.

Threatened or Endangered Species Habitat**:** This value relates to the effectiveness of the wetland or associated waterbodies to support threatened or endangered species.

3.5.4.3 Description of Wetlands within the Study Area

The following is a summary of the wetlands delineated within the study area. Complete details are provided in the Wetland Delineation Report, dated September

2015, prepared for this project. These wetlands are graphically depicted on **Figure 3.14**.

Wetland A is located along the south side of I-89, west of the I-89/I-93 interchange and Exit 1. This wetland system includes the edges of a permanent pond, forested wetlands adjacent and downslope of the pond, and drainages leading from the pond within the forested wetlands. The pond is classified as PUBH and forested wetland are classified as PFO1E. The primary functions and values exhibited by Wetland A include floodflow alteration, groundwater recharge, sediment/toxicant retention, nutrient removal, and wildlife habitat.

Wetland B is located along the north side of I-89, west of the I-89/I-93 interchange. Wetland B is comprised of three intermittent streams with wetland vegetation along the edges. These streams are hydrologically connected to Wetland A on the south side of I-89 through a system of culverts. The three streams that make up Wetland B are very similar in nature, with beds varying from cobble, to gravel, and loose soil. Wetland B is classified as R4SB2. The primary wetland functions and values exhibited by these intermittent streams include groundwater recharge/discharge, sediment/shoreline stabilization, and wildlife habitat.

Wetland C is a palustrine emergent (PEM1E) drainage ditch west of Exit 1, which runs parallel to the highway along the south side of I-89 flowing from west to east. The vegetation is dominated by emergent species with some shrubs and saplings along the edges. The primary wetland functions and values exhibited by the drainage swale include wildlife habitat and sediment/toxicant retention and nutrient removal.

Wetland D is located along the north side of I-89, east of Wetland B and north of Wetland C. Wetland D includes an intermittent stream classified as R4SB2 with a palustrine forested fringe (PFO1E) along the banks. This intermittent stream carries a mixture of roadway drainage from I-89 and is also hydrologically connected to Wetland C through a culvert. The primary wetland functions and values exhibited by this intermittent stream include groundwater recharge/discharge, sediment/shoreline stabilization, and wildlife habitat.

Wetland E include the Turkey River, a perennial stream with a classification of R2UBH, and the associated palustrine forested wetlands (PFO1E) adjacent to the river. The Turkey River flows into the project area just north of Exit 1, and flows east, parallel to the north side of I-89, before crossing under I-93 and I-89 just upstream from its confluence with the Merrimack River. The primary wetland functions and values exhibited by the Turkey River and adjacent wetland pockets include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, production export, sediment/shoreline stabilization, wildlife habitat, recreation, educational/scientific value, and aesthetics.

Wetland G is predominately a palustrine emergent depression (PEM1E) with areas of palustrine forested wetland (PFO1E), located just south of I-89 and west of I-93, within the interchange. The functions and values of Wetland G include sediment/toxicant retention, floodflow alteration, and limited wildlife habitat. Common reed (*Phragmites australis*), an invasive plant, is present throughout the emergent area.

Wetland H is a palustrine emergent depression (PEM1E) located south of I-89 and east of I-93 within the interchange. This area has been recently modified by a highway improvement project. Dominant herbaceous vegetation includes goldenrods, sedges, common rush, and grasses. Functions and values include floodflow alteration, sediment/toxicant retention, and limited wildlife habitat.

Wetlands I and J are linear drainage features that have been modified during the construction and maintenance of I-93. Wetland I is located on the west side of I-93 north of Grandview Road, and Wetland J is located on the east side of I-93 south of Grandview Road. These drainages are best classified as PFO1E. The primary wetland function and value exhibited by these intermittent drainages is limited wildlife habitat.

Wetland K is a palustrine emergent swale (PEM1E) located along the I-89 North onramp from I-93 South. This area drains to the south towards the Turkey River. Vegetation in this wetland is regularly disturbed by maintenance mowing activity along the highway. Functions and values associated with Wetland K are limited, but likely include sediment/toxicant retention given its proximity to the highway and dense herbaceous vegetation cover.

Wetlands N, O, and P are associated with Bow Brook, a perennial stream that flows through the project area. These wetland areas include the stream itself and associated palustrine emergent and forested wetlands adjacent to the stream. The stream is classified as R2UB2 and the associated wetlands are PEM/FO1E. Wetland P is located west of I-93, just north of the I-89 interchange. Bow Brook flows east under I-93 through a culvert. On the east side of I-93, Bow Brook flows south between the highway and a developed area to the east. The stream flows through a culvert under the I-89 North onramp and briefly daylights in the cloverleaf formed by the I-89 North onramp, before flowing into a twin culvert structure that outlets into the Turkey River. Wetland functions and values associated with Bow Brook and the adjacent wetlands include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/shoreline stabilization, and wildlife habitat.

Wetland Q is a palustrine emergent marsh (PEM1E) with areas of open water (PUBF). This area includes the mitigation wetland site located southeast of Exit 12, between the I-93 North onramp and the railroad tracks to the east. This area drains to a small pond to the south, outside the study area and is hydrologically connected to the Merrimack River to the South. Functions and values of this wetland area include floodflow alteration, sediment/toxicant removal, and nutrient removal/retention. This system is hydrologically connected to Wetland R located on the opposite side of I-93 to the north.

Wetland R is located just north of I-93 and Exit 12 between Route 3A to the west and the railroad tracks to the east. This large wetland complex is known as the South End Marsh, and has a large area of open water associated with it. This wetland has a classification of PEM1F/PUBH. This area is hydrologically connected to Wetland Q to the south, on the opposite side of I-93. Functions and values associated with Wetland R include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/toxicant retention, nutrient removal/retention, sediment/shoreline stabilization, wildlife habitat, and visual quality/aesthetics.

Wetland S is a palustrine forested/scrub-shrub wetland (PFO/SS1E) located south of I-93 just east of Exit 12. There are areas of open water associated with this wetland. Wetland S is hydrologically connected to Wetland Q outside the study area. This wetland complex provides several functions and values because of its size, location, accessibility and hydrologic connection to other wetlands. These include groundwater recharge/discharge, floodflow alteration, sediment/toxicant retention, and wildlife habitat.

Wetland T is a palustrine scrub-shrub wetland (PSS1E) located north of I-93 east of the railroad bed separating this area from the South End Marsh (Wetland R). This area is hydrologically connected to Wetlands R, S, Q, and U Wetland T provides several functions and values due to its size, diversity, location, accessibility and hydrologic connection to other wetlands. These include groundwater recharge, floodflow alteration, sediment/toxicant retention, and wildlife habitat.

Wetland U is a linear palustrine forested ditch (PFO1E) located parallel to I-93 and Wetland T. This area is separated from Wetland T by a gravel road. Wetland U has limited functions and values including sediment/toxicant retention and moderate wildlife habitat.

Wetland V is a palustrine emergent wetland (PEM1E) located northeast of Wetland S. Wetland V begins as a drainage swale that parallels I-93, draining to the southwest before opening into a larger marsh with areas of open water. This area is hydrologically connected to Wetland S outside the study area. Vegetation in this wetland is dominated by common reed, an invasive plant, with some speckled alder along the edges. Functions and values associated with Wetland V include floodflow alteration, groundwater recharge, and sediment/toxicant retention.

Wetland X is a palustrine forested wetland (PFO1E) located north of Exit 13. This area is part of the Merrimack River floodplain. There are pockets of palustrine scrub-shrub wetlands (PSS1E) and small areas of open water and several backwater channels throughout the floodplain. The vegetation in this wetland is typical of rich bottomland floodplain forests along a large river. Silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*) and American elm are dominant in the overstory. Functions and values associated with Wetland X include floodflow alteration, groundwater recharge/discharge, sediment/toxicant retention, sediment/shoreline stabilization, wildlife habitat, and recreation.

Wetland Z is a small palustrine emergent depression (PEM1E) located adjacent to South Commercial Street, Constitution Avenue, and a parking lot. This small wetland has limited functions and values, but likely includes some sediment/toxicant retention potential.

Wetland AA is a palustrine emergent drainage ditch (PEM1E) located along the Exit 15 ramp in the northeast cloverleaf. Functions and values of this wetland are limited but include some sediment/toxicant removal potential.

Wetland BB is the southern edge of Fort Eddy Pond located just north of I-393. This wetland is dominated by shallow open water and is classified as L1UBH, with a palustrine scrub-shrub/forested (PSS/FO1E) fringe along the perimeter. Wetland BB drains to the east, under the I-393 Exit 1 ramps, and is hydrologically connected to Wetlands CC and DD and ultimately drains to the Merrimack River. Functions and values of Wetland BB include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/shoreline stabilization, wildlife habitat, and visual quality/aesthetics.

Wetland CC is a palustrine forested wetland (PFO1E) located north of I-393 in the wooded area surrounded by the Exit 1 off ramp and College Drive. This area is hydrologically connected to Fort Eddy Pond (Wetland BB) to the east, and Wetland DD to the west. Wetland functions and values associated with Wetland CC include sediment/toxicant retention and wildlife habitat.

Wetland DD is located north of I-393 and east of College Drive. This area is a palustrine forested (PFO1E) swale that drains into the Merrimack River (R2UBH) and is hydrologically connected to Wetland CC and BB. The functions and values associated with Wetland DD include sediment/toxicant retention and wildlife habitat.

Wetland EE is a palustrine forested ditch (PFO1E) located between Fort Eddy Road and the I-93 North onramp. Functions and values associated with Wetland EE include sediment/toxicant retention.

Wetland FF is a palustrine forested ditch (PFO1E) south of I-393 and east of Fort Eddy Road. This area is hydrologically connected to Wetland EE through a culvert under Fort Eddy Road. This area outlets into the Merrimack River. Functions and values associated with Wetland EE include sediment/toxicant retention.

Wetland GG is a perennial stream (Wattanummon Brook) that drains from Horseshoe Pond, flowing east through a culvert under I-93 and draining into Wetland

HH. This stream is classified as R3UBH. The stream continues through Wetland HH and flows into the Merrimack River.

Wetland HH is located within the Merrimack River floodplain and is classified as PFO1A. This area has been identified by the NH Natural Heritage Bureau as a silver maple-false nettle-sensitive fern floodplain forest, an exemplary natural community in the State. The primary functions and values exhibited by this wetland area include floodflow alteration, groundwater recharge/discharge, fish and shellfish habitat, nutrient removal, production export, sediment/shoreline stabilization, wildlife habitat, recreation, educational/scientific value, uniqueness/heritage and aesthetics.

Wetland II is located east of I-93 at the northern end of the study area. Wetland II is a palustrine forested wetland (PFO1A) in the floodplain of the Merrimack River, and is hydrologically connected to Wetland HH outside of the study area. The primary functions and values exhibited by Wetland II include floodflow alteration, groundwater recharge/discharge, wildlife habitat, sediment/shoreline stabilization, recreation, and educational/scientific value.

Wetland Functions and Values are summarized in **Table 3.15 Wetland Functions and Values**.

Table 3.15 Wetland Functions and Values

Wetland ID	Wetland Classification	Groundwater Recharge & Discharge	Floodflow Alteration	Fish & Shellfish Habitat	Sediment & Toxicant Retention	Nutrient Removal, Retention, & Transformation	Production Export	Sediment & Shoreline Stabilization	Wildlife Habitat	Recreation	Educational & Scientific	Uniqueness & Heritage	Visual Quality & Aesthetics	Endangered Species
A	PFO1E/PUBH	X	X		X	X			X					
B	R4SB2	X			X			X	X					
C	PEM1E				X	X			X					
D	R4SB2/PFO1E	X						X	X					
G	PEM/FO1E		X		X				X					
H	PEM1E								X					
I, J	PFO1E								X					
K	PEM1E				X									
N, O, P	R2UB2/PEM/FO1E	X	X	X				X	X					
Q	PEM1E/PUBF		X		X	X								
R	PEM1F/PUBH	X	X	X	X	X		X	X				X	
S	PFO/SS1E	X	X		X				X					
T	PSS1E	X	X		X				X					
U	PFO1E				X				X					
V	PEM1E	X	X		X									
X	PFO1E	X	X		X			X	X	X				
Z	PEM1E				X									
AA	PEM1E				X									
BB	L1UBHh/R2UBH	X	X	X				X	X				X	
CC	PFO1E				X				X					
DD	PFO1E				X				X					
EE	PFO1E				X									
FF	PFO1E				X									
GG	R3UBH	X	X	X		X	X	X	X	X	X		X	
HH	PFO1A	X	X	X		X	X	X	X	X	X	X	X	
II	PFO1A	X	X					X	X	X	X			

3.5.4.4 Vernal Pools

A vernal pool is a specific type of wetland that exhibits a seasonal flooding and drying cycle. According to NHDES (Env-Wt 101.108) vernal pools typically have the following characteristics: cycles annually from flooded to dry conditions, although the hydroperiod, size, and shape of the pool might vary from year to year; forms in a shallow depression or basin; has no permanently flowing outlet; holds water for at least two continuous months following spring ice-out; lacks a viable fish population; and supports one or more primary vernal pool indicators, or three or more secondary vernal pool indicators. Primary vernal pool indicators include the presence or physical evidence of breeding by spotted salamander (*Ambystoma maculatum*), Jefferson Salamander (*Ambystoma jeffersonianum*) blue-spotted salamander (*Ambystoma laterale*), marbled salamander (*Ambystoma opacum*), wood frog (*Lithobates sylvatica*), or fairy shrimp (*Eubranchipus spp.*). Vernal pools are considered essential breeding habitat for these primary indicator species.

Secondary indicator species include clam shrimp (Orders: *Spinicaudata and Laevicaudata*), fingernail clams (Family: *Sphaeriidae*), spire-shaped snails (Families: *Physidae and Lymnaeidae*), flat-spire snails (Family: *Planorbidae*), aquatic beetle larvae (Families: *Dytiscidae, Gyrinidae, Haliplidae, Hydrophilidae*), caddisfly larvae (Families: *Limnephilidae, Phryganeidae, Polycentropodidae*), damselfly larvae (Families: *Coenagrionidae and Lestidae*), dragonfly larvae (Families: Aeshnidae and Libellulidae), and true fly larvae or pupae (Families: Culicidae, Chaoboridae, Chironomidae). Vernal pools also provide valuable habitat for a variety of other species of amphibians, turtles, snakes, birds, and mammals

A preliminary determination was made during the wetland delineation effort (conducted during summer of 2014 and fall of 2015) that vernal pools are not present within the project area.

3.5.5 Coastal Zone Management

Section 307 of the Federal Coastal Zone Management Act of 1972 (PL92-583) and the Implementation Regulations of the National Oceanic and Atmospheric Administration (15 CFR Part 930) stipulate that all federal activities affecting coastal zones must be consistent with an approved State Coastal Zone Management (CZM) Program. The Coastal Barriers Resources Act of 1982 (PL97-348) prohibits most federal funding for development within the designated Coastal Barriers Resource System. The study area is not within the coastal zone and is not subject to these Acts.

3.6 Land Resources

This section describes the existing conditions within the study area for land resources including geology, soils, farmlands, wetlands, and wildlife.

3.6.1 Geology and Soils

3.6.1.1 Bedrock and Surficial Geology

The US Geological Survey bedrock geology map shows that the entire study area is underlain by the Concord Granite (Late Devonian) unit, a common type of igneous rock in New Hampshire. The primary rock type within this bedrock unit consists of gray two-mica granite, and locally grades to tonalite, a granite having greater than 20% quartz. In the Merrimack River Valley, surficial geology consists of quaternary sandy till, lake sand, and pebbles. Refer to **Figure 3.16 Soils and Bedrock Overview** for a location of the bedrock resources.

3.6.1.2 Soils

Soils in the project area possess drainage capacities ranging from excessively well drained to poorly drained. Refer to **Figure 3.16** for the location of these soils. Based upon on the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey, the most common soil types in the project area include urban land-Pootatuck complex, Windsor-urban land complex, urban land, Raynham silt loam, and Canton very fine sandy loam.

3.6.2 Farmlands

3.6.2.1 Important Farmland Soils

The NRCS also administers the Farmland Protection Policy Act (FPPA), which provides guidelines to federal agencies involved in proposed projects that may convert farmland to non-agricultural uses. The purpose of the FPPA is "to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses..."

The four categories of farmland soils addressed in the FPPA include prime farmland, unique farmland, farmland of statewide importance, and farmland of local importance. In addition, active farmland or agriculture areas are discussed. Each farmland category is described in general terms below:

Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when the land is treated and managed using acceptable farming methods.

Unique Farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods. Examples of such crops in New Hampshire are apple orchards, lowbush blueberries, vegetable truck gardens, and maple sugar groves.

Farmland of Statewide Importance is land that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. Generally, these farmlands include those areas that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

Farmland of Local Importance includes certain additional farmlands for the production of food, feed, fiber, forage, and oilseed crops that are not identified as having national or statewide importance.

Land use within areas where the mapped soils fall into these classifications does not have to be in agricultural use for the classification to be valid, because land that is not irreversibly committed to another non-agricultural use could potentially be used in the future for agriculture. Urban built-up land and water are not subject to the FPPA.

Figure 3.17 Agricultural Resources Overview depicts farmland soils as identified from NRCS soil survey maps within the I-93 study area. Land currently in use as farmland in the vicinity of the study area include cornfields north of Horseshoe Pond and northwest of Exit 15. These farm fields are in active cultivation and most are located on soils designated as Prime Farmland by the NRCS. These include Pootatuck and Occum fine sandy loams, both of which are floodplain soils.

The project corridor contains soils classified as Farmland of Local Importance and Prime Farmland (if not frequently flooded). Some of these areas are active farmland. Important Farmland Soils and active farmlands are depicted on **Figure 3.17 Agricultural Resources Overview**. The FPPA contains provisions that exempt construction within an existing right-of-way, as well as projects involving land within areas classified as urbanized by the US Census Bureau. The entire project, with the exception of an area along the north side of Interstate 89 to the west of Exit 1, is located within an urbanized area. The area that is not within the urbanized area does not contain farmland soils.

3.6.2.2 Active Farmlands

Active farmlands are lands that are currently in active agricultural use. These lands were identified from aerial photos and windshield surveys. The only active farmland within the study area is located adjacent to I-93 to the west, near the northern end of the study area. This area is a tree nursery. Additional active farmlands in the general vicinity include cornfields located west of the tree farm adjacent to Horseshoe Pond and the Merrimack River, east of the Merrimack River in the vicinity of Exit 14, and east of Exit 12. Sycamore Community gardens is located east of Fort Eddy Pond on the west side of College Road and north of I-393. All of the areas of Active Farmland are located in areas of Prime Farmland if not frequently flooded.

3.6.3 Conservation and Public Recreational Lands

3.6.3.1 Conservation Lands

Conservation lands within the study area include properties protected by state agencies (NHDES, NH Fish and Game, and NH Department of Natural and Cultural Resources), private conservation agencies, the City of Concord, the Town of Bow and private landowners. Inquiries were made and coordination with state agencies was conducted to determine if certain lands, such as those under the jurisdiction of NH Conservation Land Stewardship program (CLS), NH Land and Community Heritage program (LCHIP), and the Land and Water Conservation Fund (LWCF), are located in the project corridor or vicinity.

Conservation lands were also identified from publicly available GRANIT data and are shown on **Figure 3.18 Conservation and Public Lands**. Conservation lands can be in the form of either fee ownership or in the form of a conservation easement that restricts the uses that can occur on the land.

Conservation lands that are within or adjacent to the study area are summarized in **Table 3.16 Conservation Lands** and include the owner, size of the parcel, and whether public access is permitted.

Table 3.16 Conservation Lands

Conservation Area Name	Acreage	Land Protection Type	Land Protection Agency	Agency Type	Public Access
Cilley State Forest	174.1	Fee Ownership	NH Dept. of Resources & Economic Dev. (DRED)	State	Allowed
Bow99-628	6.0	Conservation Easement	Town of Bow	Municipal/County	Allowed
Mitigation Wetland	4.4	Fee Ownership	NH Dept. of Transportation	State	No response to survey
South End Marsh	19.6	Fee Ownership	City of Concord	Municipal/County	Allowed
West Terrill Park	53.6	Fee Ownership	City of Concord	Municipal/County	Allowed
Woodman	124.8	Conservation Easement	Society for the Protection of NH Forests	Private	No response to survey
Merrimack River Access	1.7	Fee Ownership	NH Fish & Game	State	Allowed
Technical Institute Low Area	33.4	Fee Ownership	NH Technical Institute (Concord)	State	No response to survey

3.6.3.2 Section 6(f) Lands

Conservation lands are among the resources that may be protected under Section 6(f) of the LWCF Act. The LWCF is a Federal program that provides funding and grant matching to federal, state, and local governments for the acquisition of land and water for the benefit of the American public. If a LWCF property is proposed to be converted to a non-conservation or non-recreational purpose, specific requirements must be addressed pursuant to Section 6(f). Grant assisted areas are prohibited from conversion to non-recreation uses, unless approved by the Secretary of the Interior and replaced with comparable lands. There are no properties within the study area that are under the jurisdiction of Section 6(f).

3.6.3.3 Public Recreational Lands

Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303(c)) requirements stipulate FHWA and other DOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless the following conditions apply:

- There is no feasible and prudent avoidance alternative to the use of land; and the action includes all possible planning to minimize harm to the property resulting from such use;

  OR

- The Administration determines that the use of the property will have a *de minimis* impact.

There are two parks/recreational areas located within the study area. Reed Park contains a softball field, multi-use field and playground is owned by the City of Concord located off Hall Street between Exits 12 and 13, directly abutting southbound I-93. Healy Park is owned by the City of Concord and is located between I-93 and the Merrimack River north of Manchester Street. It contains walking trails.

3.6.3.4 Bicycles and Pedestrians

A walking trail, also used by bicycles, crosses the I-89 / I-93 Interchange within the NHDOT ROW in the Town of Bow. The trail begins at the end of Valley Road and crosses through the interchange via a tunnel under the I-89 southbound to I-93 southbound on-ramp, it continues parallel to I-89 under the I-93 bridges, under the I-93 northbound on-ramp from I-89 southbound via a tunnel, and parallels I-89 southbound to the I-89/NH Route 3A/Hall Street intersection at Bow Junction. The trail is not maintained in the winter by the Town of Bow, nor by the NHDOT, but is used throughout the year.

A segment of the East Concord Heritage Trail is located in the northern portion of the study area, north of Exit 15, in the vicinity of Horseshoe Pond and the NH Technical Institute (NHTI) campus. The trail extends from the Merrimack River at College Drive by Exit 1 of I-393 through NHTI, crosses over I-93 via the Delta Drive overpass, follows along Horseshoe Pond on Commercial Street ending at North Main Street. The Trail also extends north along a bicycle/pedestrian path from Delta Drive/NHTI campus parallel to northbound I-93, within the NHDOT ROW, over the Merrimack River on the I-93 northbound bridge and connects, beyond the project area, to Eastman Street on the north side of the Merrimack River.

Bicycle/pedestrian access from the NHTI campus to Fort Eddy Road is provided via a tunnel under I-393 in the Exit 15 area.

The NHDOT Bicycle Route Maps for the Merrimack Valley Region identify roadways within the study area as preferred recommended bicycle routes. These routes and roadways include: the NHTI path, I-93 Bicycle Path in Concord, I-89 Bicycle Path in Bow, Manchester Street, Water Street, Commercial Street, Constitution Avenue, and North Main Street.

3.6.3.5.3 River Access

Access points to the Merrimack River are locally important for recreational opportunities, including fishing and boating. The Kiwanis Riverfront Park provides one access area within the study area, just north of the Loudon Road Bridge. This park has a parking area and a walk-in (car top) boat launch. Additional access points located in the vicinity of the project include the College Drive Boat Ramp north of I-393, Fort Eddy Pond walk-in (car top) site on NHTI property, and the NH Fish and Game gravel ramp northwest of the project area.

3.7 Wildlife and Fisheries

A review of published materials and on-site field visits indicate that a variety of wildlife habitats exist within the study area, including upland hardwood forests, upland softwood forests, mixed upland forests, forested (primarily red maple) wetlands, scrub-shrub wetlands, emergent marshes, ponds, streams, rivers, agricultural fields and pastures, “old fields” (i.e., shrublands), and recently disturbed areas.

3.7.1 Wildlife

Nearly all habitats along the study corridor have been affected to some extent by their proximity to the highway. Residential and commercial development is prevalent along this 4.5 mile section of I-93, particularly in Concord. The wildlife value of much of the existing habitat is reduced due to fragmentation (by the encroaching development and the highway itself), frequent human disturbance such as vehicular traffic, human activity (including occasional foot traffic), noise, and pollution from highway and development runoff, and various other non-point sources.

The most valuable existing habitats in the study area are the riparian areas along the rivers, streams and ponds with accompanying buffer zones, and the larger emergent wetlands. Also, any large contiguous blocks of forest, particularly those on public property such as the Cilley State Forest, or within wetlands where there is some measure of protection against development, are important wildlife habitats. The Cilley State Forest is known to host a variety of wildlife including large mammals such as moose and black bear.

The NH Fish and Game Department (NHF&G) is responsible for managing and protecting resident wildlife species. NHF&G has promulgated rules (NH Administrative Rules Chapter 1000) for the protection and management of these species. These rules pertain almost entirely to the exploitation of the species and not to the habitats. The rules set seasons, bag limits, and legal means for the taking of game, fish, and furbearing species. Some wildlife habitat is protected as state forests, state parks, or state-owned or state-managed wildlife management areas where additional restrictions on land use apply. Consultation with th3e NHF&G occurred on this matter.

3.7.2 Fisheries

Three surface waters within the study area are important habitat for fisheries. These waters are the Merrimack River, Turkey River, and Bow Brook. These waters contain a wide variety invertebrates, fish, amphibians, reptiles, aquatic mammals, birds, and aquatic plants. From a regional perspective, the Merrimack River is a common fishing destination and is fished for brook trout, brown trout, rainbow trout and other species.

3.7.3 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires the federal government to identify Essential Fish Habitat (EFH) and make conservation recommendations to agencies whose actions could impact it. The Merrimack River, Turkey River, and Bow Brook are listed as EFH for all life cycle stages of Atlantic Salmon (*Salmo salar*).

The EFH Assessment Worksheet, specifically for Federal agencies, was completed and submitted for review. Refer to Chapter 4, Section 4.7 for further information and the results of this consultation.

3.8 Rare, Threatened and Endangered Species

3.8.1 Federal Jurisdictions

The US Endangered Species Act of 1973 (ESA) (P.L. 93-205), as amended in 1973 and 1978, recognizes the need, and provides the means to protect rare plants, invertebrates and vertebrate species of fish and wildlife, and provides for the protection of critical habitats and the management of endangered species. Per the 1978 Amendments to the ESA, separate (geographically or genetically isolated) but rare populations of fish and wildlife (but not plants or invertebrates) may be protected as well as entire species. Listed species are categorized as either endangered species (which are in danger of extinction throughout all or a substantial portion of its ranges) or threatened species (which are likely to become endangered throughout all or a substantial portion of its range).

Section 7 of the ESA dictates that all federal agencies must consult the US Fish and Wildlife Service (USFWS) or National Oceanic and Atmospheric Administration (NOAA) (for marine species only) to ensure that actions taken under federal funding, federal assistance, or federal permits (e.g. Section 404 Army Corps Permits) do not jeopardize the existence of threatened or endangered species. Jurisdiction is given to the USFWS and NOAA to recommend changes to the project to avoid such jeopardy (including impacts to the habitat as well as to the plants or animals themselves).

The Bald and Golden Eagle Protection Act (16 USC 668-668d) prohibits the “take” of bald eagles and golden eagles, including their parts, nests, and eggs. The act also prohibits impacts from human activities that result in nest abandonment or interruption of normal breeding, feeding, or sheltering habits. Neither of these species was reported by the NH Natural Heritage Bureau (NHB) or NHF&G as a potential concern in the project area. The USFWS Information for Planning and Consultation (IPaC) webtool identified bald eagles as potentially occurring within the project area.

The USFWS Information, Planning, and Consultation (IPaC) web tool was utilized to obtain an Official Species List for federally listed species or critical habitats that could occur in the study area.

3.8.2 New Hampshire Jurisdictions

The 2015 NH Wildlife Action Plan (WAP) provides the framework for conserving Species of Greatest Conservation Need (SGCN) and their habitats in New Hampshire. The WAP identifies 169 SGCN and focuses on 27 habitats that support these species. The WAP includes a habitat-based statewide map that identifies “Highest Ranked Wildlife Habitat” as shown on **Figure 3.19 Plants and Wildlife Overview**.

In New Hampshire, the Endangered Species Conservation Act (RSA 212-A) delegates authority and responsibility for the listing and protection of threatened and endangered species of wildlife to the NHFG. This statute outlines NHF&G authority and directs other state agencies to take reasonable steps to ensure their actions do not jeopardize the continued existence of threatened or endangered species or result in the destruction or modification of their critical habitat. NHF&G has in turn promulgated the rules for the protection of these species in Fish and Game Rules, Conservation of Endangered Species. Species eligible for listing under these rules include invertebrates and vertebrate species of fish and wildlife (plants are not included). Protected animal species are placed in one of two categories, threatened or endangered, depending on their rarity.

The New Hampshire Native Plant Protection Act RSA 217-A, enacted by the State Legislature in 1987, established the authority for the State to develop a list of rare plant species. The NH NHB was empowered with this authority and developed the list in NH Administrative Rules Chapter Res 1100. Plants deemed as rare in the State and in need of protection were listed as either endangered, threatened, or special concern plant species in descending order of rarity. The Native Plant Protection Act also gives the NHB the authority to identify exemplary natural communities in the State. These plant communities are high quality examples of natural community types and are given the same protections as rare plants.

Unlike federally listed species, plant or wildlife species need only be rare within the State of New Hampshire to be state-listed, not rare over the entire range of the species. Therefore, many state-listed species are rare because New Hampshire is at the edge of their range, or because there is a limited amount of habitat for the species within the state. Legal protection is also much less stringent in state statutes. Besides the prohibitions on the taking or killing of state-listed wildlife species, protection of state listed plants or animals is largely restricted to recommendations by the aforementioned state agencies for the approval or disapproval of projects that might impact the environment. All projects initiated or funded by the state, or applying for such state permits as Wetlands Dredge and Fill Permits, must be reviewed by the NHB and NHF&G.

The NHB maintains a database of records of known occurrences of rare species (plants and animals) and exemplary natural communities. A request was made to the NHB through their online Data Check Tool to identify any known records of rare species and exemplary natural communities in the vicinity of the proposed project area. The results of these queries to USFWS and NHB are presented in the sections that follow. Appendix B, Exhibit 1)

3.8.3 Exemplary Natural Communities/Critical Habitats

Based upon the results of the inquiries to the USFWS and NHB, there are no critical habitats within the study area. The NHB has identified one exemplary natural community in the study area. The community is described as a silver maple-false nettle-sensitive fern floodplain forest. This community type is primarily found in the central and southern parts of the state on large to medium sized rivers and tends to occur on sandier, somewhat acidic soils. This community is located at the northern end of the study area along the Merrimack River, on the east side of I-93 within the NH Technical Institute Low Area conservation land.

There are no publicly or privately-owned wildlife refuges within the study area or vicinity.

3.8.4 Plants

Federal Threatened and Endangered Species

According to the USFWS Official Species List, the federally threatened small whorled pogonia (*Isotria medeoloides*) may occur in the project area since habitat is known to exist in Merrimack County, New Hampshire. This species most often occurs in hemlock-beech-oak-pine forests and tends to prefer mesic/seasonally damp soils. Other habitat preferences can include Skerry fine sandy loams or other soils in which a fragipan exists, somewhat poorly drained soils and/or a seasonally highwater table, or terraces above streams. Small intermittent streams, ephemeral runoff channels, or old logging roads often provide breaks in the forest canopy that this species seems to prefer.

According to the NH NHB document *Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns* (July 2013) one known population of small whorled pogonia is located in Bow. An area of potential small whorled pogonia habitat was identified and investigated in June, 2018 by NH NHB staff. A determination was made by the NH NHB staff that the small whorlded pogonia was not present within the habitat investigated.

State Rare, Threatened and Endangered Species

The NHB did not report any known occurrences of any rare, threatened, or endangered plants in the study area.

3.8.5 Wildlife

Federal Threatened and Endangered Species

According to the USFWS Official Species List (Appendix B, Exhibit 2), the study area is within the range of the federally-threatened and state-endangered northern long-eared bat (*Myotis septentrionalis*). The NHB did not report any known winter hibernacula within 0.5 miles nor any documented maternity roost trees within 0.25 miles of the project. According to the USFWS, suitable summer habitat for northern long-eared bat consists of a variety of forested habitats. This species generally prefers closed canopy forest with an open understory. Potential roost trees include live trees or snags, at least 3” in diameter, with exfoliating bark, cracks, crevices, or cavities. Potential roosting habitat does exist within the study area. Also, the project proposes significant tree clearing. Therefore, an acoustic survey was undertaken in the summer of 2017 to determine whether northern long-eared bats are present in the study area. The survey resulted in no acoustic files manually identified as northern long-eared bat; therefore, the presence of this species is not considered probable.

State Rare, Threatened and Endangered Species

The NHB reported known records of four species of rare wildlife including the state-endangered brook floater (*Alasmidonta varicosa*), and the following state species of Special Concern: American eel (*Anguilla rostrata*), Northern Leopard Frog (*Rana pipiens*), and Wood Turtle (*Glyptemys insculpta*).

American eels can be found in almost any freshwater habitat that can be accessed from the ocean. The NHFG has documented American eels in the Merrimack River and many of the larger tributaries including the Turkey River.

Northern leopard frogs are typically found near wetlands. They require shallow standing water and emergent vegetation for breeding, egg deposition, and tadpole development. In the summer, northern leopard frogs can be found in a variety of wetland habitats. They typically overwinter in permanent bodies of water or streams that do not freeze solid. The NHB database has documented sightings of northern leopard frogs in the study area in the floodplain forests of the Merrimack River north of Exit 13, and in the vicinity of Horseshoe and Fort Eddy Ponds.

Wood turtles require slow moving streams and channels with sandy substrates for hibernation. Foraging habitat includes floodplains, grasslands, and shrublands. The NHB reports wood turtles in the vicinity of the Merrimack River and Fort Eddy Pond, northeast of Exit 15, and in the vicinity of Bow Brook.

The brook floater is a species of freshwater mussel that occurs in clean, well oxygenated rivers and streams. It is found in the Merrimack River and several of its tributaries. Coordination with NHF&G resulted in a commitment to conduct a mussel survey during final design of the project.

The acoustic survey completed in 2017 determined that the presence of little brown bat (*Myotis lucifugus*) and tricolored bat (*Perimyotis subflavus*) is considered probable. Both are NH-listed endangered species. Both species are also under review by the USFWS for potential future listing under the Endangered Species Act.

3.8.6 Invasive Species

Plants

An invasive plant is a non-native plant that is able to persist and proliferate outside of cultivation, resulting in ecological and/or economic harm. Under the statutory authority of NH RSA 430:55 and NH RSA 487:16-a, the NH Department of Agriculture, Markets & Food and NHDES prohibit the spread of invasive plants listed on the NH Prohibited Species List. The project area contains purple loosestrife (*Lythrum salicaria*), bush honeysuckle (*Lonicera* sp.), common reed (*Phagmites australis*) and Japanese knotweed (*Fallopia japonica*), all of which are invasive plants listed on the NH List of Prohibited Invasive Species (AGR PART 3802.01).

Insects

The emerald ash borer (*Agrilus planipennis*) is an invasive insect and a federally-regulated pest that has been documented in both Bow and Concord. In July of 2015 the New Hampshire Department of Agriculture implemented the Emerald Ash Borer Quarantine in order to prevent the unregulated movement of infested or potentially infested materials. Ash trees in the genus *Fraxinus* are the host species for the emerald ash borer. Quarantined areas in New Hampshire include Belknap, Hillsborough, Merrimack, and Rockingham Counties. The quarantine states that:

“No person shall move, carry, transport, or ship (or authorize or allow any other person to do the same) regulated articles and commodities from inside the quarantine area to outside of the quarantine area, unless specifically authorized in writing via Compliance Agreement issued by the New Hampshire Department of Agriculture Markets and Food (NHDAMF) and moving with a Plant Protection and Quarantine (PPQ) 540 (certificate) or PPQ 530 (limited permit).

3.9 Cultural Resources

State Requirements

The New Hampshire Division of Historic Resources (DHR) is charged under RSA 227-C:9, Directive for Cooperation in the Protection of Historic Resources, with coordination of the identification and evaluation of cultural resources in the State of New Hampshire, which includes the review of historical resources under Section 106 of the National Historic Preservation Act.

The DHR, in cooperation with the NHDOT and FHWA, has established a method of identification and evaluation to meet the requirements of this historic preservation review. The purposes of this process are to (1) locate and identify historical, architectural, archaeological, and historical archaeological resources within the project's area of potential effects (APE); (2) apply the criteria for evaluation of significance to any resources in the APE to determine possible eligibility for the National Register of Historic Places (NRHP), if the resource(s) is/are not already known to be eligible or listed; (3) assess the probable effects of a project on resources listed on or eligible for the National Register; and (4) develop appropriate mitigation methods to lessen the project's impact on affected historic properties.

Section 4(f) of the U.S Department of Transportation Act of 1966 stipulates that agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges or public or private historical sites unless the following apply:

- There is no feasible and prudent avoidance alternative to the use of land; and the action includes all possible planning to minimize harm to the property resulting from such use; or,
- FHWA determines that the use of the property will have a *de minimis* impact.

A detailed discussed on the resources subject to a Section 4(f) evaluation is provided in Chapter 5.

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties. Under the National Historic Preservation Act, a historic property is "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places (NRHP) maintained by the Secretary of the interior."

A historical resources assessment was completed to identify structures that are listed on or that may be eligible for the National Register of Historic Places within the study area.

A Phase 1A archaeological sensitivity assessment in accordance with the National Historic Preservation Act Section 106 process was conducted to define all known or potential archaeological resources that may be located within the study areas. Potential archaeological resources include Native American sites as well as any subsurface features related to the eighteenth to early twentieth-century use.
.
The Phase 1A report included information gathered through background research and reviewing archaeological files at NHDHR and review of local maps and local historic collections. The Phase 1A also included fieldwork and site inspections throughout the study area. The findings in the report concluded that numerous areas within the study area were moderately sensitive or highly sensitive relative to archaeological resources.

Historic properties, including archaeological sites that are listed or eligible for listing in the National Register of Historic Places are given protection by Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act of 1966.

Table 3.17 Properties/Districts Eligible for the National Register of Historic Places lists the Properties/Districts Eligible for the National Register of Historic Places within the study area.

Table 3.17 Properties/Districts Eligible for the National Register of Historic Places

Town	Name	Address
Bow	Lamora's Garage	521 South Street & 1 Valley Road
Bow	Upton House &Store	2 Valley Road
Concord	Carrigan House	244-246 North Main Street
Concord	Robert J. Hart Building	50 Storrs Street
Concord	Boston, Concord & Montreal Railroad Historic District	
Concord	New Hampshire Technical Institute Historic District	
Concord	IBM Corp. Branch Office	207 North Main Street
Concord	Concord Shoe Co/Ralph Pill Building	22 Bridge Street
Concord	Concord Electric Light Station	24 Bridge Street
Concord	Rumford Arms	248-250 North Main Street
Concord	NHDOT Garage Historic District	Stickney Avenue

3.10 Socio-economic Resources

3.10.1 Introduction

An inventory of the demographic and economic characteristics was conducted within the following study area:

- A broad corridor of influenced area, extending approximately 15 miles from the project limits (Exit 10 in northern Manchester to the south and Exit 20 in Tilton to the north, in the Franklin area), and
- The immediate communities along the corridor, including Bow and Concord.

Within the 15-mile corridor influence area, the following characteristics are present:

- The total population of the corridor influence area was 209,000 in 2017;
- The corridor's population is expected to increase modestly, to a figure of around 215,000 in 2022, a 2.5 % growth rate, which is essentially identical to the projected State population growth rate;
- There are just under 90,000 housing units within the corridor influence area;
- 56% of the housing units in the corridor influence area are owner-occupied;
- The corridor influence area is expected to add 2,400 new housing units by 2022, an increase of just over 2.5%
- Median home value in the corridor is $245,000, slightly lower than the State's $258,000;
- Median 2017 household income within the influence area was $67,400, a bit lower than the State's $69,800;
- The influence area's population is 91% white, with no single minority group dominating the balance of the racial make-up.

The regional economy of the influence area is supported by the confluence of I-89 and I-93, which affords access to the north, west and south, including interstate access to Massachusetts, Vermont and Canada.

In view of the above, the corridor influence area has a significant population base that is expected to grow modestly, at about the same pace as the State's population in the short-term future. The housing inventory is expected to grow by about 500 units a year during the next five years to accommodate anticipated population growth. The corridor's socio-economic composition also closely mirrors State-wide figures including median income, housing values, and racial composition.

Looking more narrowly at the immediate project area, the communities of Bow and Concord adjacent to the proposed I-93 improvements, the following characteristics are present:

- The combined population of the two communities in 2017 was 51,500, with approximately 90% in Concord and 10% in Bow;
- The population in the project area is expected to increase by about 10% through 2040 according to projections prepared by the NH Office of Strategic initiatives;
- There are 20,650 housing units within the corridor communities, with an expected annual growth of about 60 units per year during the next five years.
- 40% of the housing units in the corridor are rental units—this ratio has been and is expected to remain relatively constant;
- The job base within the two communities totals 44,400 jobs of which 90% are in Concord;
- The predominant economic driver of the communities is that Concord is the State's capital, with a total of 11,000 government jobs. High levels of government employment provides stability to the community's economic base;
- Concord also functions as an important retail and service center serving a broad regional market, particularly to the north, east and west (the influence of Metropolitan Manchester truncates the market influence to the south), and this role is supported by access to I-93 and I-89;
- The job base of the combined corridor communities is expected to increase by 3,400 jobs by 2026;
- Bow has experienced job growth, particularly in the wholesale trade (recent addition of the State Liquor warehouse) and construction sectors, while Concord's job base has been relatively stable;
- The concentration of government jobs, which pay middle income wages, lends a decidedly middle income profile to the area's households, who have a median income of $65,700 (2017), a bit lower than the State's median income of $69,800;
- The middle income character of the communities is further reflected in their median housing value, which is estimated to be $243,000 versus a State median of $258,000 in 2017.

The corridor communities have experienced balanced, moderate growth, and support a moderate income economic base. The presence of the State capital, with the 11,000 government jobs, provides a stable and middle-income base to the local economy. The confluence of I-93 and I-89 provides the communities with a broad market reach, particularly to the north, west, and east (via NH Routes 4 and 9). This, in turn, supports a strong retail presence both on the periphery of Concord and in its revitalizing downtown. The presence of the State capital also supports a concentration of legal and financial services clustered in downtown. Most recently, downtown Concord is beginning to see a resurgence of market rate housing, paralleling trends in other New Hampshire downtown settings.

3.10.2 General Socio-economic Observations

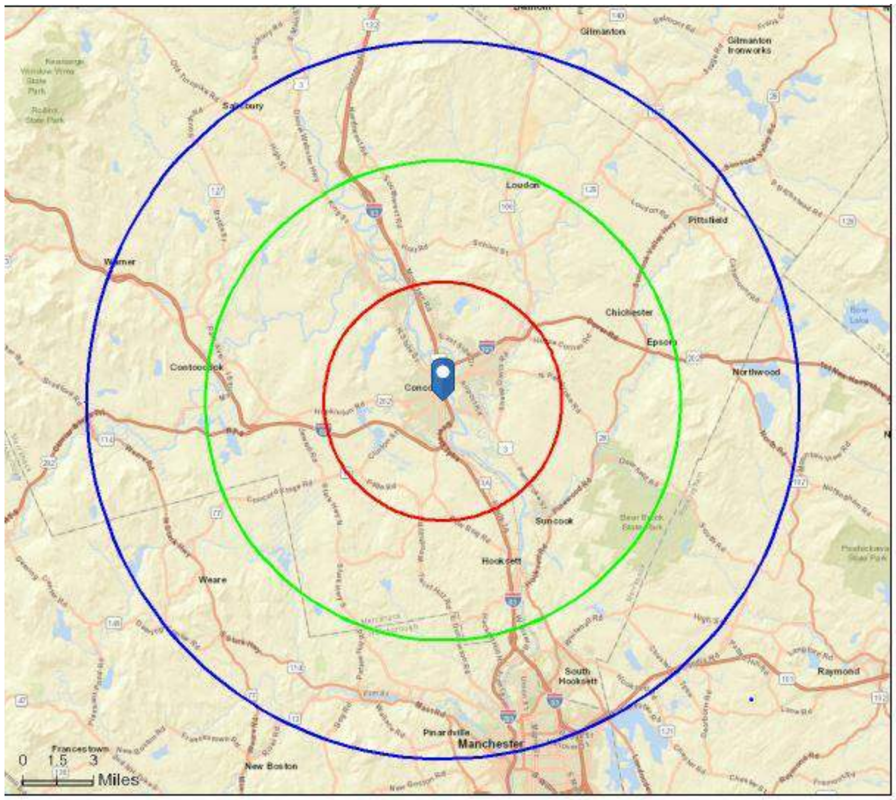
I-93 and the I-89 connection serve several important functions. They allow commuters access to the 44,000 jobs in Bow and Concord and they allow the residents of these communities access to regional job opportunities, particularly in the State's growing southern counties. I-93 and I-89 allow residents of these communities to bypass local streets, providing convenient intra-regional access. From a broader State-wide perspective, I-93 and I-89 are critical to the health of the State's tourism industry, and without them the Lakes Region and North Country, which are heavily dependent on tourism, would suffer.

Interviews with planners at the local and regional levels indicate support for improving this vital component of the regional infrastructure. According to US Census figures, 14,600 residents of the Concord Labor Market commute to jobs outside of the Concord Labor Market and 23,400 residents of other labor market areas commute to jobs within the Concord Labor Market. As such, commuting in and out of Concord substantially outnumbers the 28,600 residents that both live and work in the Concord Labor Market. Currently, rush hour congestion and weekend tourism related congestion are significant.

3.10.3 The Influence Area Trends and Characteristics

The influence area consists of 5, 10 and 15 mile rings from the center of the study area corridor, see **Figure 3.20 Socio-Economic Influence Areas** below:

Figure 3.20 Socio-Economic Influence Areas



The 5-mile ring includes the areas that rely heavily on the corridor for intra-area movements, often daily. The 10-mile ring was chosen to depict those areas that are most strongly linked to the corridor communities for employment, services, and shopping. The 15-mile ring includes those communities that interact with the corridor communities but that are not as intimately tied to the corridor.

There are several distinguishing elements to the economic aspects of the influence area. Most importantly, Concord is the State capital, with 11,000 government workers and a total employment base of 40,400 jobs in 2016, providing an economic and commuting drawing power on the surrounding region. Concord has a vibrant downtown with service, retail, and cultural attractions. Concord also has a diverse mix of big box retail along Route 106 and Fort Eddy Road that attracts shoppers from throughout the influence area. It is an important retail and service center of its economic region, which extends broadly to the east, north and west, although it is somewhat truncated to the south by the larger concentration of retail opportunities in Manchester, Bedford and Londonderry.

In contrast to Concord, Bow is a more rural community with an employment base of 4,000 jobs. A prominent economic driver specific to the Town of Bow is the coal fired power plant, developed by the former Public Service of New Hampshire and more recently operated by Eversource, the successor to PSNH. The community also houses a concentration of auto dealerships and several manufacturing and construction firms.

Population Trends

The total population within the 15-mile influence area stands at 209,450, reflecting a growth of nearly 25,000 since the year 2000.[4] The area's population has increased by nearly 6,500 since the year 2010, a modest growth of just under 3%, which mirrors the State's growth rate during this period. All three of the analysis rings experienced rising population during the past several decades, see **Table 3.18 Population Trends**.

Population growth has tended to be more pronounced in the communities surrounding Concord, including Bow, due to greater land availability and a regional transportation system that allows for efficient commuting, although peak hour delays are experienced within the entire I 93 study area corridor.

Table 3.18 Population Trends

					Change		
Population	**2000**	**2010**	**2017**	**2022**	**2000-2010**	**2010-2017**	**2017-2022**
5 mile	42,353	43,876	44,992	45,786	1,523	1,116	794
10 mile	82,991	87,720	89,907	91,680	4,729	2,187	1,773
15 Mile	190,748	203,018	209,458	214,656	12,270	6,440	5,198

Population within the influence area is expected to continue to increase in the short term future, adding just under 5,200 new residents. Short term population projections, prepared by ESRI (mapping and analytical software) through the year 2022, anticipate continued modest population growth with the influence area, with total population growth in the 15-mile corridor influence area estimated at just under 5,200—a growth rate of just under 2.5%, essentially identical to ESRI's population growth rate estimate for the State.

Housing Trends and Characteristics

There are currently just under 90,000 housing units within the 15-mile corridor influence area, in contrast to 77,500 in the year 2000, reflecting an increase of just under 9,500 units (12%) between 2000 and 2010 and an additional 2,900 units (3%) since 2010, see **Table 3.19 Housing Trends**.

4 The source of the demographic information in this section of the analysis is ESRI, a proprietary data source drawing on US Census data including the American Community Survey.

Table 3.19 Housing Trends

					Change		
Housing Units	**2000**	**2010**	**2017**	**2022**	**2000-2010**	**2010-2017**	**2017-2022**
5 mile	17,079	18,885	19,376	19,820	1,806	491	444
10 mile	33,032	37,147	38,056	38,953	4,115	909	897
15 Mile	77,503	86,982	89,934	92,327	9,479	2,952	2,393

Between 2000 and 2010, the average annual growth was 950 housing units per year. Because of the 2007-2012 recession, the average annual growth in units fell to about half that pace between 2010 and 2017—a decline experienced state-wide.

Projections prepared by ESRI anticipate continued modest housing growth during the 2017-2022 period, with an overall addition of just under 2,400 units within the 15-mile influence area, an average annual pace of 500 units.

The influence area incorporates a diverse mix of housing unit types. Concord, a more urban setting, dominates the 5-mile ring, and includes a higher concentration (42%) of rental housing than the 10 and 15-mile ring study areas. In these larger areas the concentration of rental housing drops into the 32-36% range, see **Table 3.20 Rental Housing.**

Table 3.20 Rental Housing

2017 Housing Occupancy	**5 Mile**	**10 Mile**	**15 Mile**
% Owner Occupied	52%	62%	56%
% Renter Occupied	42%	32%	36%
% Vacant	7%	6%	8%
	100%	100%	100%

Median home values within the influence area fall into the range of $240,000-$245,000, slightly lower than the State median of $258,500. ESRI anticipates that median home values will increase modestly during the coming years, a projection that is consistent with recent trends reported State-wide by the New Hampshire Housing Finance Authority, see **Table 3.21 Median Home Value**.

Table 3.21 Median Home Value

Median Home Value	**5 Mile**	**10 Mile**	**15 Mile**
2017	$243,395	$240,436	$245,597
2022	$256,334	$256,403	$263,111

Household Income

The corridor influence area is best characterized as a middle-income area. Median household income in 2017 fell in the $65,000- $70,000 range—the comparable state median income is $69,800, see **Table 3.22 Median Household Income**.

Table 3.22 Median Household Income

Median Household Income	5 Mile	10 Mile	15 Mile
2017	$65,735	$70,533	$67,370
2022	$74,806	$77,416	$75,100

The concentration of government jobs within the influence area leads to a tendency for household incomes to cluster close to the median, as most government jobs are middle income jobs. There are just over 83,000 households (with tabulated household income) within the 15-mile corridor influence area. 35% of the households have incomes in the $50,000- $99,000 range, while only 16% have incomes under $25,000 and 13% have incomes of $150,000 and over.

Racial Composition

The corridor influence area, within 15 miles surrounding the project area, is not racially diverse. Over 90% of the influence area is white, with the remaining 10% of the population spread across a range of racial categories with no one minority group standing out as a concentration, see **Table 3.23 2017 Racial Composition**.

Table 3.23 2017 Racial Composition

	5 Mile	10 Mile	15 Mile
Total	44,991	89,907	209,457
White Alone	91.1%	93.3%	91.5%
Black Alone	2.5%	1.7%	2.2%
American Indian Alone	0.3%	0.3%	0.3%
Asian Alone	3.8%	2.6%	2.8%
Pacific Islander Alone	0.0%	0.0%	0.0%
Some Other Race Alone	0.5%	0.5%	1.2%
Two or More Races	1.8%	1.7%	2.1%
	100.0%	100.0%	100.0%

3.10.4 Profile of the Immediate Corridor Communities

The immediate corridor communities are those communities abutting the proposed project area. The demographic and economic characteristics of these two communities closely parallel those of the abutting communities described in the preceding paragraphs - not surprisingly since the immediate corridor communities and the influence area function within the same regional economic setting.

Population and Housing

The total population of the corridor communities in 2017 was 51,508. Between 2000 and 2010, population in the corridor communities increased by 2,389—a 5% increase that closely mirrors the State's population growth during that decade. Since 2010, the corridor communities' population increased by 1,294—a 3% growth rate during the 7-year period. ESRI projects that population in the corridor communities will increase by 942 from 2017 to 2022, reflecting a continuation of the modest growth experienced since the year 2000 and paralleling State growth rates, see **Table 3.24 Corridor Community Profile (Bow and Concord**.

Table 3.24 Corridor Community Profile (Bow and Concord)

					Change		
	2000	2010	2017	2022	2000-2010	2010-2017	2017-2022
Population	47,825	50,214	51,508	52,450	2,389	1,294	942
Households*	18,525	20,298	20,647	21,032	1,773	349	385
Housing Units	19,211	21,659	22,197	22,711	2,448	538	514
% Rental	41.7%	39.3%	40.6%	40.3%			

*Occupied Housing Units

The inventory of households (occupied housing units) and changes in total housing units correlates with population changes. That is, modest growth has been experienced and is expected to continue. Rental units represent 40% of the housing inventory in the corridor communities, with most of the rental units located in Concord—close to downtown Concord, within the Concord Heights section bordering Loudon Road to the east of the I-93 corridor.

Corridor Community Economic Profile

The economy of the corridor communities is driven primarily by non-manufacturing sectors, including just over 11,000 government jobs in Concord, the State capital. The communities added 226 jobs between 2006 and 2016, with Bow experiencing significant job growth, while Concord saw modest job losses because of the economic recession, see **Table 3.25 Corridor Covered Employment Trends**.

Table 3.25 Corridor Covered Employment Trends

2006	Bow	Concord	Combined
Manufacturing	760	1,478	2,238
Non Manufacturing	1,992	27,637	29,629
Government	471	11,848	12,319
Total	3,223	40,963	44,186

2016	Bow	Concord	Combined
Manufacturing	600	1,133	1,733
Non Manufacturing	2,961	28,248	31,209
Government	455	11,015	11,470
Total	4,016	40,396	44,412

Change 2006-2016	Bow	Concord	Combined
Manufacturing	(160)	(345)	(505)
Non Manufacturing	969	611	1,580
Government	(16)	(833)	(849)
Total	793	(567)	226

Source: NH Employment Security

Most of Bow's employment growth occurred in the construction and wholesale trade sectors—the State of New Hampshire's liquor warehouse, which is operated by a private vendor, was constructed in Bow during this period.

As is true state-wide, the corridor communities are essentially operating at full employment levels with a combined unemployment rate of 1.6% and 1.9% respectively in Concord and Bow (December 2017) slightly lower than the State's 2.3% figure. At these levels, the availability of labor is a constraint on employment and business growth.

Corridor Employment and Population Projections

The NH Employment Security Commission has prepared long term (10 year) employment projections for New Hampshire counties. Estimated future employment within the corridor communities is based on their share of employment within the County. NH Employment Security has projected an average annual growth of 600 jobs within Merrimack County. The corridor communities' share of County employment has been in the range of 58-60% during the past decade. Future employment in the corridor communities is projected at the recent 58% portion of the

County, resulting in an anticipated growth of 3,400 jobs during the next decade. This is more pronounced growth than experienced by the communities during the past decade, during which the "Great Recession" thwarted employment growth State-wide and within the corridor communities, see **Table 3.26 Corridor Employment Projections**.

Table 3.26 Corridor Employment Projections

	2006	2016	2026	Change 2016-2022
Corridor Communities	44,200	44,400	47,800	3,400
Merrimack County	74,100	76,400	82,400	6,000
Corridor Share of County	60%	58%	58%	

The New Hampshire Office of Strategic Initiatives has prepared population projections for the State, its counties and municipalities. The most recent projections were released in 2016 and indicate that the corridor communities are expected to realize modest population growth through the year 2040, see **Table 3.27 Population Projections**.

Table 3.27 Population Projections

						Change		
	2015	2025	2035	2040		2015-2025	2025-2035	2035-2040
Bow	7,700	8,100	8,600	8,700		400	500	100
Concord	42,400	43,000	45,700	46,400		600	2,700	700
	50,100	51,100	54,300	55,100		1,000	3,200	800
Merrimack County	147,800	154,500	164,000	166,800		6,700	9,500	2,800
New Hampshire	1,330,501	1,374,700	1,402,900	1,432,700		44,199	28,200	29,800

Source: NH Office of Strategic Initiatives, 2016

The projections anticipate that the population in the corridor communities will increase from a 2015 estimate of 50,100 to a figure of 55,100 in 2040. This reflects an anticipated growth of 10 percent during the 25-year projection period.

3.10.5 Commuting Patterns

There is substantial commuting into and out of the Concord Labor Market. According to the NH Employment Security, Economic Labor Market Information Bureau and US Census figures, currently 14,684 residents of the Concord Labor market commute to jobs outside of the Concord Labor Market and 23,419 residents of other labor market areas commute to jobs within the Concord Labor Market. As such, commuting in and out substantially outnumbers the 28,600 residents that both live and work in the Concord Labor Market.

3.11 Land Use and Zoning

General land use patterns and zoning were inventoried throughout the study area. Below is a summary of the land use and zoning within the study area in the Town of Bow and the City of Concord. Refer to **Figure 3-21 Zoning and Land Use** for the location of the prominent land uses and zoning categories.

Town of Bow

The Town of Bow is located in Merrimack County, New Hampshire, and is located just south of the City of Concord. Land use in the study area in Bow is primarily open space, residential areas, and some commercial development. The I-89 corridor in the study area is primarily forested with some residential areas, a gas station and a hotel are located in the vicinity of Exit 1. Residential areas are located adjacent to the I-93 corridor south of the I-89 interchange. Commercial and industrial development dominates the area east of I-93 in the vicinity of the I-89 interchange, including car dealerships and manufacturing facilities.

The current zoning in this area of Bow is a mix of residential, commercial, and institutional. The Residential District is located along the southern side of I-89 and the western side of I-93, south of the interchange. South of the interchange along the east side of I-93 is also zoned as Residential. The Residential District is designed to accommodate a range of residential uses at low densities in areas where sewer service is available or the extension of such is anticipated at some future time, as indicated in Bow's Master Plan.

The area east and north of the I-89 and I-93 interchange in Bow is zoned as the Commercial District. The Commercial District is designed to allow a broad range of commercial uses including retail, service, offices, restaurants, recreational, institutional, and transportation-related uses along arterial roads where sewer service is available or the extension of such is anticipated at some future time, as indicated in Bow's Master Plan.

The northern side of I-89 and the western side of I-93 north of the interchange is zoned as the Institutional District. The Institutional District is intended to accommodate office and institutional uses in an area where sewer service is available.

City of Concord

Concord is the capital city of New Hampshire, and the third largest city in the state. The majority of the study area is located in a highly developed urban area. Land use in the study area is a mix of primarily commercial and industrial uses with some residential areas and open space interspersed. Northwest of Exit 12 is a residential area and to the northeast of Exit 12 there is an area of open space known as the South End Marsh. Continuing north along I-93 the highway corridor is bordered by commercial development to the west, consisting primarily of hotels, and industrial development to the east including an automotive salvage yard, and automotive repair facilities.

Land use in the vicinity of Exit 13 is primarily commercial development to the west consisting of gas stations, restaurants, and hotels. Between Exits 13 and 14 the Merrimack River is located just east of I-93. There is a floodplain forest in West Terrill Park, north of Exit 13. A large shopping plaza is located west of I-93, south of Exit 14. This shopping plaza includes a grocery store, retail shopping, and restaurants. The I-93 corridor between Exits 14 and 15 is highly developed and includes industrial areas and a park and ride to the west, and retail shopping and a grocery store to the east. The NHTI Community College is located north of Exit 15 on the east side of I-93. Industrial office complexes are located west of I-93, north of Exit 15.

In Concord, the study area passes through many different zoning districts including: Institutional, General Commercial, Open Space Residential, Medium Density Residential, Industrial, Opportunity Corridor Performance, and Gateway Performance Districts.

The current zoning includes an Institutional District, which is located southwest of Exit 12 and northeast of Exit 15. The area in the vicinity of Exit 15 includes the New Hampshire Technical Institute Community College. In the study area the General Commercial District is located southeast of Exit 12 and includes a hotel, a gas station, and a fast food restaurant.

3.11.1 Regional Plans and Policy

The "Central New Hampshire Regional Planning Commission Regional Transportation Plan" provides recommendations for transportation services and facilities in the central New Hampshire region. Bow and Concord are both considered in this plan. The plan provides nine major recommendations for improving transportation, as follows:

1. Towns in the region need to focus on Smart Growth and create town centers for public transportation hubs
2. A Transportation Management Association (TMA) is needed in the region
3. Park and Ride facilities are being utilized and should be expanded
4. Corridor studies are needed throughout the region to maintain connections
5. Efforts to establish passenger rail should be encouraged
6. Airports should develop long range plans to ensure smart growth
7. The public ought to be involved in transportation changes
8. Programs enabling children to walk or bike to school should be encouraged
9. Support the Coordinated Transit Study

Specifically, the plan states: *Measures should be made to improve the current roadway system in terms of safety and capacity without major reconstruction or road building. Some of the recommended improvements may include intelligent signalized traffic light systems, corridor monitoring, and adequate access management*.

3.11.2 Community Facilities

There are numerous community resources in the study area and vicinity including schools, parks, recreational facilities, and police and fire stations. Because Concord is the State Capital and the largest community in Merrimack County, there are many state and county facilities in addition to town and municipal facilities. Important public/community facilities nearby the I-93 corridor in Bow and Concord include:

- State Capital
- Concord City Hall
- Concord Library
- Museum of New Hampshire History
- Merrimack County Courthouse
- NH Technical Institute
- Baker Free Library
- Everett Arena
- Water Front Park
- Terrill Park
- Reed Playground

Refer to **Figure 3-22 Community Resources Overview** for the location of community facilities within the vicinity.

3.12 Visual Resources

The visual setting and resources were inventoried throughout the study area. Features such as topography, structures, waterways, and vegetation were evaluated to determine the visual context of the study area in four segments. Federal Highway Administration Visual Resource Manual was used as a reference to guide the inventory. A general description of the visual resources follows:

I-89 Area

The I-89 Area is located in the Town of Bow. The Turkey River runs west to east beneath South Street and the exit ramp to I-89 and connects to the Merrimack River to the east. Vegetation is dense near the embankment of the river and then gradually thins as the elevation rises closer to I-89. Areas of maintained grass surround I-89. In general, the I-89 area contains a mix of vegetation including evergreen and deciduous trees with an overgrown understory layer throughout the undeveloped lands.

The grading of South Street is at a consistent elevation as it passes beneath I-89, but the road begins to rise as it passes the Bow Mobil Gas station and continues to the north. On the east side of South Street a continuous bituminous concrete pedestrian sidewalk passes beneath the bridge but terminates at the Bow Mobil.

The roadway consists of one vehicular travel lane in the north/south direction along South Street. The exit ramp from I-89 meets South Street directly opposite the Bow Mobile, with one travel lane for entry and exit purposes. There are currently no accommodations for bikes in this area.

Exit 12 Area

The Exit 12 Area is located in the City of Concord. The large wetland complex and open water feature known as South End Marsh is located to the north of Exit 12. South End Marsh is adjacent to a large undeveloped forested area, also on the north side of I-93. The railroad corridor fragments these areas of undeveloped vegetation. Residential neighborhoods are located along South Main Street. To the east of I-93 is the built up commercial area known as the Concord Business Center. On the south side of I-93, a Wetland Mitigation site is present that is owned by the NHDOT.

The existing vegetation adjacent to I-93 and Exit 12 is mainly mown grass with a single group of deciduous and evergreen tree plantings, which do provide some visual buffering from I-93 for the residential neighborhood to the north.

The grading of South Main Street is at a consistent elevation as it passes over I-93 but begins to fall as it continues to the south on Route 3A. On the west side of South Main Street, a continuous bituminous concrete pedestrian sidewalk continues to the south. Delineated pedestrian crosswalks exist where the entry and exit ramps of I-93 interrupt the sidewalk. The outside shoulders along South Main Street accommodate bicycles although they are not designated bike routes.

Route 3A consists of one vehicular travel lane in the north/south direction. The exit ramp from I-93 South meets Route 3A in two separate locations, with one travel lane for entry and exit purposes. There are currently no accommodations for bikes. Utility poles with overhead power lines dominate the landscape.

Exit 13 Area

The Exit 13 Area is located in the City of Concord. To the east, a six-lane bridge carries Route 3 (Manchester Street) over the Merrimack River and then the road proceeds beneath I-93. A raised concrete median helps to separate the vehicular traffic moving in the east/west direction. Sidewalks exist on both sides of Manchester Street in the Exit 13 Area. Lighting, in the style of ornamental shepherd's crook lamps, illuminates Manchester Street. As it passes over Route 3, I-93 is a four-lane highway with two lanes heading in each direction.

The existing vegetation adjacent to this exit is primarily on the northeast side of I-93 adjacent to the Merrimack River. This vegetation is predominantly deciduous trees. On either side of the bridge, concrete retaining walls support some additional plantings. These plantings are made up of deciduous trees, ornamental trees, shrubs, and vines. The splitter islands on both sides of I-93 are planted with similar species. There is also a central grass median located on I-93 which separates the north/south traffic into two travel lanes in each direction.

The grading of Route 3 is at a consistent elevation as it passes over the bridge, from the east, across the Merrimack River, but begins to rise as it continues north on Water Street. Pedestrian access across the bridge is supported by a concrete sidewalk on both sides of the road. These sidewalks connect to Basin Street to the south and to a pedestrian riverfront walk to the north. The sidewalks continue in a westerly direction toward Water Street. There are no accommodations for bikes in the current layout.

Exit 14/15 Area

The Exit 14/15 Area is located in the City of Concord. To the east a five-lane bridge carries Loudon Road over the Merrimack River and then the road proceeds beneath I-93 to downtown Concord. A striped median helps to separate the vehicular traffic moving in the east/west direction. Commercial outlets are located to the east along Fort Eddy Road, which runs parallel to I-93. The main intersection at Loudon Road, Fort Eddy Road, and the I-93 off-ramp is controlled by 4-way overhead signalization. Signalized intersections also exist for the northbound entrance ramp, southbound ramps, and Stickney Avenue. Vehicular scaled light fixtures illuminate the bridged section of Loudon Road.

The existing vegetation adjacent to this exit is mainly on the east side of I-93 adjacent Fort Eddy Road. The area is primarily mown lawn with sporadically placed deciduous trees. On the west side of I-93, mown lawn is also prevalent. A few deciduous trees are located on the banks of the Merrimack River in this location. Steep slopes of mown lawn are located on the east and west sides of I-93.

The grading of Route 9 (Loudon Road) is at a consistent elevation as it passes over the bridge from the east, across the Merrimack River, but begins to rise as it continues west toward North Main Street. Pedestrian access across the bridge is supported by a concrete sidewalk on both sides of the road. These sidewalks lead all the way to downtown Concord and the commercial outlets (big box) located along Fort Eddy Road. There are no accommodations for bikes in the current layout.

3.13 Contaminated Properties and Structures

Hazardous waste sites are regulated by both the federal Resource Conservation and Recovery Act of 1980 (RCRA) (40 CFR Part 261 C) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1986 (CERCLA). NHDES regulations incorporate by reference 40 CFR 260-270 (hazardous waste). The regulations include procedures for identifying hazardous waste, requirements for generators and transporters of hazardous waste, requirements for treatment, storage and disposal facilities, and other provisions. This section provides a summary of the existing conditions based upon a cursory records review of readily available information. Refer to Appendix H (Volume 2) Hazardous Materials Report for further detail.

Database Review

Existing records and databases were searched for records of hazardous materials spills or known occurrences within the study area. Environmental regulatory agency records were searched through State and Federal databases accessed and summarized by Environmental Data Resources, Inc. (EDR) in the winter of 2018. In addition, NHDES records were reviewed in the January of 2018 through the NHDES's OneStop Records Database. Refer to Appendix H for a detailed discussion and the locations of these sites.

The majority of sites listed in the EDR and NHDES databases have been "closed"; however, even closed sites could present a potential risk for encountering contaminated soils or groundwater during construction. The sites that have been determined to have greater potential for resulting in impacts to the project, based on type of site and proximity to the project, are described below. The status of these sites are “open” and summarized below in eight sections of the project study area from south to north. The information provided below is preliminary in nature and would be updated and reevaluated during final design. Based upon this future work, sites with the potential to impact the project would be identified in regard to surface and subsurface conditions such as: type and depth of contaminant, medium impacted (soil and/or groundwater) and similar.

I-89 Exit 1 Area

One potential area of contamination relative this area was identified.

- The Mobil service station, located at 519 South Street, Bow. Contaminants of concern being MtBE and 1,1-DCE in relation to an underground storage tank (UST) petroleum release.

I-89 and I-93 Interchange Area

One potential area of contamination relative to this area was identified.

- Grappone Honda, located at 507 Route 3A, Bow. Contaminants of concern being oil, toluene, acetone, and MtBE.

I-93 Exit 12 Area

No sites identified.

I-93 Exit 13 Area

Six potential areas of contamination relative to this area were identified.

- The Concord Coal Gas Site, located at the junction of Gas Street and South Main Street, Concord. Contaminants of concern including BTEX, Naphthalene, Styrene, 1,2,4-TMB, and SVOCs.

- The Coal Tar Pond at Exit 13, located at the Manchester Street Bridge Area, Concord. Contaminants of concern including Benzene, Naphthalene, MtBE, tBA, and PAHs.

- The former Johnson & Dix Bulk Fuel facility located a 1 Gulf Street, Concord. Contaminants of concern including BTEX, Naphthalene, 1,2,4-TMB, 1,3,5-TMB, PCE, and cis-1,2-DCE.

- The Prolerized New England Company and former Advanced Recycling, located at 25 Sandquist Street, Concord. Contaminants of concern including PCE, TCE, MtBE, and tBA.

- Store 24, located at 201 South Main Street, Concord. Contaminants of concern including BTEX, MtBE, Naphthalene, 1,2,4-TMB, 1,3,5-TMB, and Isopropylbenzene in relation to a leaking underground storage tank (LUST).

- Lot 26-1-10, located at 14-16 Water Street, Concord. Contaminants of concern include Benzo[a]pyrene and Indeno[1,2,3-cd]pyrene, in relation to hazardous waste.

I-93 Exit 14 Area

Three potential areas of contamination relative to this area were identified.

- The Concord Cleaners, located at 80 South Main Street, Concord. Contaminants of concern including PCE, TCE, and cis-1,2-DCE.

- The Mobil service station located at 129 South Main Street, Concord. Contaminants of concern including Benzene, tBA, and 1,2-DCA in relation to a LUST.

- The Citgo service station located at 81 South Main Street, Concord. Contaminants of concern including BTEX, MtBE, tBA, Naphthalene, 1,2,4-TMB, 1,3,5-TMB, and EDB in relation to a LUST.

○

I-93 Exit 14 and 15 Area

Eight potential areas of contamination relative to this area were identified.

- Concord Center Trust, located at 10 Ferry Street, Concord. Contaminants of concern including PCE and Asbestos in relation to an inactive asbestos disposal site.

- The Cumberland Farms service station located at 165 North Main Street, Concord. Contaminants of concern including Benzene, Napthalene, MtBE, tBA, and 1,2,4-TMB in relation to a LUST.

- The Exxon facility located at 196 North Main Street, Concord. Contaminants of concern including BTEX, Naphthalene, MtBE, tBA, tAME, 1,2,4-TMB, and PCE in relation to a LUST.

- The Getty service station, located at 242 North main Street, Concord. Contaminants of concern including BTEX, Naphthalene, and 1,2,4-TMB in relation to a LUST.

- The Hess Station located at 175 North Main Street, Concord. Contaminants of concern including BTEX, MtBE, and Naphthalene.

- The New Hampshire DOT Highway Garage 12, located at 11 Stickney Avenue, Concord. Contaminants of concern including Fuel Oil, BTEX, Naphthalene, tBA, MtBE, and TCE in relation to hazardous waste and a LUST.

- Prescott & Sons Oil, located at 196 North Main Street, Concord. Contaminant of concern fuel oil in relation to a leaking aboveground storage tank (LAST).

- The Mobil service station located at 32 South Commercial Street, Concord. Contaminants of concern including Ethylbenzene, Xylenes, Isopropylbenzene, n-Propylbenzene, 1,2,4-TMB, and 1,3,5-TMB in relation to a LUST.

Asbestos in Soils Along the Corridor

Asbestos was used in a wide variety of building materials until approximately the 1970s. Buildings within the City of Concord and Town of Bow are known to have historically used asbestos-containing materials. When buildings were demolished or renovated, asbestos was often disposed of as fill material in construction sites, including construction of the turnpike. According to the NHDES database there is one documented Asbestos Disposal Site in the vicinity of the project area. It is located at 10 Ferry Street, approximately 1,000 feet southwest of Exit 15. It is assumed that fill along the corridor contains asbestos, and NHDOT has committed to conduct necessary subsurface investigations prior to project construction sufficient to identify and characterize asbestos in areas of proposed earthwork. NHDOT will plan for the proper handling and disposal of any contaminated materials that may be encountered during project construction.

Limited Reuse Soils

Statewide analytical data collected by NHDOT, as well as nationwide information, indicates that roadside soils commonly contain metals at concentrations above naturally occurring background conditions, and Polycyclic Aromatic Hydrocarbons (PAHs) exceeding acceptable reuse concentrations. These “Limited Reuse Soils” (LRS) excavated from within the operational right-of-way must be addressed in accordance with applicable NHDES rules and/or waivers. Soils that are anticipated to meet the definition of LRS may be subject to management through a Soils Management Plan. Roadside soils currently managed as LRS by the Department include all topsoil within the limits of the existing right-of-way, regardless of its depth. In those instances where there is no measurable topsoil, LRS will be measured from the top of the ground to a depth of six inches.

LRS will be generated by the project and a soils management plan will need to be developed prior to the start of construction. The LRS material will require reuse on-site, disposal, and/or temporary stockpiling. Any excess materials that result from the project within the operational right-of-way will be addressed in accordance with applicable NHDOT guidance and NHDES rules and the soil management plan.

Per- and Polyfluoroalkyl Substances (PFAS)

Per- and polyfluoroalkyl (PFAS) are a diverse group of compounds resistant to heat, water, and oil. For decades, they have been used in hundreds of industrial applications and consumer products such as carpeting, apparels, upholstery, food paper wrappings, fire-fighting foams and metal plating. PFAS have been found at very low levels both in the environment and in the blood samples of the general U.S. population.

The current regulatory parameters for per- and polyfluoroalkyl (PFAS) substances is evolving at this time and information updates will be ongoing throughout this project and into its next phase, final design.

This section provides a summary of readily available information from the NHDES PFAS informational webpage. The PFAS database includes a state-wide map of all current PFAS sampling sites; however, this database is in the preliminary stages and does not include all possible sites, only those where testing has been conducted and reported. For privacy purposes, the map does not include ownership information or addresses; but it does provide a qualitative assessment of whether there are potential PFAS issues along the study corridor.

The PFAS database indicates that there are three sites with PFAS detections just to the north of the I-89/I-93 interchange, but at concentrations well below the AGQS of 70 parts per trillion. There are no other PFAS detections shown in the database along the remainder of the corridor. During final design the PFAS database will be reviewed again to determine if the sites and/or concentrations have changed. If new sites are detected, higher concentrations are observed, or if thresholds are reduced, the PFAS contaminated water would need to be managed in accordance with NHDES rules.

Asbestos and Lead in Bridge Materials

As-built plans from NHDOT of the bridges and overpasses present within the study area were reviewed for the potential presence of asbestos and lead. The as-built plans did not identify any evidence of the presence of asbestos or lead-based paint in the building materials of the bridges and overpasses within the corridor. Inspections of these structures were not conducted as part of this assessment.

Figure 3.1: Project Transportation Elements

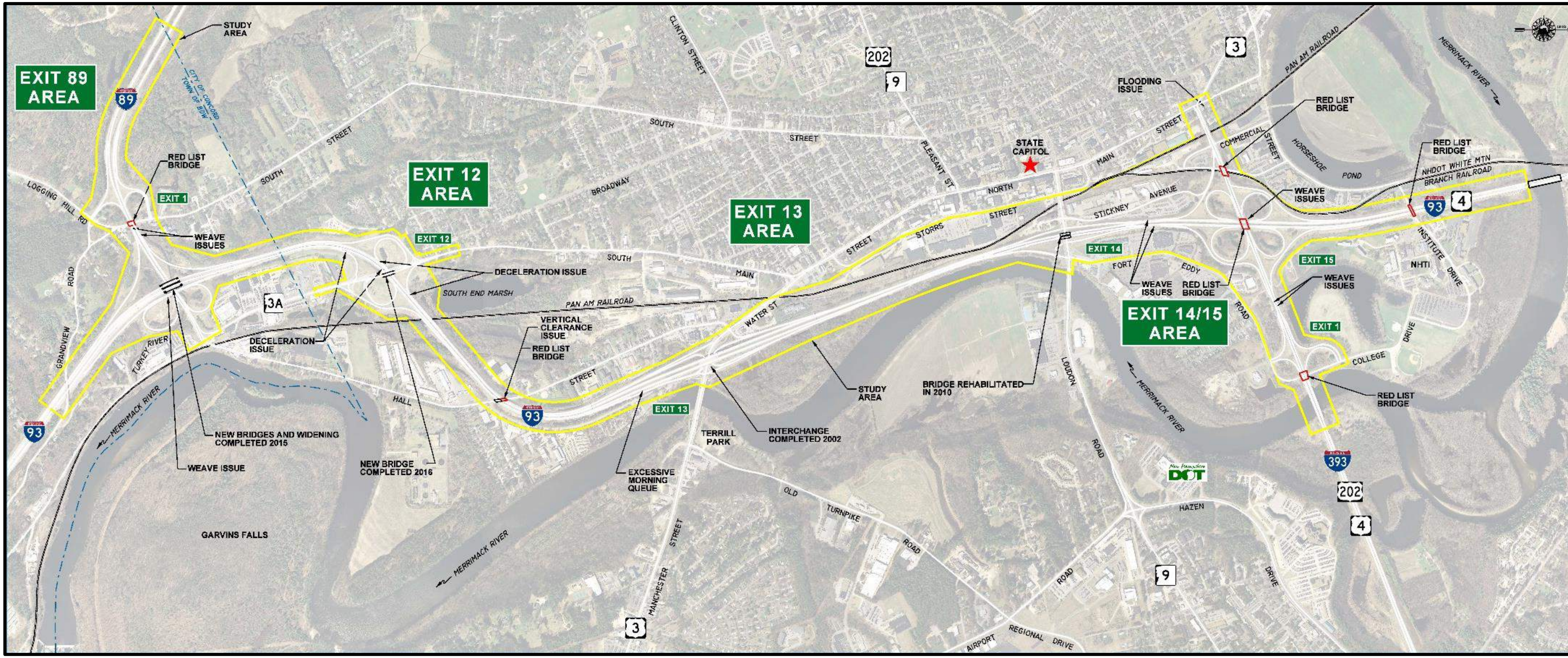
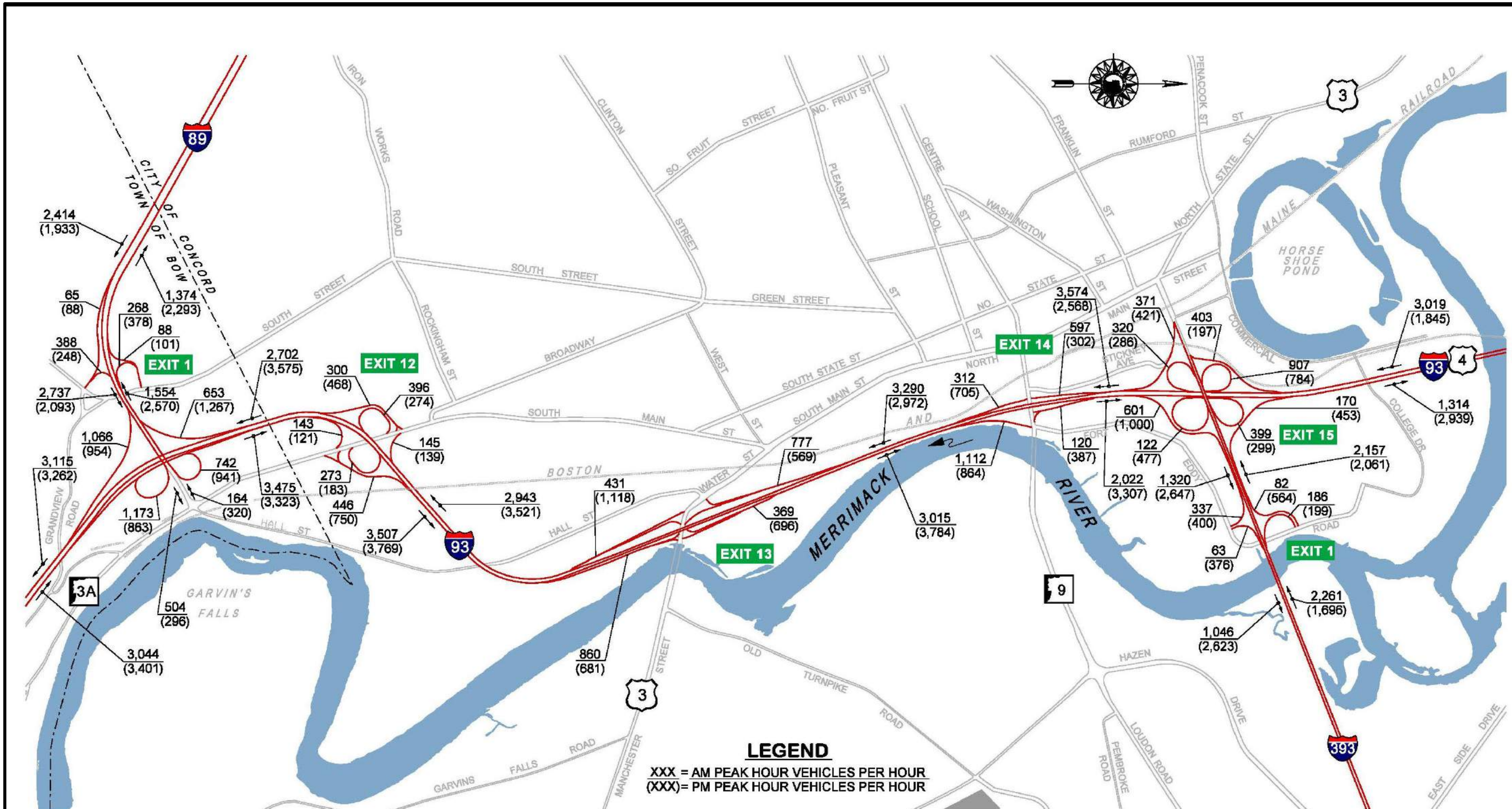
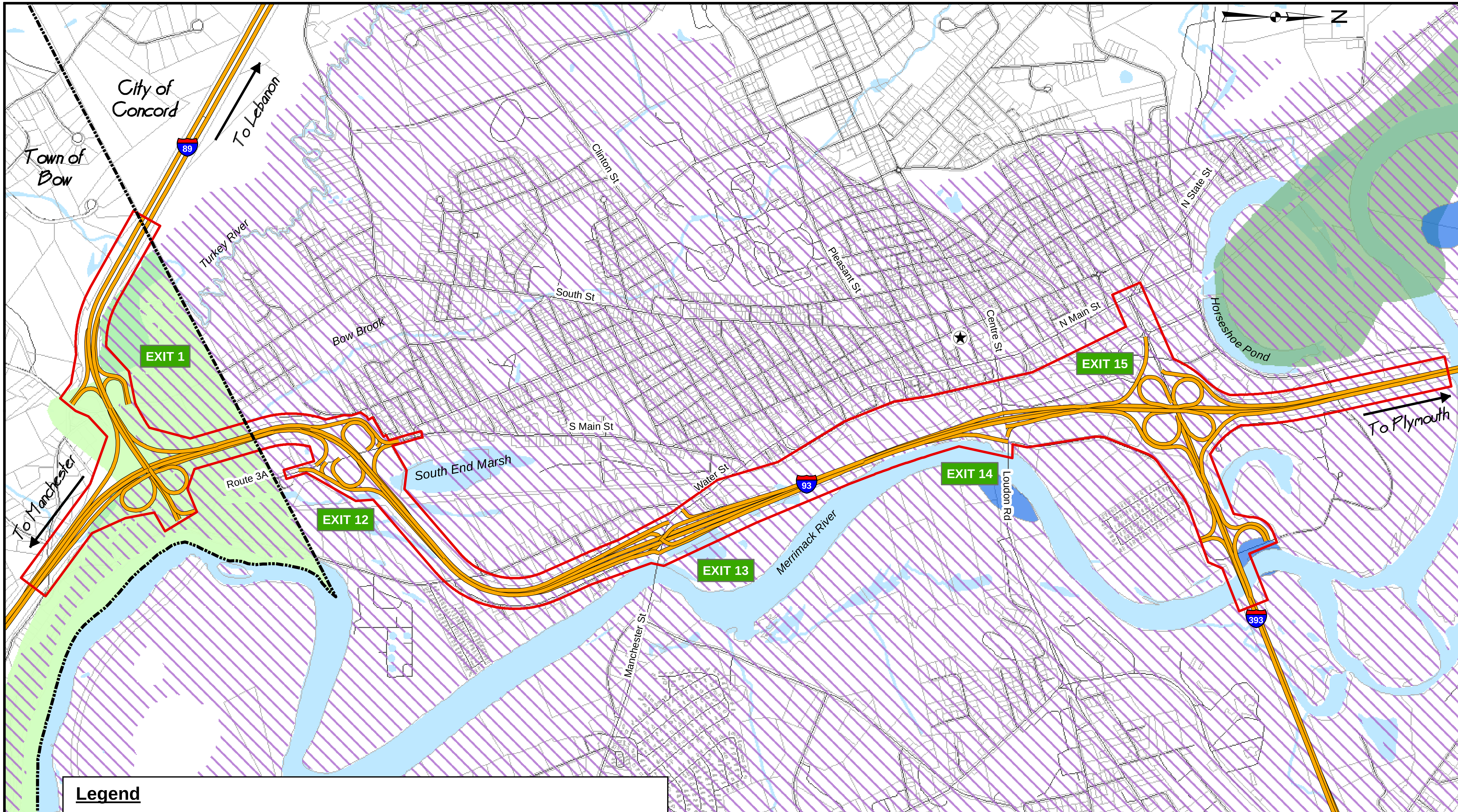


Figure 3.5 Base Year 2014 Peak Hour Traffic Volumes





Legend

- Study Area
- Parcels
- Streams
- Rivers and Ponds

Aquifer Transmissivity

- 0-1000 square feet/day
- Groundwater Classification GA2
- Town of Bow Aquifer Overlay District (existing)
- Town of Bow Aquifer Overlay District (proposed)
- City of Concord Aquifer Protection District

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

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BOW-CONCORD I-93 IMPROVEMENTS

GROUNDWATER RESOURCES OVERVIEW

FIGURE 3.9

DATE: AUGUST 2018

SCALE: 1"=1500'

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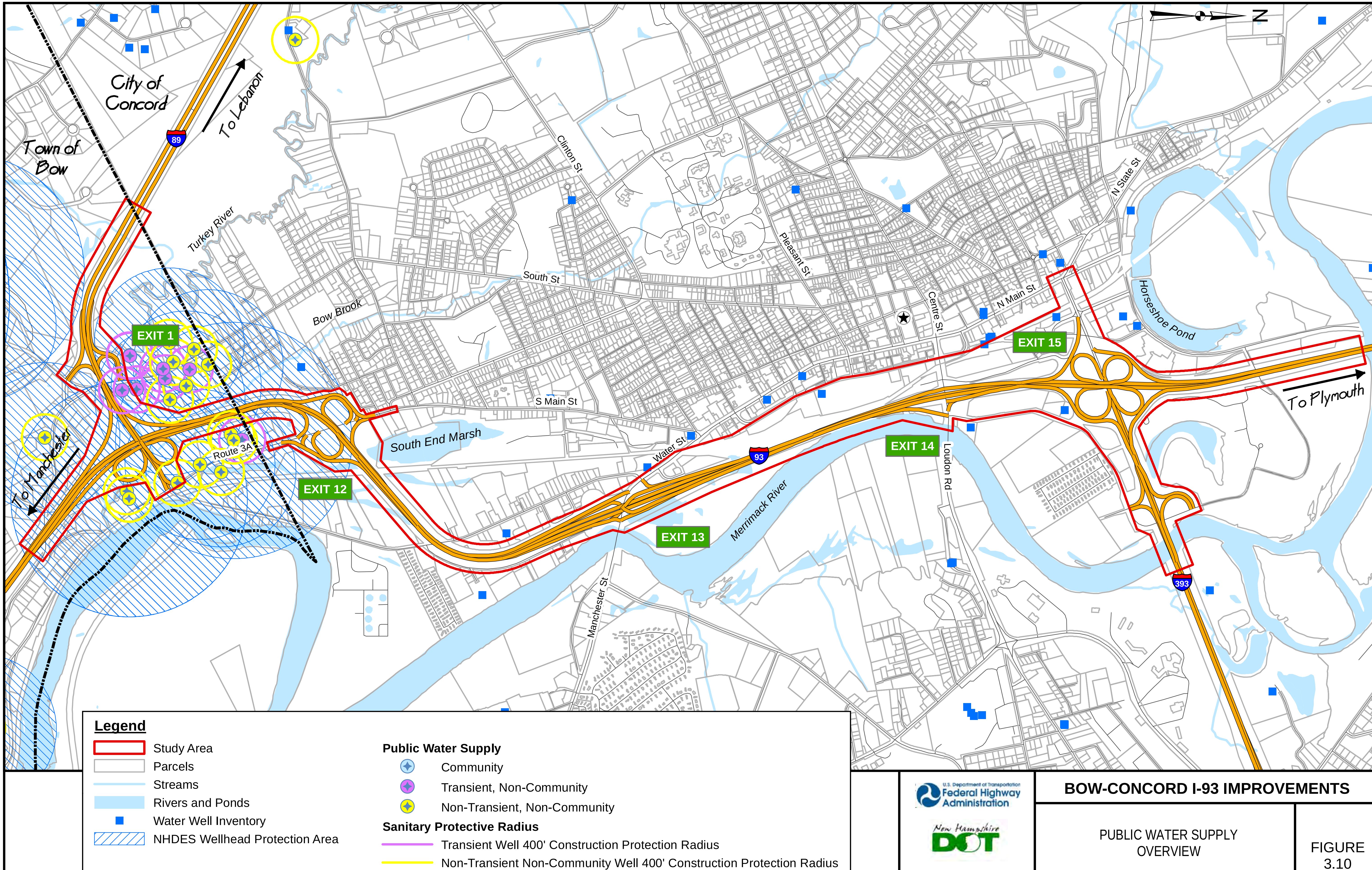

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BOW-CONCORD I-93 IMPROVEMENTS

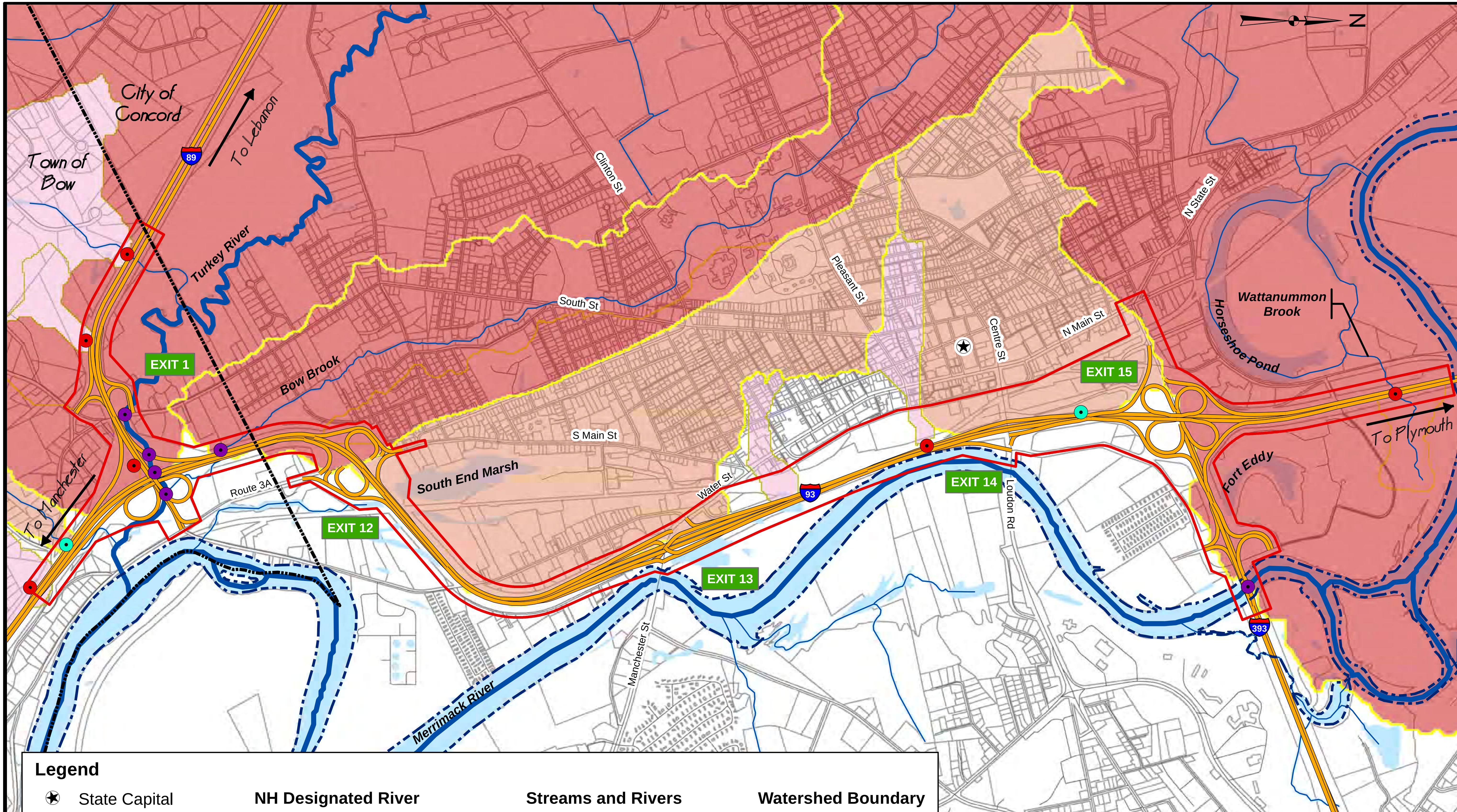
PUBLIC WATER SUPPLY OVERVIEW

FIGURE 3.10

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.10 Public Water Supply Overview.mxd



Legend

- ★ State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds

NH Designated River

- Merrimack River (Upper)

Stream Crossings

- Tier 1
- Tier 2
- Tier 3

Streams and Rivers

- 1st-3rd Order
- 4th Order or Larger

Watershed Boundary

- <200 Ac
- 200-640 Ac
- >640 Ac

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BOW-CONCORD I-93 IMPROVEMENTS

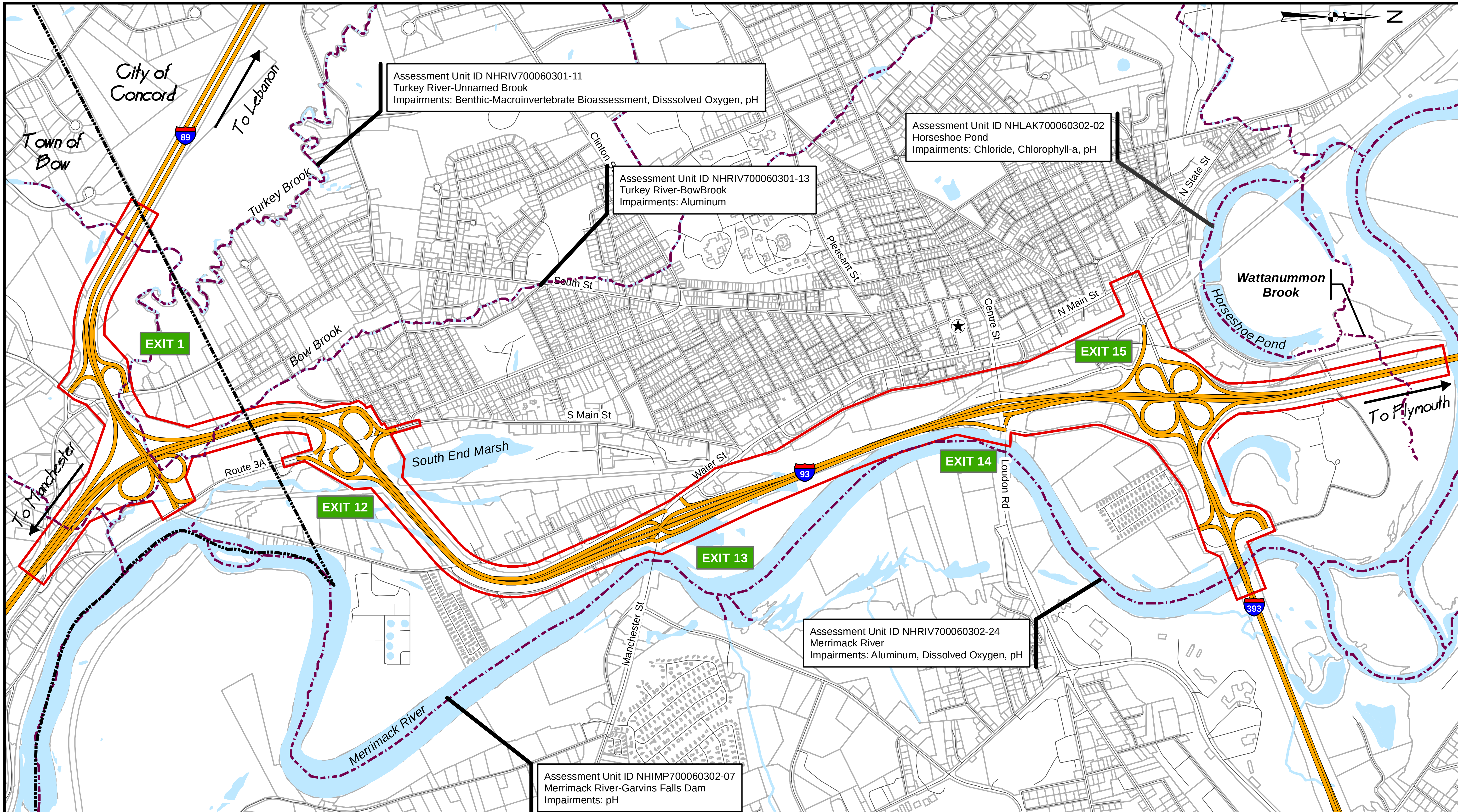
SURFACE WATER OVERVIEW

FIGURE 3.11

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.11 Surface Waters.mxd



Legend

- Study Area
- Parcels
- Streams
- Rivers and Ponds
- Total Maximum Daily Load (TMDL) is Required - 2016 Section 303(d) List
- TMDL Required (Low Priority) - 2016 Section 303(d) List

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BOW-CONCORD I-93 IMPROVEMENTS

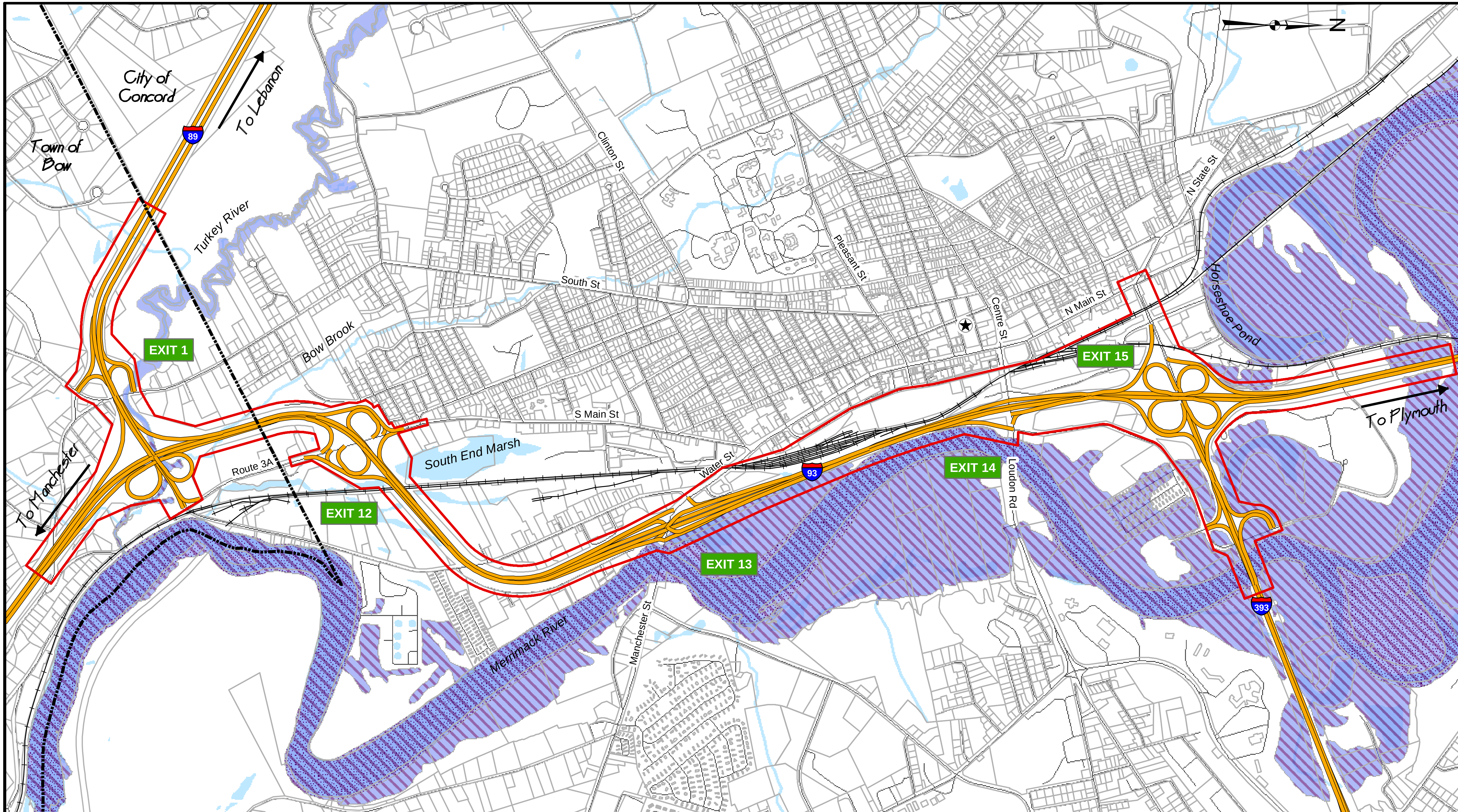
IMPAIRED WATERS OVERVIEW

FIGURE 3.12

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.12 Impaired Waters.mxd



Legend

- Study Area
- Parcels
- Railroad
- Streams
- Rivers and Ponds
- Regulatory Floodway
- ZONE A - No Base Flood Elevation
- ZONE AE - Base Flood Elevation Provided

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BOW-CONCORD I-93 IMPROVEMENTS

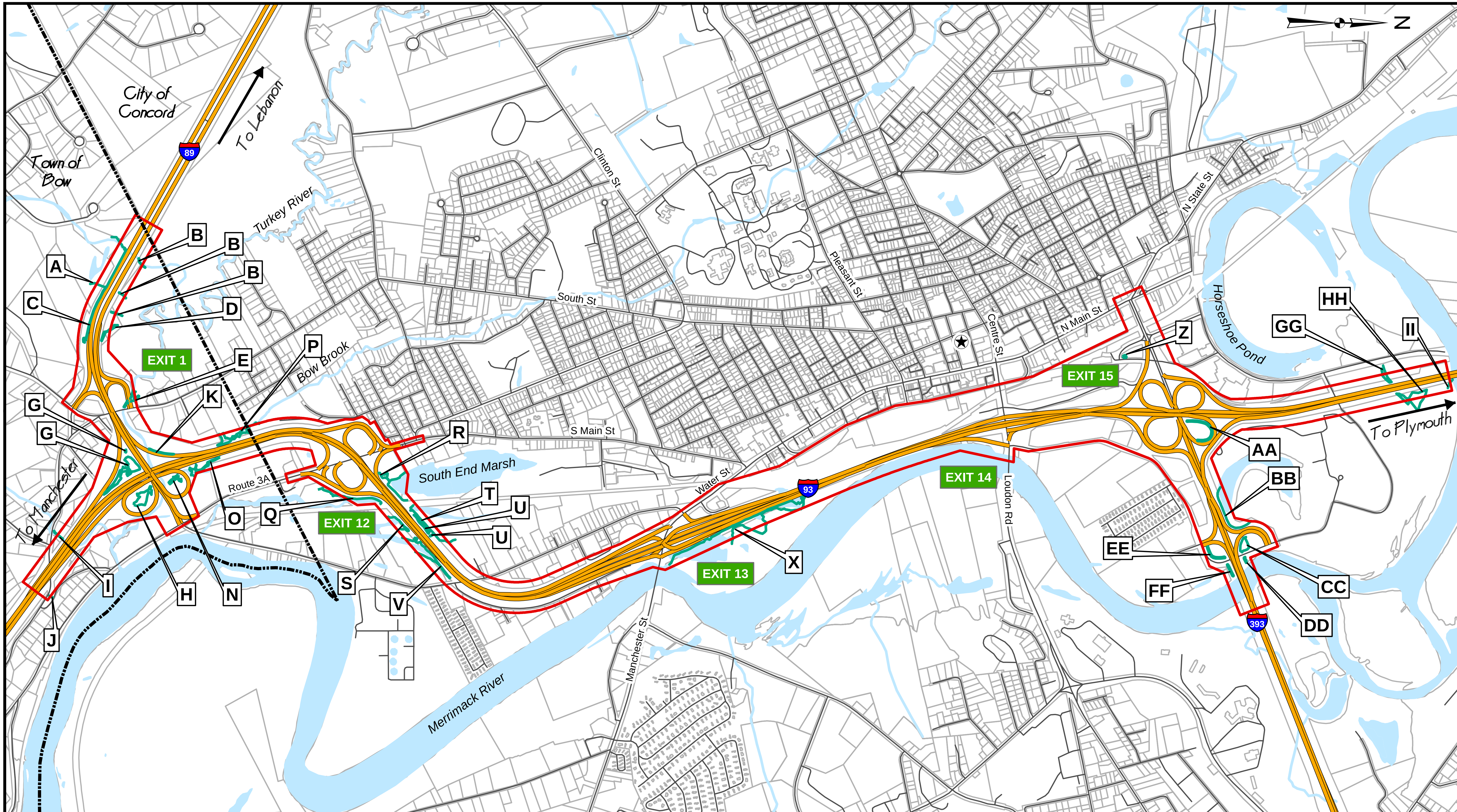
FLOOD HAZARD AREAS OVERVIEW

FIGURE 3.13

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.13 Flood Hazard Area.mxd



Legend

State Capital

Study Area

Parcels

Streams

Rivers and Ponds

Wetlands / Waterways

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

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BOW-CONCORD I-93 IMPROVEMENTS

DELINEATED WETLANDS

FIGURE 3.14

DATE: AUGUST 2018

SCALE: 1"=1500'

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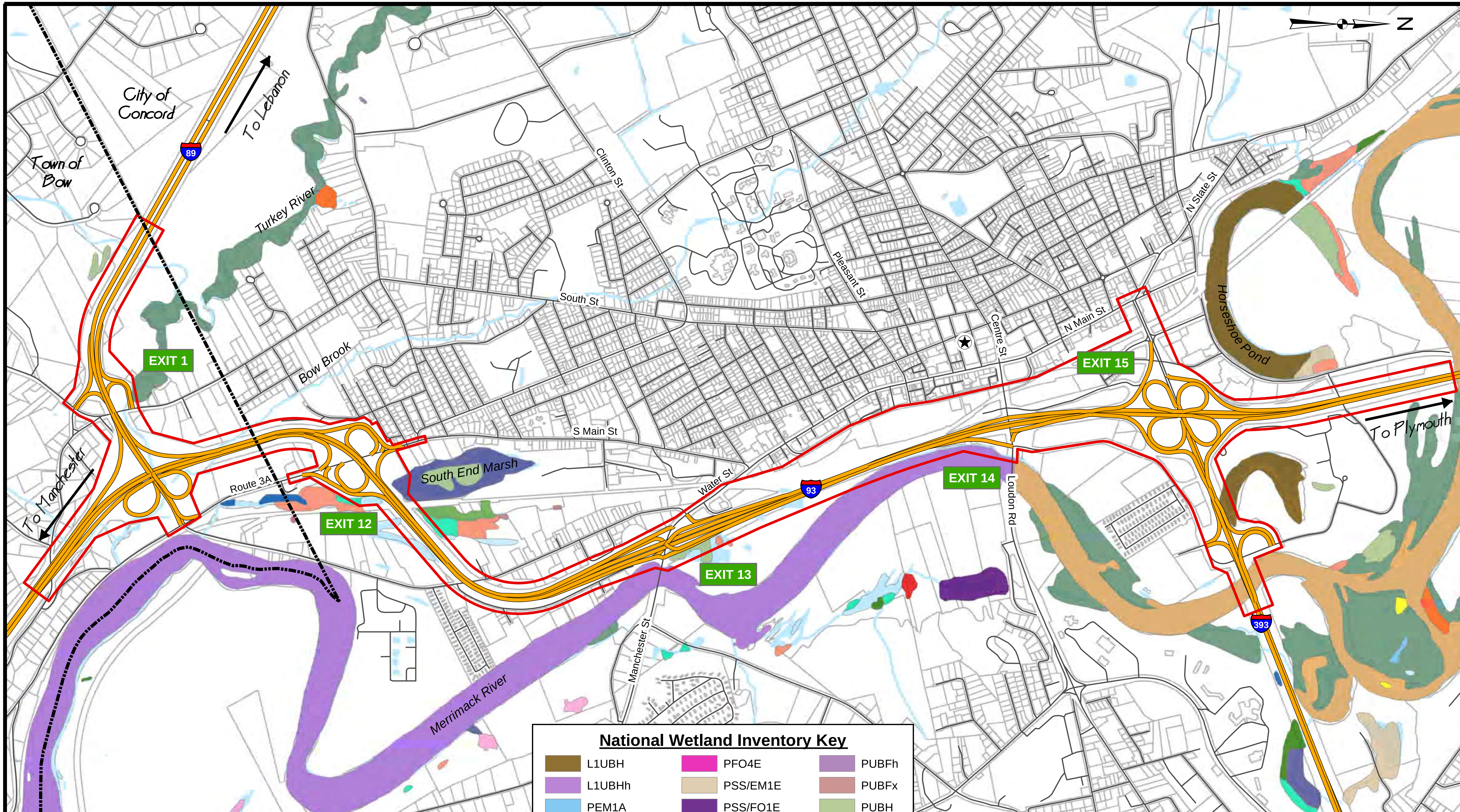

National Wetland Inventory Key

L1UBH	PFO4E	PUBFh
L1UBHh	PSS/EM1E	PUBFx
PEM1A	PSS/FO1E	PUBH
PEM1Ad	PSS1A	PUBHh
PEM1E	PSS1Ad	PUBHx
PEM1F	PSS1C	R2UBH
PFO/SS1E	PSS1E	R2USA
PFO1A	PUB/EM1F	R2USC
PFO1E	PUBF	

Legend

State Capital
Study Area
Parcels
Streams
Rivers and Ponds

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

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BOW-CONCORD I-93 IMPROVEMENTS

NWI WETLANDS

FIGURE 3.15

DATE: AUGUST 2018

SCALE: 1"=1500'

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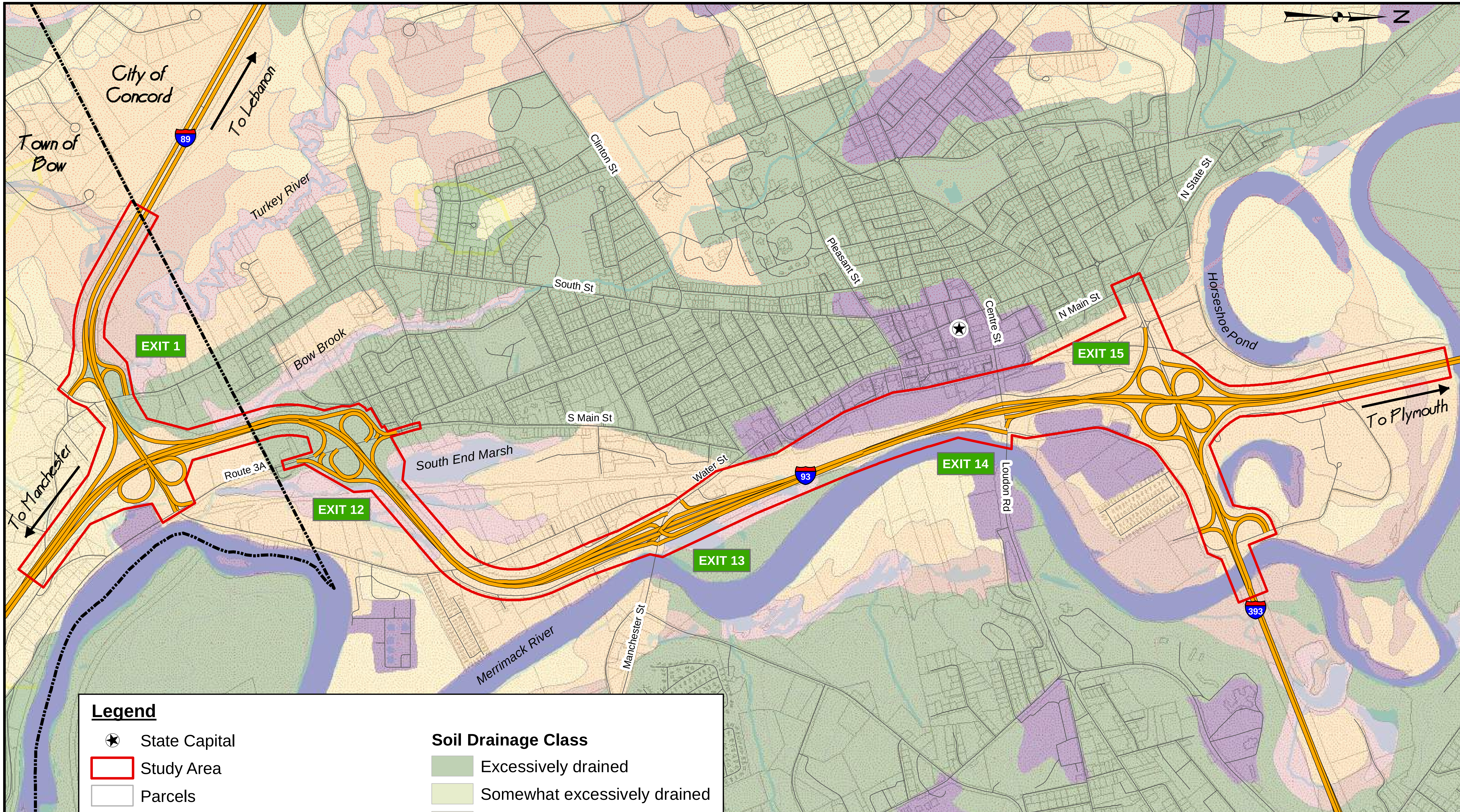

Legend

- State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds

Bedrock

- Concord Granite (Late Devonian)
- Rangeley Formation

Soil Drainage Class

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Poorly drained
- Very poorly drained
- Urban Land or Water

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BOW-CONCORD I-93 IMPROVEMENTS

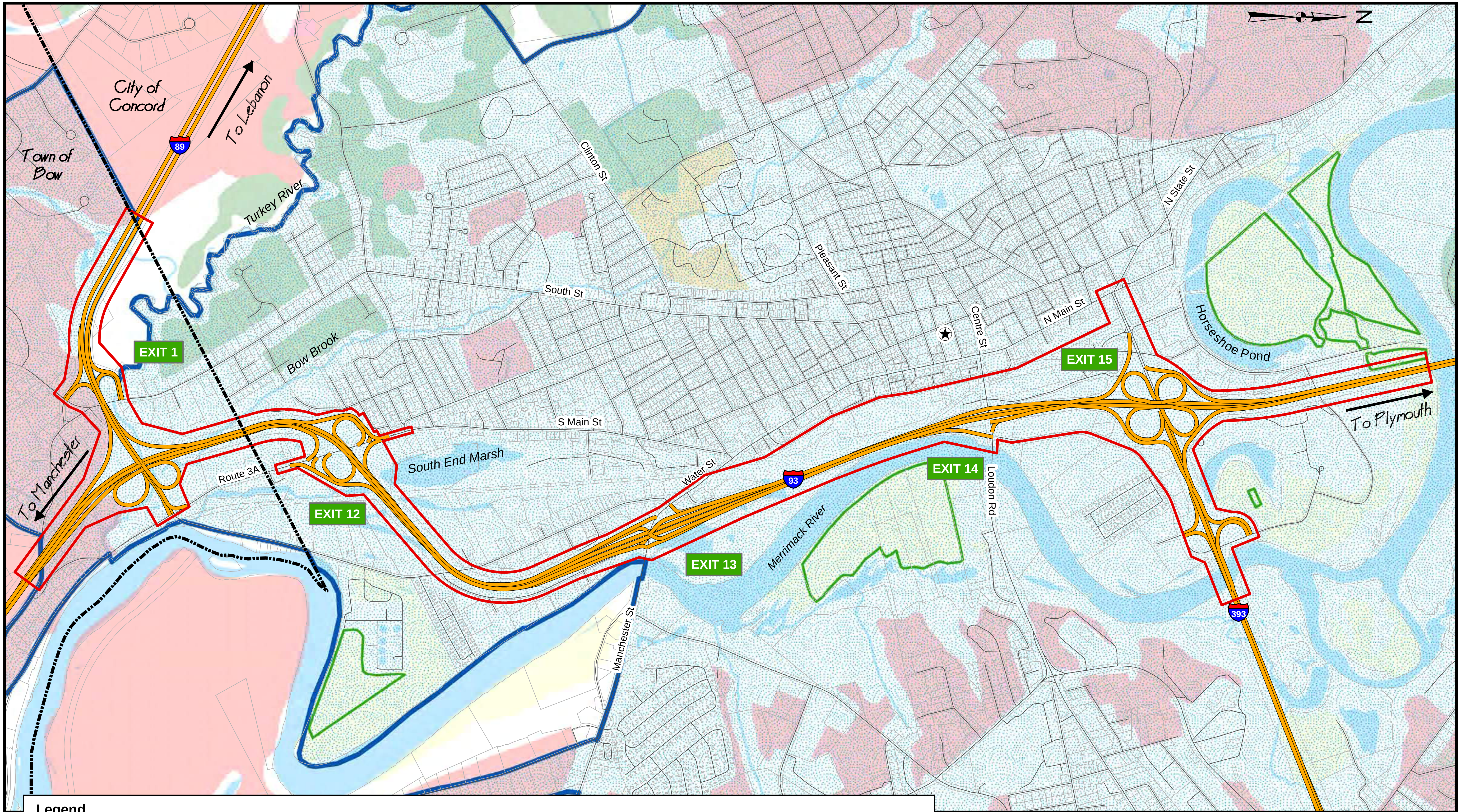
SOILS AND BEDROCK OVERVIEW

FIGURE 3.16

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.16 Soils and Bedrock.mxd



Legend

★ StateCapital	Streams	**Soil Types**
Study Area	Rivers and Ponds	Prime Farmland
Parcels	US Census Bureau 2010 Urbanized Cluster	Farmland of statewide importance
	Active Agricultural Land	Farmland of local importance
		Prime farmland if not frequently flooded

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BOW-CONCORD I-93 IMPROVEMENTS

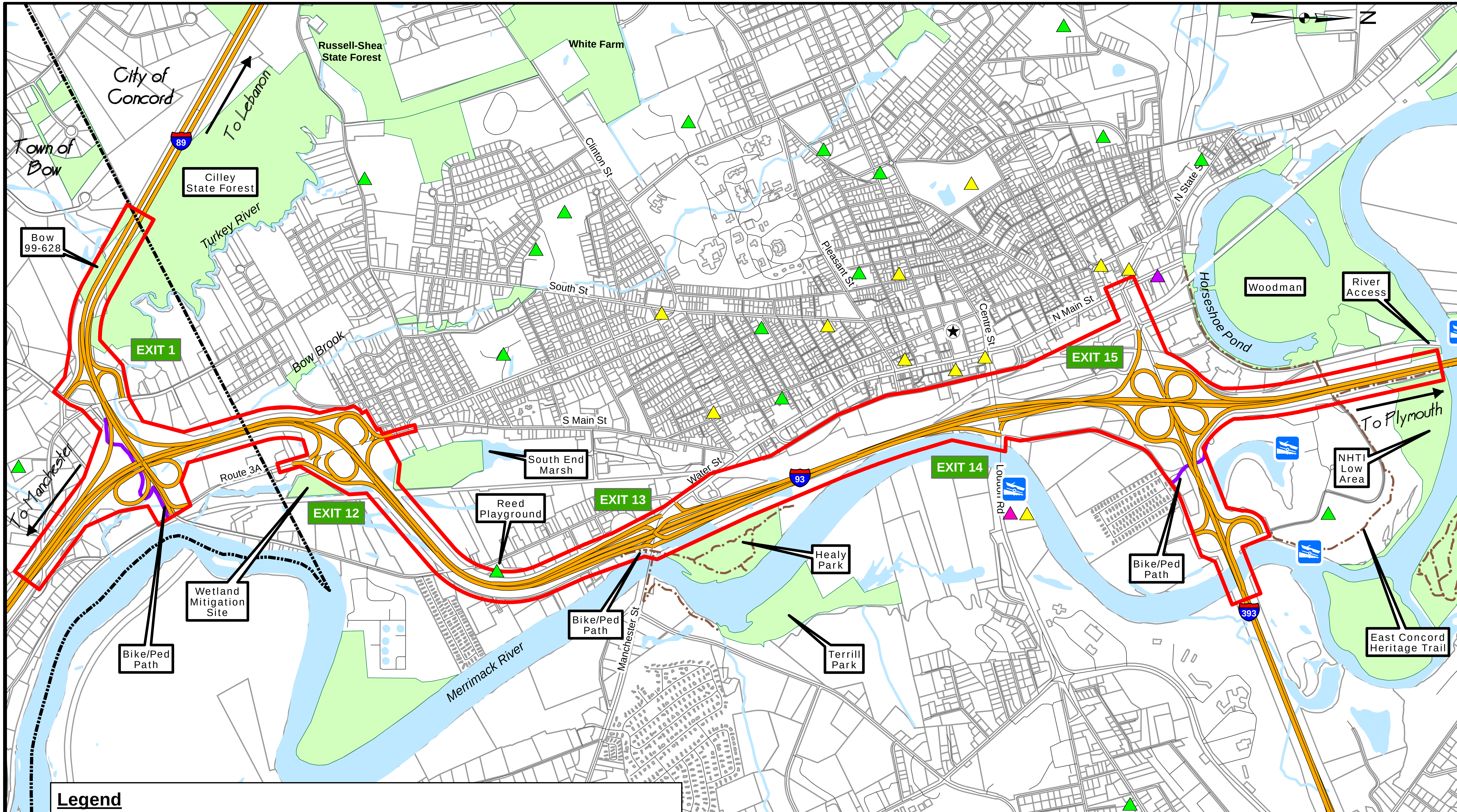
AGRICULTURAL RESOURCES OVERVIEW

FIGURE 3.17

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.17 Agricultural Resources.mxd



Legend

- State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds
- Trails
- Bike/Ped Path
- Public Water Access
- Conservation Lands
- Field Sports
- Historic Site
- Park
- Winter Sports Area

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BOW-CONCORD I-93 IMPROVEMENTS

CONSERVATION AND PUBLIC LANDS

DATE: AUGUST 2018

SCALE: 1"=1500'

FIGURE 3.18

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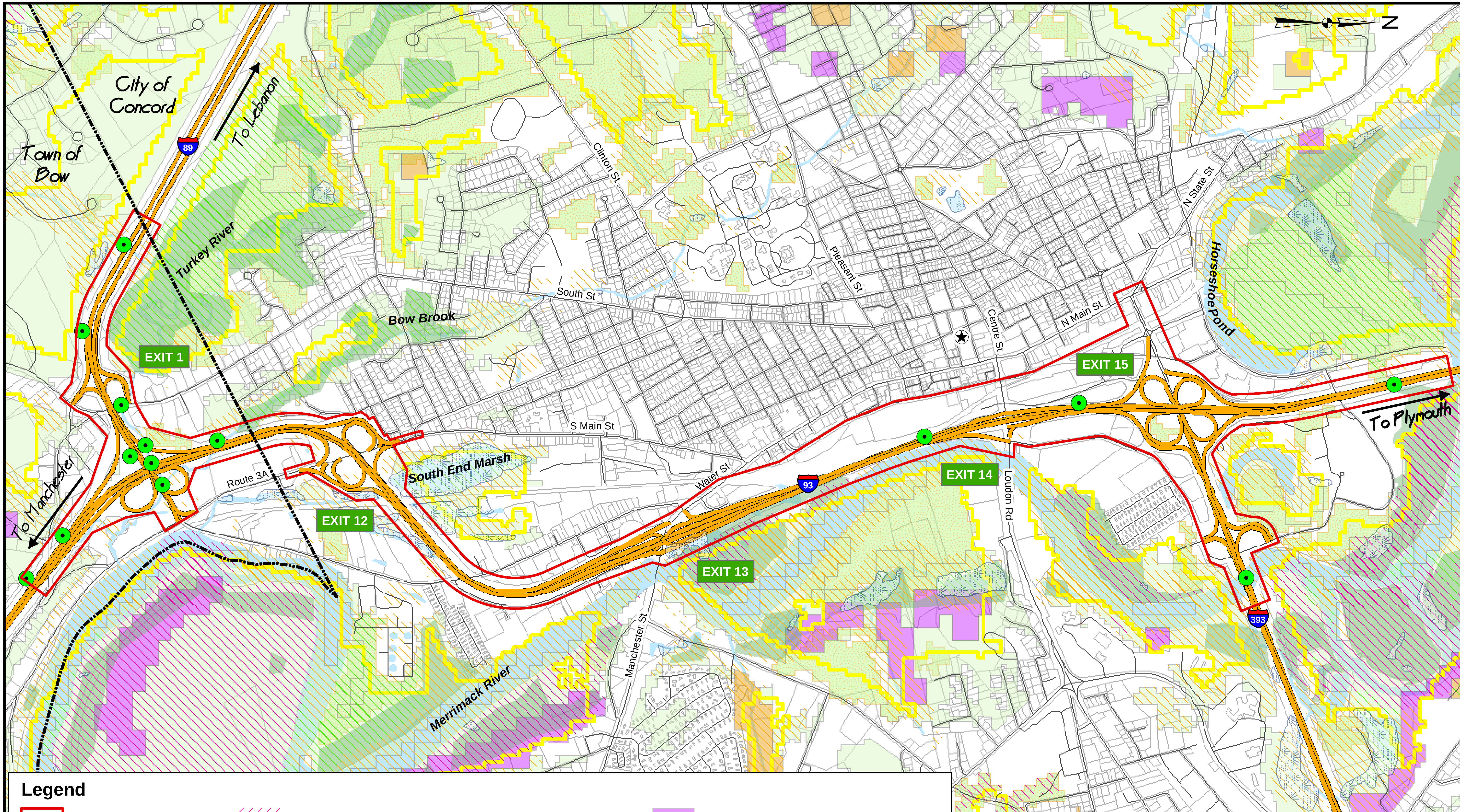

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BOW-CONCORD I-93 IMPROVEMENTS

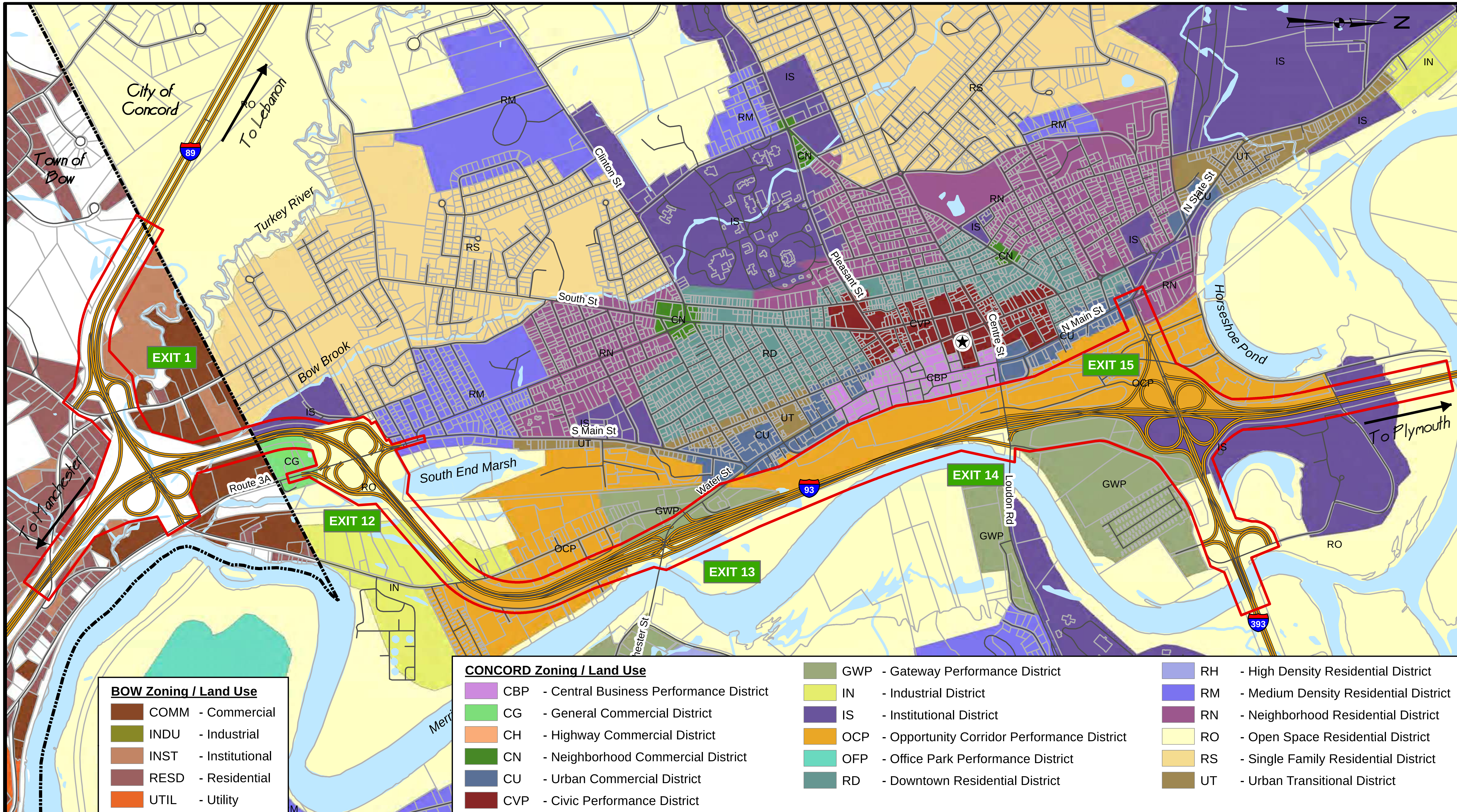
PLANTS AND WILDLIFE OVERVIEW

FIGURE 3.19

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.19 Plants and Wildlife.mxd



Legend

State Capital
Study Area
Parcels
Streams
Rivers and Ponds

U.S. Department of Transportation Federal Highway Administration
New Hampshire DOT
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BOW-CONCORD I-93 IMPROVEMENTS

ZONING AND LAND USE

FIGURE 3.21

DATE: AUGUST 2018

SCALE: 1"=1500'

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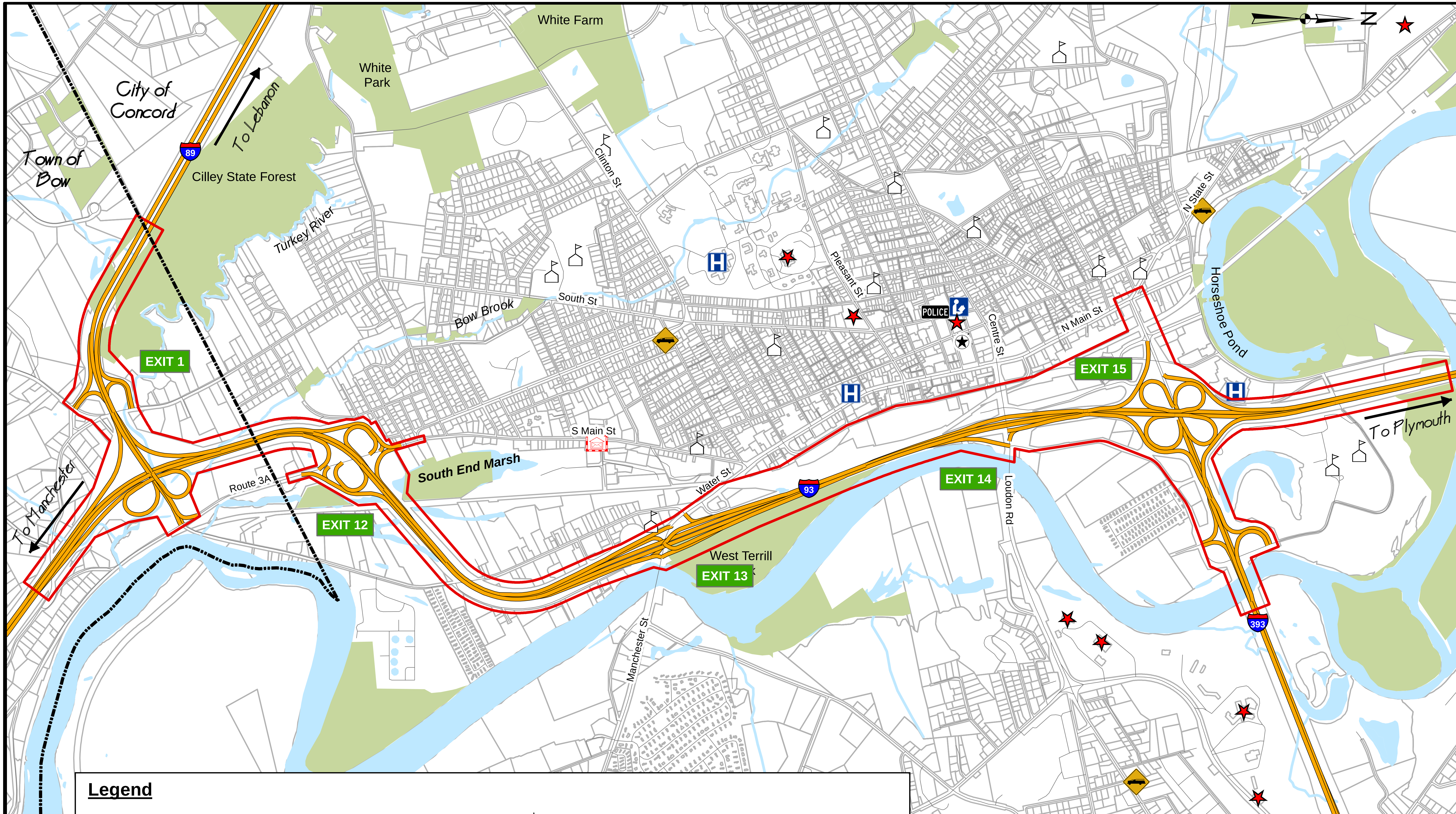

Legend

State Capital	Streams	Government Facility	Police
Study Area	Rivers and Ponds	Hospital	Post Office
Parcels	Open Space	Library	School
			Fire Station

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BOW-CONCORD I-93 IMPROVEMENTS

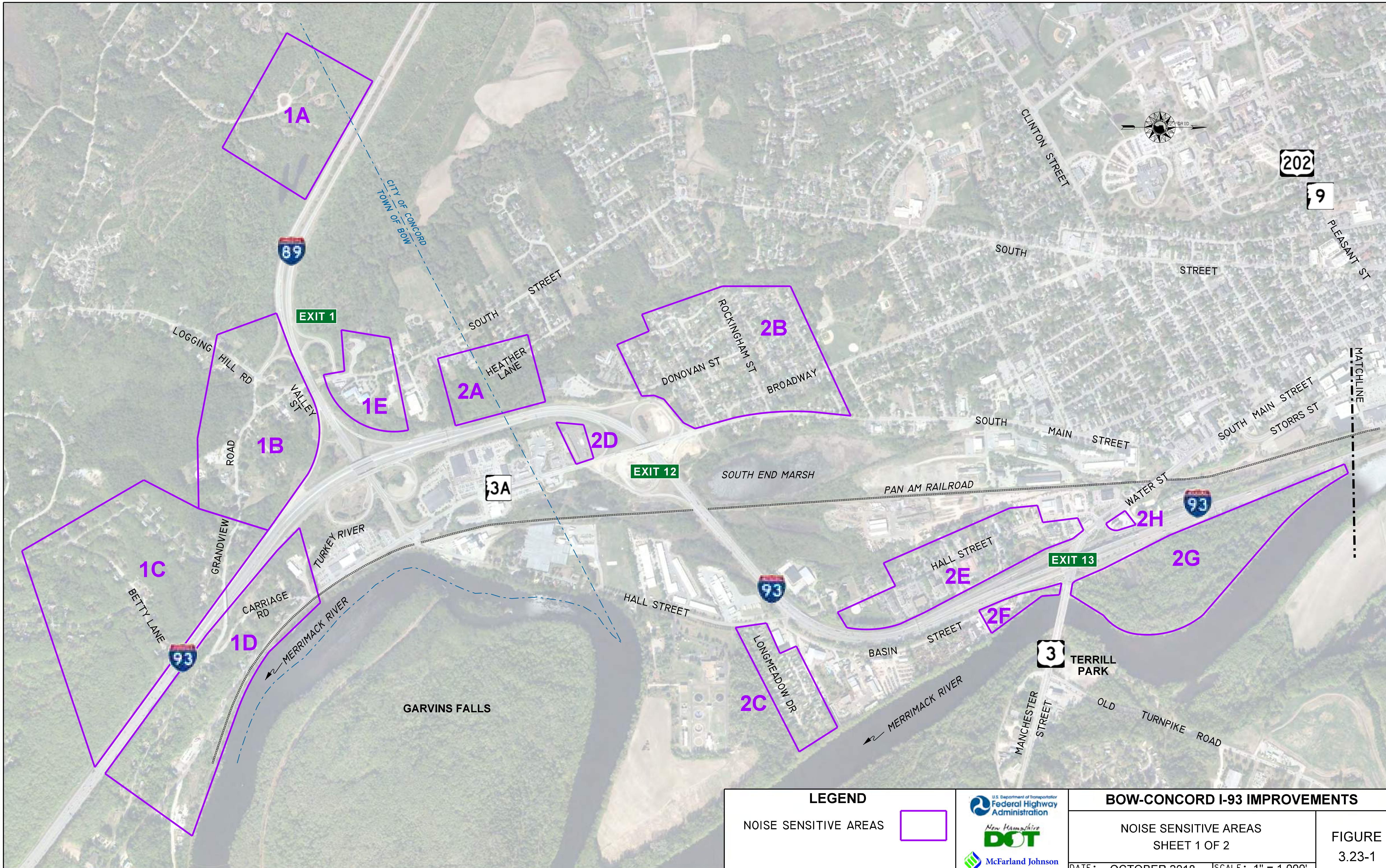
COMMUNITY RESOURCES OVERVIEW

FIGURE 3.22

DATE: AUGUST 2018

SCALE: 1"=1500'

M:\17841.00 Bow Concord I93 Part B\Draw\GIS\EA Figures\3.22 Community Resources.mxd



LEGEND

NOISE SENSITIVE AREAS

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

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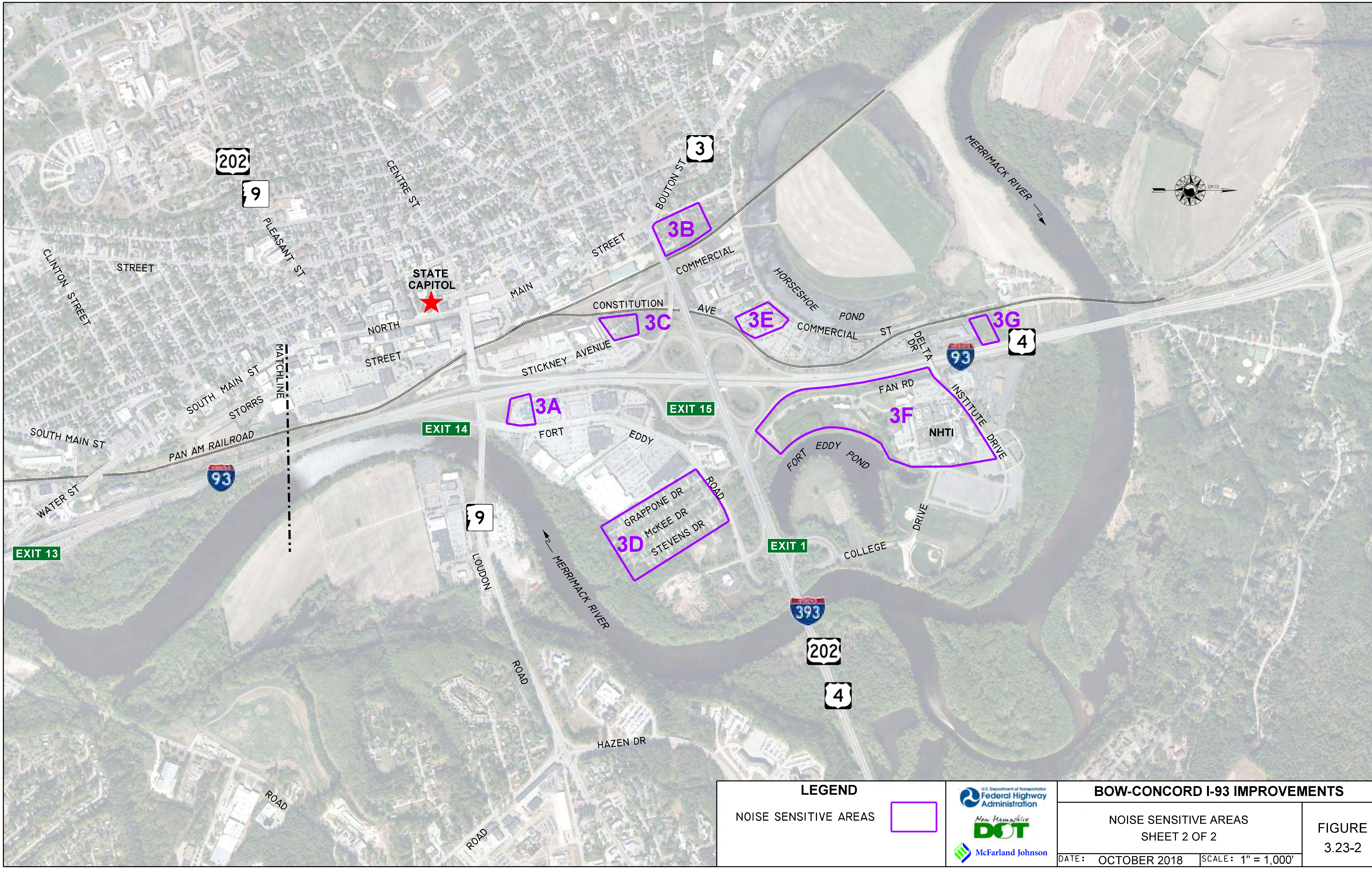
BOW-CONCORD I-93 IMPROVEMENTS

NOISE SENSITIVE AREAS
SHEET 1 OF 2

FIGURE 3.23-1

DATE: OCTOBER 2018

SCALE: 1" = 1,000'



LEGEND

NOISE SENSITIVE AREAS

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

McFarland Johnson

BOW-CONCORD I-93 IMPROVEMENTS

NOISE SENSITIVE AREAS
SHEET 2 OF 2

DATE: OCTOBER 2018 | SCALE: 1" = 1,000'

FIGURE 3.23-2

Chapter 4
Environmental Consequences and Mitigation

4.1 Introduction

This chapter provides a detailed description of the impacts (and indirect impacts where applicable) associated with the alternatives under consideration. The impacts of alternatives that were screened out earlier in project development are discussed in Chapter 2. This chapter focuses on the impacts that would be realized from the Preferred Alternative. All of the concepts considered as part of the NEPA process are similar in impacts. The non-preferred concepts are discussed in the chapter when the impacts vary distinctly from the preferred alternative, and relevant to the overall discussion and decision process.

4.2 Traffic and Transportation

4.2.1 Introduction

The capacity and operational benefits of the proposed alternatives are summarized in this section. Alternatives include the No Build as a base for comparison, Transportation Demand Management (TDM) strategies, Transportation System Management (TSM) measures, and the various highway widening and interchange improvement alternatives.

4.2.2 No-Build Alternative

The No Build Alternative serves as a benchmark for comparison to the build alternatives. The No Build assumes that no improvements are made to the I-93 corridor or its interchanges to address capacity and operational issues. However, other projects that have been programmed and approved for the project area and region are assumed to have been implemented.

The Microsimulation Model discussed in Section 3.2.1 was used to develop both morning (AM) and afternoon (PM) peak hour traffic within the project limits. The design hour represents the average peak hour of the peak month. For this project, the peak AM month is September and peak PM month is August. Therefore, the AM design hour represents the average AM peak hour condition in September and the PM design hour represents the average PM peak hour in August. **Figure 4.1 Design Year 2035 AM and PM Volumes** depicts the Design Year 2035 AM and PM volumes within the project limits.

The traffic operations analyses for this project were also developed using the project Microsimulation Model. See Section 3.2.3 for a detailed description of the operating conditions of a roadway based on Level-of-service (LOS). There are six levels of service (LOS A to F), freeway segments with LOS A to LOS C are deemed acceptable, LOS D is considered acceptable during peak periods, and LOS E and LOS F are considered unacceptable.

The results of the freeway analyses for the future No Build condition are summarized in **Table 4.1 2035 No Build I-93 Freeway Segments** for Southbound I-93 and Northbound I-93. Those segments with LOS E or F are highlighted in red, indicating improvements are warranted.

Table 4.1 2035 No Build I-93 Freeway Segments

I-93 Segment	Direction	Type	Segment Density (veh/mi/lane) (AM/PM)	Speed (mph) (AM/PM)	LOS (AM/PM)
I-89 Off ramp	Northbound	Diverge	32/24	61/63	D/C
At I-89	Northbound	Basic	81/47	16/34	F/F
I-93/I-89 Weave	Northbound	CD Weaving	97/54	11/25	F/F
I-89 On ramp	Northbound	Merge	112/84	11/17	F/F
Exit 12 Off ramp S	Northbound	Diverge	113/85	16/26	F/F
Exit 12 Off ramp N	Northbound	Diverge	112/76	15/27	F/F
Exit 12 On ramp	Northbound	Merge	111/73	12/22	F/F
Exit 13 Off ramp	Northbound	Diverge	111/61	16/35	F/F
Between Exit 13 Ramps	Northbound	Basic	70/81	19/24	F/F
Exit 13 On ramp	Northbound	Merge	104/73	11/19	F/F
Exit 14 Off ramp	Northbound	Diverge	109/58	13/35	F/F
Between Exit 14 Ramps	Northbound	Basic	18/36	54/52	B/E
Between Exit 14 & 15	Northbound	Weaving	20/42	53/48	B/E
Exit 15 Weave	Northbound	Weaving	17/37	49/46	B/E
Exit 15 On ramp	Northbound	Merge	11/34	59/50	B/D
North of Exit 15	Northbound	Basic	12/36	58/52	B/E

I-93 Segment	Direction	Type	Segment Density (veh/mi/lane) (AM/PM)	Speed (mph) (AM/PM)	LOS (AM/PM)
North of Exit 15	Southbound	Basic	146/22	10/56	F/C
Exit 15 Off ramp	Southbound	Diverge	140/23	10/54	F/C
Exit 15 Weave	Southbound	Weaving	61/41	32/42	F/E
Between Exit 14 & 15	Southbound	Weaving	49/34	42/52	F/D
Between Exit 14 Ramps	Southbound	Basic	29/30	54/54	D/D
Exit 14 On Ramp	Southbound	Merge	30/39	52/42	D/E
Exit 13 Off ramp	Southbound	Diverge	33/40	53/49	D/E
Between Exit 13 Ramps	Southbound	Basic	24/29	55/52	C/D
Exit 13 On ramp	Southbound	Merge	29/56	50/28	D/F
Exit 12 Off ramp N	Southbound	Diverge	30/47	52/42	D/F
Exit 12 Off ramp S	Southbound	Diverge	33/47	48/46	D/F
Exit 12 On ramp	Southbound	Merge	14/27	56/52	B/C
At I-89	Southbound	Basic	12/16	59/59	B/B
I-89 On ramp	Southbound	Merge	10/13	66/66	B/B
South of I-89	Southbound	Basic	18/22	63/62	C/C

The number of shaded I-93 segments above for the 2035 No Build condition indicate poor operating conditions for most of the segments within the project limits.

The results of the intersection analyses for the future No Build condition are summarized in **Table 4.2 2035 No Build Intersection Operations** for each of the interchange area within the project limits. The results indicate the overall Delay and LOS for the intersection with the exception of those with “Stop” control. Overall operations for “Stop” control intersections are not possible; therefore, the worst-case approach of the intersection is presented. Those segments with LOS E or F are highlighted in red, indicating improvements are warranted.

Table 4.2 2035 No Build Intersection Operations

Project Area	Intersection	Type	Overall Delay (Seconds) (AM/PM)	LOS (AM/PM)
I-89/I-93	NH 3A/I-89/Hall Street	Signal	41/51	D/D
I-89 Exit 1	Logging Hill Road/I-89 Exit 1 Southbound Ramps (Westbound Approach)	Stop	36/34	D/D
	South Street/I-89 Exit 1 Northbound Ramps (Eastbound Approach)	Stop	11/77	B/F
Exit 12	I-93 Exit 12 Northbound Ramps/NH 3A	Yield	6/6	A/A
	I-93 Exit 12 Southbound Ramps/NH 3A	Yield	6/8	A/A
Exit 13	I-93 Exit 13/Manchester Street (Route 3)	SPUI[1] Signal	123/100	F/F
	I-93 Exit 13 Northbound Off ramp Right turn	Stop	326/329	F/F
	I-93 Exit 13 Southbound Off ramp/Manchester Street/Hall Street	Signal	20/30	C/C
	Manchester Street/Old Turnpike Road/Black Hill Road[2]	Signal	18/31	B/C
Exit 14	Northbound Off ramp/Loudon Road/Fort Eddy Road	Signal	299/209	F/F
	Northbound On ramp/Loudon Road	Signal	33/22	C/C
	Southbound Ramps/Loudon Road	Signal	55/26	D/C
	Loudon Road/Stickney Avenue/Bridge Street	Signal	13/25	B/C
Exit 15	Southbound Off ramp/US 202	Stop	1,050/27	F/D
	South Commercial Street/US 202 Eastbound	Signal	6/32	A/C
	Commercial Street/US 202 Westbound	Signal	33/18	C/C
I-393 Exit 1	Westbound Ramps/College Park Drive (Eastbound Approach)	Stop	9/12	A/B
	Eastbound Ramps/Fort Eddy Road	Signal	13/17	B/B

[1] Single Point Urban Interchange (SPUI).
[2] The Manchester Street/Old Turnpike Road/Black Hill Road intersection is scheduled to be improved in 2025.

As the volume of traffic increases by the design year 2035, the level of congestion and delay would worsen during peak hours under the No Build condition. Also, the congestion is expected to expand to longer periods of time and to a greater number of days as drivers look to avoid the peak periods.

4.2.3 Build Alternatives

4.2.3.1 Travel Demand Management

Travel Demand Management (TDM) strategies aim to reduce the demand for travel during peak travel periods such as the morning and afternoon commuting times, rather than increase the capacity of the transportation system. The strategies included with the project include preservation of rail corridor for future passenger rail service, retention and expansion of park-and-ride lots in the project area, and increased bicycle and pedestrian facilities. These TDM strategies and proposals would provide some reduction to the traffic demand on I-93, but would not address the overall need to increase capacity and improve safety.

4.2.3.2 Transportation System Management

Transportation Systems Management (TSM) refers to low cost easy to implement measures to address safety and congestions issues. A measure evaluated as part of the project included adding a right turn signal at the end of the northbound exit ramp at Exit 13. The daily back up from this ramp extends onto northbound I-93 and creates safety issues for the ramp and mainline. While a new signal would provide a short-term solution to this back-up, it would not address the long term need to widen the ramp and provide additional capacity.

4.2.3.3 Interstate 93 Mainline

The traffic projections developed for the project indicate that by 2035, I-93 through Bow and Downtown Concord would require six traffic lanes, three in each direction, to accommodate the future traffic demand. An eight-lane interstate, four lanes in each direction, is not required for the projected traffic demand. Therefore, all the build alternatives developed for the project include the widening of I-93 to a basic six-lane interstate through Exit 15. **Table 4.3 I-93 Projected Traffic Volumes** below outlines the peak hour traffic, both AM and PM, for the various segments of I-93 for the projected demand by 2035.

The widening of I-93 and the reconstruction of the ramps at the interchanges also requires an evaluation of the need for auxiliary lanes on the mainline between successive ramps. The two main criteria used to evaluate the need for auxiliary lanes were the operation of the ramp merges and diverges and the spacing between successive entrance and exit ramps. As a result of this evaluation, it was determined that auxiliary lanes are warranted between interchanges for all segments of I-93, both northbound and southbound as described below.

Table 4.3 I-93 Projected Traffic Volumes

Segment	Peak Hour Volumes (Vehicles per Hour) Projected 2035[1]	
	AM	PM
Between I-89 and Exit 12		
Northbound	4,039	4,352
Southbound	3,267	4,192
Between Exit 12 & 13		
Northbound	4,045	4,747
Southbound	3,633	4,238
Between Exit 13 & 14		
Northbound	3,398	4,697
Southbound	4,077	3,968
Between Exit 14 & 15		
Northbound	2,265	4,104
Southbound	4,714	3,265

[1] The projected volumes are demand volumes from the Central NH Regional Model developed by RSG in 2015. The volumes represent true demand and not just the volume that can be accommodated by the existing roadway system.

Between I-89 and Exit 12 and between Exits 13 and 14, the distance between the entrance ramps and subsequent exit ramps is less than the minimum 2,000 feet distance recommended by ASSHTO. At these locations, the merge and diverge areas overlap and there is no “basic” segment between the exits. Auxiliary lanes are proposed to address this deficiency.

Between Exits 12 and 13 the volume of traffic, and more importantly the amount of traffic entering and exiting I-93, creates congestion that results in poor operations. See **Table 4.4 I-93 Auxiliary Lane Comparison** below for a comparison of the I-93 segments with and without auxiliary lanes.

The segment between Exits 14 and 15 is currently a weaving section and each alternative for this area handles the weaving in a unique way. See Section 4.2.3.7 for this discussion.

The following sections discuss the seven interchanges that exist within the project limits and the concepts developed to address operational and safety issues.

Table 4.4 I-93 Auxiliary Lane Comparison

Segment	Level of Service (LOS)			
	Projected 2035			
	Without Auxiliary Lane		With Auxiliary Lane	
	AM	PM	AM	PM
Between Exit 12 & 13				
Northbound	E	D	C	C
Southbound	C	D	B	C

4.2.3.4 Interstate 89 Area Concepts

The I-89 Area is comprised of the I-93/I-89 Interchange and I-89 Exit 1 in addition to approximately 3,700 feet of I-93. The widening of I-93 addresses the capacity needs of this area but not the operational issues that exist due to the close proximity of the two interchanges. Three concepts (Concepts C, K and P) were developed to address the weaving deficiencies that exist between Exit 1 and I-93. There is also a deficient weave within the I-93/I-89 Interchange, which is on the Collector-Distributor road (CD Road) that carries northbound I-93 traffic connecting to I-89.

<u>Concept C</u>

Concept C proposes shifting Exit 1 further to the west to lengthen the weave between Exit 1 and the I-93 ramps to about 1,000 feet. Providing a longer weaving length improves the operations of both the northbound and southbound weaves. Concept C does not propose improvements to the I-93 northbound CD Road weave. **Table 4.5 I-89 Area Concept C Weaving Comparison** below compares the weaving operations of Concept C to the No Build.

Table 4.5 I-89 Area Concept C Weaving Comparison

Segment	Level of Service (LOS)			
	Projected 2035			
	No Build		Concept C	
	AM	PM	AM	PM
I-89 Northbound between Exit 1 and I-93	B	E	B	B
I-89 Southbound between Exit 1 and I-93	F	E	D	C
I-93 Northbound CD Road connecting to I-89[1]	F	F	E	F

Concept C proposes minimal change to the intersections in the I-89 Area. **Table 4.6 I-89 Area Concept C Intersection Operations** below presents the intersection operations for the I-89 Area Concept C. These values are very similar to those of the No Build.

Table 4.6 I-89 Area Concept C Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035 Overall Delay (Seconds)	AM/PM Peak Period Projected 2035 LOS
I-89/I-93	NH 3A/I-89/Hall Street	Signal	42/56	D/E
I-89 Exit 1	Logging Hill Road/I-89 Exit 1 Southbound Ramps (Westbound Approach)	Stop	42/31	D/D
	South Street/I-89 Exit 1 Northbound Ramps (Eastbound Approach)	Stop	14/127	B/F

Concept K

Concept K retains the basic configuration of both interchanges; however, it proposes “braided” ramps between the two interchanges. The term “braid” refers to a grade separated crossing that occurs at an acute angle that resembles braids. The braided ramps eliminate the weaving section between the two interchanges.

Concept K also includes a new directional ramp for northbound I-93 to northbound I-89 traffic. While the existing northbound C-D Road would remain, a s portion of the traffic volume in the weave would be diverted as the northbound I-93 to northbound I-89 traffic would use the new directional ramp.

Table 4.7 I-89 Area Concept K Weaving Comparison below compares the weaving operations of Concept K to the No Build. The term Not Applicable (N/A) applies to the elimination of a weaving segment.

Table 4.7 I-89 Area Concept K Weaving Comparison

Segment	Level of Service (LOS) Projected 2035 No Build AM	No Build PM	Concept K AM	Concept K PM
I-89 Northbound between Exit 1 and I-93	B	E	N/A	N/A
I-89 Southbound between Exit 1 and I-93	F	E	N/A	N/A
I-93 Northbound CD Road connecting to I-89	F	F	D	C

The new directional ramp for northbound I-93 to northbound I-89 traffic eliminates the direct I-89 extension to Bow Junction. This traffic can still access Bow Junction, but only by using Exit 1 or Exit 12 on I-93. The additional traffic on South Street and Logging Hill Road require that both intersections are signalized. **Table 4.8 I-89 Area Concept K Intersection Operations** below presents the intersection operations for the I-89 Area Concept K.

Table 4.8 I-89 Area Concept K Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035	
			Overall Delay (Seconds)	LOS
I-89/I-93	NH 3A/I-89/Hall Street	Signal	34/45	C/D
I-89 Exit 1	Logging Hill Road/I-89 Exit 1 Southbound Ramps	Signal	19/14	B/B
	South Street/I-89 Exit 1 Northbound Ramps	Signal	13/20	B/C

Concept K is the preferred alternative for the I-89 Area.

<u>Concept P</u>

Concept P is identical to Concept K except that it proposes new 50 mph directional ramps to replace both loop ramps at the I-93/I-89 Interchange. The results discussed above concerning Exit 1 and the weaving between Exit 1 and I-93 are the same for Concept P. The proposed directional ramps for the I-93/I-89 would eliminate the existing weaving on the CD Road.

Table 4.9 I-89 Area Concept P Weaving Comparison below compares the weaving operations of Concept P to the No Build. The term Not Applicable (N/A) applies to the elimination of a weaving segment.

Table 4.9 I-89 Area Concept P Weaving Comparison

Segment	Level of Service (LOS) Projected 2035			
	No Build		Concept P	
	AM	PM	AM	PM
I-89 Northbound between Exit 1 and I-93	B	E	N/A	N/A
I-89 Southbound between Exit 1 and I-93	F	E	N/A	N/A
I-93 Northbound CD Road connecting to I-89	F	F	N/A	N/A

As with Concept K, Concept P eliminates the direct I-89 extension to Bow Junction and this traffic must use Exit 1 or Exit 12 on I-93. The additional traffic on South Street and Logging Hill Road require that both intersections are signalized. **Table 4.10 I-89 Area Concept P Intersection Operations** below presents the intersection operations for the I-89 Area Concept P, which is similar to Concept K.

Table 4.10 I-89 Area Concept P Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035	
			Overall Delay (Seconds)	LOS
I-89/I-93	NH 3A/I-89/Hall Street	Signal	34/45	C/D
I-89 Exit 1	Logging Hill Road/I-89 Exit 1 Southbound Ramps	Signal	19/14	B/B
	South Street/I-89 Exit 1 Northbound Ramps	Signal	12/19	B/B

4.2.3.5 Exit 12 Area Concepts

The Exit 12 Area is comprised of approximately 4,000 feet of I-93 and Exit 12. The widening of I-93 addresses the capacity needs of this area but not the safety issues that exist at Exit 12. Two concepts (Concepts E and F) were developed to address the deficient deceleration at the Exit 12 off ramps. The solution for both concepts is to eliminate one of the two off ramps in each direction, which allows the remaining off ramps to have the appropriate deceleration distance. The proposed would be partial cloverleaf interchanges. The two concepts handle the new ramp intersections with NH Route 3A in different ways as described below.

Concept E

Because all exiting traffic terminates at NH Route 3A at a single intersection, intersection control is required to provide acceptable levels of service. Concept E proposes traffic signals at the two ramp intersections with NH Route 3A. **Table 4.11 Exit 12 Area Concept E Intersection Operations** below presents the intersection operations for the Exit 12 Concept E.

Table 4.11 Exit 12 Area Concept E Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035	
			Overall Delay (Seconds)	LOS
Exit 12	I-93 Exit 12 Northbound Ramps/NH 3A	Signal	16/16	B/B
	I-93 Exit 12 Southbound Ramps/NH 3A	Signal	15/16	B/B

The two intersections are only about 1,000 feet apart, which restricts the amount of vehicle storage that can be provided for turning vehicles. The result is queuing that occurs on NH Route 3A for all approaches. The southbound queue does extend back along NH Route 3A such that Joffre Street is blocked.

Concept F

Concept F proposes hybrid roundabouts at the two ramp intersections with NH Route 3A. **Table 4.12 Exit 12 Area Concept F Intersection Operations** below presents the intersection operations for Exit 12 Concept F.

Table 4.12 Exit 12 Area Concept F Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035	
			Overall Delay (Seconds)	LOS
Exit 12	I-93 Exit 12 Northbound Ramps/NH 3A	Roundabout	11/12	B/B
	I-93 Exit 12 Southbound Ramps/NH 3A	Roundabout	12/14	B/B

The roundabouts effectively process the traffic between the two intersections and there is little queuing on NH Route 3A as a result.

Concept F is the preferred alternative for the Exit 12 Area.

4.2.3.6 Exit 13 Area Alternatives

The Exit 13 Area is comprised of approximately 6,900 feet of I-93 and Exit 13. Exit 13 was reconstructed in 2002 with the Single Point Urban Interchange (SPUI) and a new bridge that accommodates up to six lanes on I-93. The widening of I-93 addresses the capacity needs of this area but not the operational issue that exists at the northbound exit ramp at Exit 13.

During morning peak periods, traffic backs up daily from the intersection of Manchester Street (US Route 3) onto I-93. The cause of the backup is the high volume of traffic that makes a right turn onto Manchester Street. This movement is controlled by a stop sign and the limited sight distance requires each turning vehicle to wait to make the turn. Two concepts (Concepts A and B) were developed to address the queuing issue that exists.

Concept A

Concept A proposes signalizing the northbound exit ramp right turn onto Manchester Street. The proposed signal addresses the queuing issue in the short term; however, by the design year 2035 the queue would again back onto I-93.

Concept B

Concept B proposes signalizing and widening the northbound exit ramp right turn by providing two right turn lanes onto Manchester Street. The combination of the proposed signal and widening addresses the queuing issue through to the design year 2035. The traffic queue would not back onto I-93 in 2035.

Concept B is the preferred alternative for the Exit 13 Area.

4.2.3.7 Exit 14 / 15 Area Concepts

The Exit 14/15 Area is comprised of Exit 14, Exit 15 and I-393 Exit 1 in addition to approximately 10,000 feet of I-93. The widening of I-93 addresses the capacity needs of this area but not the operational issues that exist due to the close proximity of the interchanges. Four concepts (Concepts D2, F, F2, and O3) were developed to address the weaving deficiencies. There are eight deficient weaving segments between Exit 14 and 15, within Exit 15, and between Exit 15 and I-393 Exit 1.

Concept D2

Concept D2 retains most of the existing configurations for each interchange and proposes widening I-93 to six lanes to a point south of the bridge over the Merrimack River. The one exception to maintaining the existing configuration is at Exit 14 where the northbound entrance ramp would be eliminated. Eliminating this ramp allowed the alignment of I-93 to be shifted east to avoid impacts along the west side of the corridor.

The elimination of the entrance ramp eliminated one of the weaving deficiencies in this area. The weaving on I-93 southbound between Exits 14 and 15, as well as the weaving on I-93 in both directions at Exit 15, improve with Concept D2 due to the added lanes on I-93. This increased capacity allows vehicles passing through on I-93 to remain in the left lanes and this provides more capacity in the right lanes for the weaving traffic.

Table 4.13 Exit 14/15 Area Concept D2 Weaving Comparison below compares the weaving operations of Concept D2 to the No Build. The term Not Applicable (N/A) applies to the elimination of a weaving segment. Those segments with LOS E or F are highlighted in red, indicating improvements are warranted.

Table 4.13 Exit 14/15 Area Concept D2 Weaving Comparison

Segment	Level of Service (LOS)			
	Projected 2035			
	No Build		Concept D2	
	AM	PM	AM	PM
I-93 Northbound between Exit 14 and 15	B	E	N/A	N/A
I-93 Southbound between Exit 14 and 15	F	D	C	B
I-93 Northbound at Exit 15	B	E	A	B
I-93 Southbound at Exit 15	F	E	C	B
I-393 Westbound at Exit 15	D	C	D	C
I-393 Eastbound at Exit 15	A	B	A	B
I-393 Westbound between Exit 15 and Exit 1	C	C	C	C
I-393 Eastbound between Exit 15 and Exit 1	A	C	B	C

The proposed modifications to ramps at Exit 14 benefits the operations of the Loudon Road corridor. Currently there are four signalized intersections within a distance of 700 feet. The elimination of the northbound entrance ramp eliminates one of these intersections, which allows for more storage and fewer conflicts. The delay is considerably reduced as compared to the No Build. **Table 4.14 Exit 14/15 Area Concept D2 Intersection Operations** below presents the intersection operations for the Exit 14/15 Area Concept D2.

Table 4.14 Exit 14/15 Area Concept D2 Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035	
			Overall Delay (Seconds)	LOS
Exit 14	Northbound Off ramp/Loudon Road/Fort Eddy Road	Signal	30/46	C/D
	Northbound On ramp/Loudon Road	N/A	N/A	N/A
	Southbound Ramps/Loudon Road	Signal	21/17	C/B
	Loudon Road/Stickney Avenue/Bridge Street	Signal	5/11	A/B
Exit 15	Southbound Off ramp/US 202	Yield	3/2	A/A
	South Commercial Street/US 202 Eastbound	Signal	6/22	A/C
	Commercial Street/US 202 Westbound	Signal	81/16	F/C
I-393 Exit 1	Westbound Ramps/College Park Drive Eastbound Approach)	Stop	10/13	A/B
	Eastbound Ramps/Fort Eddy Road	Signal	13/16	B/B

Concept F

Concept F proposes substantial changes to I-93, Exit 14 and Exit 15 as follows:

- Collector-Distributor (C-D) Roads for northbound and southbound I-93 between Exits 14 and 15.
- A Single Point Urban Interchange (SPUI) at Exit 14.
- A cloverstack interchange at Exit 15.
- No changes to Exit 1 on I-393.
- New access to Stickney Avenue Area.

The C-D Roads benefit the weaving because the weaving traffic is traveling at slower speeds and there is no interference with I-93 traffic. The proposed cloverstack at Exit 15 eliminates the four weaving segments within the interchange. The weaving segments between Exit 15 and I-393 Exit 1 are geometrically deficient, however, due to the relatively low volume of ramp traffic at Exit 1, they operate at acceptable levels. No modifications to Exit 1 are proposed.

Table 4.15 Exit 14/15 Area Concept F Weaving Comparison below compares the weaving operations of Concept F to the No Build. The term Not Applicable (N/A) applies to the elimination of a weaving segment. Those segments with LOS E or F are highlighted in red, indicating improvements are warranted.

Table 4.15 Exit 14/15 Area Concept F Weaving Comparison

Segment	Level of Service (LOS)			
	Projected 2035			
	No Build		Concept F	
	AM	PM	AM	PM
I-93 Northbound between Exit 14 and 15	B	E	A	B
I-93 Southbound between Exit 14 and 15	F	D	B	B
I-93 Northbound at Exit 15	B	E	N/A	N/A
I-93 Southbound at Exit 15	F	E	N/A	N/A
I-393 Westbound at Exit 15	D	C	N/A	N/A
I-393 Eastbound at Exit 15	A	B	N/A	N/A
I-393 Westbound between Exit 15 and Exit 1	C	C	C	C
I-393 Eastbound between Exit 15 and Exit 1	A	C	B	C

The SPUI intersection at Exit 14 operates very well; however, to accommodate four ramps and the SPUI, the Loudon Road intersection with Stickney Avenue must be eliminated. Eliminating this intersection also eliminates access to the Ralph Pill Building. The Loudon Road corridor operates well but the access to Stickney Avenue and Bridge Street are lost. **Table 4.16 Exit 14/15 Area Concept F Intersection Operations** below presents the intersection operations for the Exit 14/15 Area Concept F.

Table 4.16 Exit 14/15 Area Concept F Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035	
			Overall Delay (Seconds)	LOS
Exit 14	Northbound Off ramp/Loudon Road/Fort Eddy Road	Signal	23/57	C/E
	Exit 14/Loudon Road	SPUI Signal	27/34	C/C
	Loudon Road/Stickney Avenue/Bridge Street	N/A	N/A	N/A
Exit 15	Southbound Off ramp/US 202	Yield	12/3	B/A
	South Commercial Street/US 202 Eastbound	Signal	10/39	A/D
	Commercial Street/US 202 Westbound	Signal	48/12	D/B
I-393 Exit 1	Westbound Ramps/College Park Drive (Eastbound Approach)	Stop	10/12	A/B
	Eastbound Ramps/Fort Eddy Road	Signal	13/16	B/B

Concept F2

Concept F2 is a hybrid alternative that contains elements of Concept F and Concept D2. Like Concept D2, it includes a modified diamond interchange at Exit 14 where the northbound entrance ramp has been eliminated. It also includes a southbound C-D Road between Exits 14 and 15. Like Concept F, it includes a cloverstack interchange at Exit 15 where two of the loop ramps are eliminated.

Table 4.17 Exit 14/15 Area Concept F2 Weaving Comparison below compares the weaving operations of Concept F2 to the No Build. The term Not Applicable (N/A) applies to the elimination of a weaving segment. Those segments with LOS E or F are highlighted in red, indicating improvements are warranted.

Table 4.17 Exit 14/15 Area Concept F2 Weaving Comparison

Segment	Level of Service (LOS)			
	Projected 2035			
	No Build		Concept F2	
	AM	PM	AM	PM
I-93 Northbound between Exit 14 and 15	B	E	N/A	N/A
I-93 Southbound between Exit 14 and 15	F	D	B	B
I-93 Northbound at Exit 15	B	E	N/A	N/A
I-93 Southbound at Exit 15	F	E	N/A	N/A
I-393 Westbound at Exit 15	D	C	N/A	N/A
I-393 Eastbound at Exit 15	A	B	N/A	N/A
I-393 Westbound between Exit 15 and Exit 1	C	C	C	C
I-393 Eastbound between Exit 15 and Exit 1	A	C	B	C

As with Concept D2, the proposed modifications to ramps at Exit 14 benefits the operations of the Loudon Road corridor. The elimination of the northbound entrance ramp eliminates one of these intersections, which allows for more storage and fewer conflicts. The delay is substantially reduced as compared to the No Build. **Table 4.18 Exit 14/15 Area Concept F2 Intersection Operations** below presents the intersection operations for the Exit 14/15 Area Concept F2.

Table 4.18 Exit 14/15 Area Concept F2 Intersection Operations

Project Area	Intersection	Type	AM/PM Peak Period Projected 2035	
			Overall Delay (Seconds)	LOS
Exit 14	Northbound Off ramp/Loudon Road/Fort Eddy Road	Signal	30/46	C/D
	Northbound On ramp/Loudon Road	N/A	N/A	N/A
	Southbound Ramps/Loudon Road	Signal	21/17	C/B
	Loudon Road/Stickney Avenue/Bridge Street	Signal	5/11	A/B
Exit 15	Southbound Off ramp/US 202	Yield	12/3	B/A
	South Commercial Street/US 202 Eastbound	Signal	10/39	A/D
	Commercial Street/US 202 Westbound	Signal	48/12	D/B
I-393 Exit 1	Westbound Ramps/College Park Drive (Eastbound Approach)	Stop	10/12	A/B
	Eastbound Ramps/Fort Eddy Road	Signal	13/16	B/B

Concept F2 is the Preferred Alternative for the Exit 14/15 Area.

Concept O3

Concept O3 proposes several ambitious modifications to the Exit 14/15 Area. At Exit 14, Concept O3 proposes "flipping" the interchange whereby I-93 would be depressed and Loudon Road would cross over the interstate. The northbound entrance ramp at Exit 14 would be eliminated. Two of the loop ramps at Exit 15 would be eliminated and replaced with directional ramps thus eliminating the four weaves that exist within Exit 15.

Access to and from southbound I-93 for Concept O3 is provided with a combination of C-D roads and "slip ramps". A C-D road is provided for southbound traffic between Exits 14 and 15. A portion of this road is for two-way traffic and a portion is for one-way traffic. The two-way portion provides access to the Stickney Avenue area by the way of bridges over the relocated railroad corridor. The one-way portion of the C-D road provides access to Loudon Road from southbound I-93 and westbound I-393. The southbound connection between Exits 15 and 14 would be eliminated by Concept O3 and this traffic would have to use local roadways.

The combination of eliminating ramps, directional ramps, C-D Roads, and slip lanes results in the elimination of all weaving sections along I-93 at Exits 14 and 15. The only weaving sections to remain are those between Exit 15 and Exit 1 on I-393, which operate at acceptable levels of service.

Table 4.19 Exit 14/15 Area Concept O3 Weaving Comparison below compares the weaving operations of Concept O3 to the No Build. The term Not Applicable (N/A) applies to the elimination of a weaving segment. Those segments with LOS E or F are highlighted in red, indicating improvements are warranted.

Table 4.19 Exit 14/15 Area Concept O3 Weaving Comparison

Segment	Level of Service (LOS) Projected 2035			
	No Build		Concept O3	
	AM	PM	AM	PM
I-93 Northbound between Exit 14 and 15	B	E	N/A	N/A
I-93 Southbound between Exit 14 and 15	F	D	N/A	N/A
I-93 Northbound at Exit 15	B	E	N/A	N/A
I-93 Southbound at Exit 15	F	E	N/A	N/A
I-393 Westbound at Exit 15	D	C	N/A	N/A
I-393 Eastbound at Exit 15	A	B	N/A	N/A
I-393 Westbound between Exit 15 and Exit 1	C	C	C	C
I-393 Eastbound between Exit 15 and Exit 1	A	C	B	C

There was no specific operational analysis conducted for the intersections associated with Concept O3. However, Loudon Road would be expected to operate very well as not only is the northbound entrance ramp eliminated, the Stickney Avenue intersection is eliminated. The intersections associated with Exit 14 and I-393 Exit 1 are expected to operate similar to Concept F2 as the configurations are similar.

It should be noted maintaining traffic during construction for Concept O3 would require closing Loudon Road for an extended period. Traffic on I-93 would be maintained at all times during construction but Loudon Road would be closed while lowering I-93.

4.2.3.8 Comparison of Alternatives

Tables 4.20a – 4.20d on the following pages include Alternative Comparison Matrices for the four project areas. The safety and operational impacts of the proposed modifications of the Preferred Alternative are discussed in detail in the *Technical Feasibility Report*, included in Appendix G (Volume 2). **Figure 4.4 - Preferred Alternative Year 2035 Peak Hour Traffic Volumes** shows the projected design year (2035) peak hour volumes for the Preferred Alternative.

Table 4.20a I-89 Area Alternatives Comparison Matrix

CRITERIA	NO BUILD	BUILD ALTERNATIVES		
		CONCEPT C	CONCEPT K	CONCEPT P
Description	• No Improvements	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added on both sides of I-93 between I-93/I-89 Interchange and Exit 12 • Relocate I-89 Exit 1 to provide improved weaving distances to I-93 ramps. • No changes to I-93/I-89 Interchange	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added on both sides of I-93 between I-93/I-89 Interchange and Exit 12 • Grade separated ramps between I-89 Exit 1 and I-93 to eliminate weaving. • Provide new NB I-93 to NB I-89 directional ramp to improve the weave on the existing collector-distributor road at the I-93/I-89 Interchange.	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added on both sides of I-93 between I-93/I-89 Interchange and Exit 12 • Grade separated ramps between I-89 Exit 1 and I-93 to eliminate weaving. • New directional ramps at the I-93/I-89 Interchange to make it a fully directional interchange. No weaving.
Traffic Capacity	• No additional capacity. • Congestion to worsen as traffic demand increases.	• Additional lanes on I-93 would address projected traffic volumes.	• Additional lanes on I-93 would address projected traffic volumes.	• Additional lanes on I-93 would address projected traffic volumes.
Traffic Operations	• Undesirable weave between I-89 Exit 1 and I-93 would continue to deteriorate. • Undesirable weave within the I-93/I-89 Interchange for NB traffic would continue to deteriorate.	• Improved weave lengths between I-89 Exit 1 and I-93 ramps would improve operations. • Undesirable weave within the I-93/I-89 Interchange for NB traffic would continue to deteriorate.	• Elimination of the weaves between I-89 Exit 1 and I-93 would eliminate this operational issue. • The substantial reduction in the amount of traffic within the NB weave at the I-93/I-89 Interchange would improve this operation.	• Elimination of the weaves between I-89 Exit 1 and I-93 would eliminate this operational issue. • Elimination of the weave within the I-93/I-89 Interchange would eliminate this operational issue.
Access	• No Change	• No Change	• Direct access between I-89 and Route 3A would be eliminated. Access to be provided via Exit 1 or Exit 12. • New access from NB I-93 to Route 3A to be provided.	• Direct access between I-89 and Route 3A would be eliminated. Access to be provided via Exit 1 or Exit 12. • New access from NB I-93 to Route 3A to be provided.
Estimated Project Cost (Approx. - 2017$)	• $0	• $34.1M • Includes 1 Red List Bridge	• $70.0M • Includes 1 Red List Bridge	• $92.8M • Includes 1 Red List Bridge

Concept K is the Preferred Alternative for the I-89 Area.

Table 4.20b Exit 12 Area Alternatives Comparison Matrix

CRITERIA	NO BUILD	BUILD ALTERNATIVES	
		CONCEPT E	CONCEPT F
Description	• No Improvements	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added NB & SB between I-89 and Exit 12. • Auxiliary Lanes added NB & SB between Exit 12 and Exit 13. • Partial Cloverleaf configuration. • Traffic Signals at both ramp terminals.	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added NB & SB between I-89 and Exit 12. • Auxiliary Lanes added NB & SB between Exit 12 and Exit 13. • Partial Cloverleaf configuration. • Hybrid Roundabouts at both ramp terminals.
Traffic Capacity	• No additional capacity. • Congestion to worsen as traffic demand increases.	• Additional lanes on I-93 would address projected traffic volumes.	• Additional lanes on I-93 would address projected traffic volumes.
Traffic Operations	• Deficient deceleration at exit ramps would remain.	• Deficient deceleration at exit ramps eliminated.	• Deficient deceleration at exit ramps eliminated.
Access	• No Change	• Two exit ramps eliminated but full access between I-93 and Route 3A maintained.	• Two exit ramps eliminated but full access between I-93 and Route 3A maintained.
Estimated Project Cost (Approx. - 2017$)	• $0	• $36.1M • Includes new bridge over Railroad.	• $33.8M • Includes new bridge over Railroad.

Concept F is the Preferred Alternative for the Exit 12 Area.

Table 4.20c Exit 13 Area Alternatives Comparison Matrix

CRITERIA	NO BUILD	BUILD ALTERNATIVES	
		CONCEPT A	CONCEPT B
Description	• No Improvements	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added NB & SB between Exit 12 and Exit 13. • Auxiliary Lanes added NB & SB between Exit 13 and Exit 14. • Maintain SPUI configuration. • Signalize Right Turn for NB Exit Ramp onto Route 3.	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added NB & SB between Exit 12 and Exit 13. • Auxiliary Lanes added NB & SB between Exit 13 and Exit 14. • Maintain SPUI configuration. • Widen NB exit ramp to provide two right turn lanes onto Route 3. • Signalize Right Turn for NB Exit Ramp onto Route 3.
Traffic Capacity	• No additional capacity. • Congestion to worsen as traffic demand increases.	• Additional lanes on I-93 would address projected traffic volumes.	• Additional lanes on I-93 would address projected traffic volumes.
Traffic Operations	• Traffic backups at NB exit ramp would continue to worsen.	• Signal for NB Exit Ramp Right Turn addresses queuing that extends back onto I-93 until 2035.	• Widened and Signalized NB exit ramp for Right Turn solves queuing that extends back onto I-93.
Access	• No Change	• No change.	• No change.
Estimated Project Cost (Approx. - 2017$)	• $0	• $33.2M • Includes 1 Red List Bridge	• $38.7M • Includes 1 Red List Bridge

Concept B is the Preferred Alternative for the Exit 13 Area.

Table 4.20d Exit 14/15 Area Alternatives Comparison Matrix

CRITERIA	NO BUILD	BUILD ALTERNATIVES			
		CONCEPT D2	CONCEPT F	CONCEPT F2	CONCEPT O3
Description	• No Improvements	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added on both sides of I-93 between Exits 13 and 14 • Retain Exit 14 Configuration, except eliminate NB entrance ramp. • Retain Full Cloverleaf at Exit 15 • Retain I-393 Exit 1 Configuration	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added on both sides of I-93 between Exits 13 and 14 • SPUI at Exit 14. • Cloverstack at Exit 15, which eliminates 2 loop ramps. • Collector-Distributor (C-D) Roads between Exits 14 & 15.	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added on both sides of I-93 between Exits 13 and 14 • Retain Exit 14 Configuration, except eliminate NB entrance ramp. • Cloverstack at Exit 15, which eliminates 2 loop ramps. • SB C-D Road between Exits 14 & 15.	• I-93 to be widened to a six-lane interstate. • Auxiliary Lanes added on both sides of I-93 between Exits 13 and 14 • Modified Diamond at Exit 14. • Exit 14 Flipped with Loudon Road over I-93. • Exit 14 eliminate NB entrance ramp. • Two-loop/two-directional ramp configuration at Exit 15. • Relocated Railroad an option.
Traffic Capacity	• No additional capacity. • Congestion to worsen as traffic demand increases.	• Additional lanes on I-93 would address projected traffic volumes.	• Additional lanes on I-93 would address projected traffic volumes.	• Additional lanes on I-93 would address projected traffic volumes.	• Additional lanes on I-93 would address projected traffic volumes.
Traffic Operations	• Undesirable weaves between Exit 14 and 15 would continue to deteriorate. • Undesirable weaves within Exit 15 would continue to deteriorate. • Loudon Road would continue to operate poorly.	• NB weave between Exit 14 and 15 eliminated. • SB weave between Exit 14 and 15 to improve with additional of lane on I-93. • Undesirable weaves within Exit 15 to improve with additional lanes on I-93. • Loudon Road to improve as one intersection is eliminated.	• Weaves between Exit 14 and 15 improved with C-D Roads. • Weaves within Exit 15 eliminated. • Loudon Road to improve with the single point intersection. • Potentially more traffic on Fort Eddy Road.	• NB weave between Exit 14 and 15 eliminated. • SB weave between Exit 14 and 15 improved with C-D Road. • Weaves within Exit 15 eliminated. • Loudon Road to improve as one intersection is eliminated.	• NB weave between Exit 14 and 15 eliminated. • SB weave between Exit 14 and 15 eliminated. • Weaves within Exit 15 eliminated. • Loudon Road to improve as one intersection eliminated.
Access	• No Change	• Exit 14 NB entrance ramp eliminated.	• Stickney Ave access from Loudon Road eliminated. • Access to Ralph Pill Bldg. eliminated. • New connection over I-93 between Fort Eddy Road and Stickney Ave.	• Exit 14 NB entrance ramp eliminated.	• Exit 14 NB entrance ramp eliminated. • Stickney Ave access via Storrs Street.
Estimated Project Cost (Approx. - 2017$)	• $0	• $91.5M • Includes 4 Red List Bridges	• $188.9M • Includes 4 Red List Bridges • Includes 4 New Bridges	• $124.6M • Includes 4 Red List Bridges Includes 2 New Bridges	• $170.8M • Includes 4 Red List Bridges • Includes 7 New Bridges

Concept F2 is the Preferred Alternative for the Exit 14/15 Area.

4.3. Air Quality

A microscale air quality analysis was completed to document project-level conformity with the National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO), Particulate Matter 10 (PM10), and Particulate Matter 2.5 (PM2.5). Refer to the *Air Quality Report Analysis* report in Appendix E (Volume 2) for detailed information regarding this analysis.

4.3.1 Methods

The three Intersections in the analysis were chosen based on throughput traffic volumes, levels of service, and distance from or connection with the Interstate. The intersections are as follows:

- Exit 13 SPUI and Manchester Street
- Exit 14 Northbound off Ramp with Ft Eddy Road
- Exit 14 Southbound off and on ramp with Loudon Road

The analysis was done with the EPA Motor Vehicle Emissions Simulator (MOVES2014a) and dispersion modeling software CAL3QHC through the CAL3i Windows interface. The function of the MOVES modeling was to determine emission factors and emission inventories from on-road motor vehicles. MOVES models the emissions produced from cars and trucks at the identified signalized intersections based on vehicle types, time period of analysis, geographical area, vehicle operating characteristics, and road types. The pollution output from motor vehicles as calculated through MOVES2014a is then used as input for the CAL3QHC dispersion modeling. The CAL3QHC dispersion modeling determines concentrations of the pollutants at set distances from the intersection based on roadway geometries, receptor locations, meteorological conditions and vehicular emission rates. This analysis is used to determine the concentrations of pollutants at receptor locations intended to replicate likely pedestrian experiences, essentially recording the air quality for someone walking along the sidewalk or nearby.

The worst-case scenario was modeled for the build design year with the presumption that if the concentrations of CO, PM2.5, and PM10 are substantially below the NAAQS limits, then it can be safe to assume the project would meet these standards during other scenarios, and no further modeling is necessary. The worst-case modeling assumptions were made for traffic, meteorological conditions, and other inputs to generate estimates of the maximum concentrations. Traffic volumes used in the model were the peak hours for the AM and PM. The model was run for January because the winter months historically are found to have higher concentrations of air pollutants.

All modeling inputs and procedures were developed based on EPA guidance, including *EPA 1992 Guideline for Modeling Carbon Monoxide from Roadway Intersections*, *Using MOVES2014 in Project-Level Carbon Monoxide Analyses*, and *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM2.5 and PM10*

Nonattainment and Maintenance Areas. These inputs reflect the traffic information generated for the project, including vehicle volumes and classifications (trucks, etc.). CAL#QHC inputs were per the EPA guidance, including *Users Guide to CAL3QHC Version 2.0: A Modeling methodology for Predicting Pollutant Concentrations Near Roadway Intersections*. Additional assumptions may be found in the *Air Quality Analysis* report.

4.3.2 Results

Carbon monoxide (CO)

The highest CO concentrations modeled ranged from 0.10 - 0.30 ppm at the three locations over the 24-hour period. With the majority of the receptors recording a negligible concentration of CO under the aforementioned worst-case scenario, it can be assumed that this project would not cause exceedances of the current 1-hour CO NAAQS of 35 ppm. Recent CO samples taken from the Londonderry Air Monitoring Station operated by NHDES at Moose Hill School in Londonderry, NH (approximately 29 miles southeast of the project area) show a maximum of 2.65 ppm over 8,600 hourly samples taken in 2011. Even if the ambient CO levels at the intersections of interest are equivalent to the highest measured concentrations at the Londonderry station, the concentrations would still be well below the 1-hour standard of 35 ppm. Due to these findings, no additional analysis of CO is deemed necessary.

Particulate Matter 10 (PM10)

Modeled PM10 concentrations ranged from 9.5 µg/m3 to 13.3 µg/m3 at the three locations over both time periods. The concentration limit in the NAAQS is 150 µg/m3 averaged over a 24-hour period. There is no information in the SIP regarding an ambient concentration to consider in the modeling. Since modeled concentrations for the worst-case scenario are substantially below the NAAQS, no additional analysis of PM10 is believed to be necessary.

Particulate Matter 2.5 (PM2.5)

Modeled PM2.5 concentrations ranged from 2.4 µg/m3 to 2.8 µg/m3 at the three intersections over both time periods and are well below the 24-hour NAAQS concentration of 35 µg/m3. Because these results represent the worst-case scenario for one hour, it is assumed the 24-hour average is well below the threshold and no further analysis is needed.

4.3.3 Conclusions

The build conditions for the design year are well below the CO, PM2.5, and PM10 standards. Therefore, it is concluded that this project would not cause or contribute to exceedances of the NAAQS. No analysis of additional alternatives or design years is warranted.

4.4 Noise

The noise analysis predicted existing and future sound levels for 300 receptor locations within the 4.5 mile project corridor. Noise study methods, terminology, and existing noise levels are reported in Chapter 3. A barrier analysis was conducted to determine if noise mitigation measures were feasible and reasonable.

4.4.1 Noise Analysis Results

This section summarizes noise analysis results for each Noise Measurement Site. For each location, results are compared to the Noise Abatement Criteria (NAC) to determine whether there would be a noise impact based on federal definitions. For each impacted location, the results of an abatement analysis are also reported, including the ability to achieve the required 7 dB reduction in noise levels ("insertion loss") at the most benefitted property, number of benefitted receptors, and barrier effectiveness. The results are summarized below in **Tables 4.21** and **4.22.**

In December 2017, after evaluation of all of the concepts (11 total) within the four project segments, the NHDOT selected a preferred concept for each segment. The four preferred concepts became the overall preferred alternative for the project. The concept selected in each segment as the preferred are listed below:

- Concept K in the segment known as the I-89/Exit 1 Area
- Concept F in the segment known as the I-93 Exit 12 Area
- Concept B in the segment known as the I-93 Exit 13 Area
- Concept F2 in the segment known as the I-93 Exit 14/15 Area

These four concepts were used for the final Traffic Noise Prediction Model (TNM) analyses.

Each concept was created as a separate TNM run with all receptors within the 500 foot buffer, as seen on the appendices figures. The Exit 12 Area has a relatively small footprint and few receptors located adjacent to the proposed improvements, therefore there are not many receptors located within the buffer. Additionally, the majority of traffic is focused on off and on ramps, which do not model accurately for continuous travel. Due to the small footprint and limited number of receptors, the Exit 12 Area was modeled separately and combined with preferred concept Exit 13 Area Concept B. It was determined from modeling the Existing and No Build models, that Exit 12 alone was not providing a verified model of accurate travel due to the acceleration and deceleration of traffic focused on the off and on ramps. Combining the preferred alternative models for Exit 12 and Exit 13 allowed for a more complete analysis of potential noise. Therefore, the preferred concept at the Exit 12 Area, Concept F, was modeled and illustrated on the graphics in conjunction with preferred concept Exit 13 Area Concept B.

4.4.2 Noise Abatement Measures

According to NHDOT, noise abatement measures should be considered where predicted traffic noise levels approach or exceed the applicable noise abatement criteria (NAC), or when the predicted traffic noise levels substantially exceed the existing noise levels.

When assessing noise abatement measures, there are two main elements to consider: reasonableness and feasibility. Reasonableness is based on a number of factors including, but not limited to:

- The noise abatement measure must provide a noise reduction of at least 7 db(A) for at least one benefitted receptor. A receptor is considered benefitted when a 7 db(A) reduction is provided.
- The noise abatement measure must provide a noise reduction of at least 5 dB(A) for at least one impacted receptor.
- The noise abatement measure must provide a noise reduction of at least 5 db(A) to be considered a benefit for any other receptors.
- The noise abatement measure must not pose a safety hazard.
- The noise abatement measure must not exceed 1,500 square feet (SF) of protective surface per benefited receptor.
- The majority of the affected residents must agree with installation of the noise abatement measure.

Feasibility is based on the engineering and safety considerations of noise abatement. These considerations include topography, access, drainage, maintenance, safety, and the consideration of other noise sources. In order to be considered feasible, NHDOT requires at least a 7 db(A) reduction for at least one receptor and 5 db(A) reduction to be considered benefitted. A feasible noise barrier has the following characteristic:

- The barrier must be less than 25 feet tall.

Possible noise abatement measures include berms, traffic management measures, buffer zones, and noise barriers (walls). Traffic management measures were considered during the design phase of the project and implemented as necessary to create a safe and efficient roadway. Changing the traffic management measures for the purpose of noise abatement is not a feasible option as it would change the design characteristics of the roadways. Buffer zones are not feasible since there is not enough space between the roadway and the residences to create a sufficient buffer zone. Due to the amount of space available and the level of noise reduction needed, noise barriers were the option chosen for analysis.

The 20 Noise Sensitive Areas contained impacted receptors, therefore, noise barrier modeling was warranted for the impacted receptors.

Fourteen noise barriers were modeled within the project corridor based upon the identification of the impacted receptors. The barriers modeled included the following and their locations are depicted on **Figures 4.3-1 and 4.3-2 Modeled Noise Barriers.**

- NHTI Barrier
- Delta Drive Soccer Field Barrier
- Kimball School of Art Barrier
- Higgins Place Barrier
- Uno's Outside Seating Area Barrier
- Fort Eddy Road Barrier
- 74 Basin Street Barrier
- The Common Man Barrier
- West Terrill Park Barrier
- Hall Street Barrier
- Basin Street Barrier
- Logging Hill Road Barrier
- Grandview Road North and South Barriers
- Carriage Road North and South Barriers

Of the 14 barriers modeled, only one barrier was found both reasonable and feasible; however, it was found feasible and reasonable at two separate heights, both 16 feet and 25 feet. This barrier is located along the edge of the NHTI Community College Complex and further detailed below in Section 4.4.3.

4.4.3 NHTI Barrier

A potential noise barrier was modeled along the NHTI property adjacent to I-93. The NHTI Barrier includes impacts at five receptor locations. The barrier was modeled south of Delta Drive parallel to I-93 and terminating at Fan Road. This area includes residence halls, tennis courts, and the McAuliffe-Shepard Discovery Center. A total of four receptors were benefitted by this barrier.

The 16 foot barrier totals 25,760 SF in size (16 feet tall by 1,610 feet long). One benefitted receptor is a residence hall which has fifty (50) bedrooms. None of the other impacted receptors would receive above the 5 decibel reduction with the 16 foot barrier. If every bedroom of the benefitted residence hall is occupied and counted as a benefitted receptor, the noise barrier is feasible as it is under the 1,500 SF per benefitted receptor threshold at 515 SF per benefitted receptor.

The 25 foot barrier totals 40,250 SF in size (25 feet tall by 1,610 feet long). Two of the benefitted receptors protected by this barrier are residence halls each with fifty (50) bedrooms. Additionally, two other benefitted receptors (a classroom building and a recreation area) would receive above the 5 decibel reduction with the 25 foot barrier. Therefore, if every bedroom in the benefitted residence halls is occupied and the additional two receptors are counted as benefitted, the noise barrier is feasible as it is under the 1,500 SF per benefitted receptor threshold at 395 SF per benefitted receptor.

Communication about the noise barrier with NHTI is currently ongoing with FHWA and NHDOT.

4.4.4 Conclusions

The following conclusions have been drawn from the noise analysis:

The I-89/Exit 1 Area Concept K along Carriage Road and I-93 yielded the potential for two modeled noise barrier options separated by Grandview Road, for a total of four separate potential barriers. Neither of the Carriage Road North and South Barriers were deemed cost effective (below the 1,500 SF per benefitted receptor threshold) at the optimized height (the height at or below 25 feet tall with sufficient decibel reduction). The Grandview North and South Barriers were modeled at several heights for optimization of sufficient reduction and cost effectiveness. However, while many receptors were considered benefitted, the 1,500 SF limit of barrier size per benefited receptor was not met. A separate barrier was modeled along the eastbound on-ramp to I-89 for the residence at 2 Logging Hill Road (Appendix B, Figure 16); however, the barrier exceeds the 1,500 SF per benefitted receptor threshold measure of cost effectiveness.

Modeling the Exit 12 Area alone was yielding inconclusive and widely varying noise results due to the small area the limits encompassed. Because of this, and in order to yield the most precise future models, the preferred concept for the Exit 12 Area, Concept F, was modeled with the Exit 13 Area, Concept B. Additionally, all of the receptors within the 500 foot buffer of the Exit 12 Area overlap the Exit 13 Area, which supports the validity of combining the two concepts. Therefore, once combined, these two areas allow a model with accurate and valid results. Impacts were not identified in the Exit 12 Area.

The Exit 13 Area (including the Exit 12 Area) did have receptors that approached or exceeded the noise abatement criteria (NAC) of 67.0 db(A), including receptors along Basin Street and Hall Street. However, noise barriers protecting these neighborhoods were not cost effective based on the 1,500 SF size limit per benefitted receptor. The Hall Street and Basin Street Barriers did not have the appropriate cost effectiveness with optimized barrier heights. 74 Basin Street, West Terrill Park (Healy Park) and the Common Man restaurant outside seating area were modeled with 16 feet barriers. Although the receptors were benefitted, they exceeded the 1,500 SF cost effectiveness.

In the I-93 Exit 14/15 Area impacted receptors were located on the south side of Fort Eddy Road. For Fort Eddy Road a barrier was modeled on the south side of Fort Eddy Road, adjacent to the receptors. However, it was not feasible to construct a barrier in this location due to space and access constraints. The barrier was then modeled on the north side of Fort Eddy Road at the maximum height for optimized noise reduction. However, due to the distance from the receptors, the barrier did not sufficiently reduce the noise from I-93. At Uno’s Outside Seating Area, Higgins Place, Kimball School of

Art, and Delta Drive Soccer Field a barrier would result in noise reductions but would exceed the cost effectiveness.

Residence Halls, sports complexes, and outdoor activity areas are associated with the NHTI Community College campus. At this time, FHWA and the NHDOT are in discussions with NHTI regarding a noise barrier that may be placed along I-93 from Delta Drive south to Fan Road. The barrier analysis resulted in the finding that a barrier between 16 and 25 feet tall is feasible and reasonable.

Out of fourteen modeled barriers, only one barrier (at two potential heights) meets the criteria set forth by FWHA and NHDOT for noise abatement. Both the 16 foot and 25 foot barriers in Exit 14/15 Area would be located along I-93 from Delta Drive south to Fan Road along the NHTI property. Communications with NHTI are on-going at this time.

Table 4.21 Measured, Existing, and Predicted Noise Levels

Noise Sensitive Area	Highest Leq in NSA/Neighborhood		Impact Y/N	Total Impacts 2035	Modeled Leq W/Barrier @ Same Receptor (2035)	Max. Insertion Loss In Neighborhood 2035	Accoust. Feasible or Reasonable
	2017	2035					
1A	67	68	Y	3			
1B	66	68	Y	2	62	9	Y
1C	76	75	y	42	61	13	Y
1D	70	72	Y	28	67	11	Y
1E	66	68	N	0			
2A	57	59	N	0			
2B	61	64	N	0			
2C	68	70	Y	5	67	8	Y
2D	67	71	N	NA			
2E	67	70	Y	26	61	11	Y
2F	67	73	Y	1	65	8	Y
2G	66	71	Y	6	66	5	Y
2H	70	73	Y	1	66	7	Y
3A	69	74	Y	1	66	9	Y
3B	63	66	Y	1	60	6	Y
3C	65	67	Y	1	62	7	Y
3D	64	66	Y	3	64	3	N
3E	69	71	Y	NA			
3F	68	70	Y	50+	68	7	Y
3G	68	72	Y	1	66	6	Y

Leq = the value of a steady sound level that contains the same amount of energy as the actual time-varying sound evaluated over the same period

NSA = Noise Sensitive Area (Neighborhood)

Insertion Loss = reduction in noise due to barriers

Table 4.22 Noise Barrier Analysis Results

Noise Sensitive Area	Barrier Name	Barrier Height Ave. (FT)	Barrier Length (FT)	Barrier Area (SF)	No. Benefitted Receptors	Barrier Area Per Benefitted Receptor (SF)	Effective? (Reasonable)
1A				0			
1B	Grandview Road North	20	2,723	54,460	12	4,538	N
1B	Logging Hill Road	16	713	11,408	2	5,704	N
1C	Grandview Road South	20	4,972	99,440	12	8,287	N
1D	Carriage Road North	25	1,962	49,050	6	8,175	N
1D	Carriage Road South	25	4,758	118,950	7	16,993	N
1E	NA						
2A	NA						
2B	NA						
2C	Basin Street Barrier	14	1,806	25,284	14	1,806	N
2D	NA						
2E	Hall Street Barrier	14	2,997	41,958	9	4,662	N
2F	74 Basin Street Barrrier	16	1,012	16,192	1	16,192	N
2G	West Terrill Park Barrier	16	980	15,680	6	2,613	N
2H	Common Man Barrier	16	829	13,264	1	13,264	N
3A	Uno's Outside Barrier	16	720	11,520	1	11,520	N
3B	Kimball Jenkins Barrier	25	531	13,275	1	13,275	N
3C	Higgins Place Barrier	25	480	12,000	4	3,000	N
3D	NA						
3E	NA						
3F	NHTI Barrier 16'	16	1,610	25,760	50	515	Y
3F	NHTI Barrier 25'	25	1,610	40,250	102+	395	Y
3G	Delta Dental Field Barrier	16	373	5,968	1	5,968	N

4.5 Water Resources

4.5.1 Groundwater Resources

This section presents an analysis of potential impacts to the groundwater resources within the project area associated with the proposed project. The groundwater resources located within the project area include an aquifer and public water supply wells. Some of the public water supply wells have Wellhead Protection Areas (WHPAs). Increased impervious area represents a concern as it may reduce or restrict the amount of rainfall that is able to recharge the groundwater.

As discussed in Section 3.5.1.1, the majority of the project area is underlain by an aquifer with relatively low transmissivity of 0-1,000 square feet per day.

The No Build Alternative would not result in a change in the amount of existing impervious surface. The preferred alternative would result in approximately 24 acres of new impervious surface. Considering the densely developed nature of the project area, this increase in impervious surface is not expected to have a significant impact on aquifers.

Spills of oil, gas or other hazardous materials could also affect local aquifers. The widened highway and reconfiguration of the interchanges should result in safer driving conditions, reducing the chances of spills from vehicular crashes. Finally, most highway runoff would be captured in stormwater BMP areas, which should facilitate cleanup of any spills.

4.5.1.1 Mitigation

Stormwater BMP areas would be incorporated into the drainage design to capture and treat stormwater runoff prior to discharge. Stormwater treatment is addressed in further detail in Section 4.5.2.

4.5.2 Surface Waters

Potential impacts to surface water resources associated with infrastructure improvements are generally due to changes in the amount and intensity of highway runoff which conveys sediment and pollutants from the roadway surface to receiving waters. It is expected that projects that increase the amount of pavement also increase the amount of stormwater runoff. Unmitigated, this increased stormwater runoff would carry increased amounts of sediment and pollutants to receiving waters as well as increase the potential for erosion within existing waterways. Stormwater BMPs can be employed to remove sediment and pollutants from stormwater and also mitigate peak flow rates through detention and retention of the stormwater. This analysis outlines the BMPs necessary to minimize potential impacts to surface water resources associated with the preferred alternative.

4.5.2.1 Regulatory Framework

In accordance with the New Hampshire Department of Environmental Services (NHDES) Alteration of Terrain (AOT) Administrative Rules Env-Wq 1500, activities that result in terrain alteration shall not cause or contribute to any violations of the surface water quality standards established in Env-Wq 1700. These rules apply when the project area is more than 100,000 ft^2 of land (or more than 50,000 ft^2 if within a protected shoreland) or any land with a grade of 25% or greater within 50 feet of a surface water. Per a Permit Exemption signed by NHDES and NHDOT in 2011, NHDOT projects are not required to obtain an AOT Permit but must still comply with AOT regulations.

4.5.2.2 Receiving Waterways

The study area is located entirely within the Merrimack River watershed, meaning that all of the stormwater runoff along the roadways within the study area ultimately ends up in the Merrimack River. Overall, the watershed area of the Merrimack River is approximately 2,400 square miles where it flows adjacent to the east side of the project area. Within this larger watershed are sub-watersheds which include the Turkey River, Bow Brook, the South End Marsh/NHDOT Mitigation Wetland, Fort Eddy Pond, and Wattanummon Brook (the outlet stream from Horseshoe Pond). These watersheds are smaller than the Merrimack River but are still comprised of at least a few square miles each.

4.5.3 Water Quality Analysis

As previously mentioned, since the preferred alternative would be increasing the amount of pavement by approximately 24 acres, the amount of sediment and pollutants generated within the project limits would be increasing as well. To mitigate this, stormwater BMPs must be employed to remove these sediments and pollutants before they reach any of the receiving waterways. Typical BMPs include ponds, wetlands, infiltration practices, or filtering practices. The selection of BMPs is dependent on many factors such as size of the catchment area, existing soils type, and groundwater elevation. The selection of specific types of BMPs to be utilized on projects would be done during final design.

Each type of BMP removes pollutants from stormwater differently and therefore, has different removal efficiencies for total suspended solids, nitrogen, and phosphorus. BMP removal efficiency rates are published in the New Hampshire Stormwater Manual published by NHDES. In general, stormwater BMPs can remove on average 80% of total suspended solids, 50% of total nitrogen, and 50% of total phosphorus from stormwater, with total suspended solids, total nitrogen, and total phosphorus being the key indicators of pollutants related to stormwater. Therefore, to estimate that the amount of pollutants to receiving surface waters is not increased, roughly twice the amount of new pavement area resulting from the preferred alternative would need to be directed to stormwater BMPs to receive treatment to mitigate any increase in the amount of sediment, total nitrogen and total phosphorus entering receiving waterways. Overall, the preferred alternative would be increasing the amount of pavement by approximately 24 acres which is distributed within the four project segments as the following:

- Six additional acres in the I-89 Exit 1 Area;
- Three additional acres near Exit 12;
- Seven additional acres near Exit 13; and
- Eight additional acres in the Exit 14 and 15 Area.

Therefore, the project action would direct approximately 48 acres of pavement to stormwater treatment within the study area so as not to impact water quality.

It is important to note that two areas of existing pavement within the study area are already directed to existing stormwater BMPs (gravels wetlands). These BMPs were constructed when the bridges that carries I-93 over I-89 were reconstructed. These gravel wetlands currently treat 5.6 acres of stormwater. The approximately 48 acres of pavement that would need to be directed to new stormwater BMPs is in addition to the pavement areas that are already receiving treatment.

Ideally, stormwater treatment would be provided at every stormwater outfall location within the project area anywhere new pavement is being added. This would be the goal as the design of the project progresses, but there are many places within the project area where this would not be possible. The largest area where stormwater treatment would not be possible would be between Exit 13 and Exit 14 on I-93. The existing roadway constructed in the 1950's is directly adjacent to wetlands and the Merrimack River where there are not any suitable locations available to construct a stormwater BMP to provide water quality treatment. Therefore, water quality treatment would be maximized in other areas where it can be provided, such that stormwater runoff from at least 48 acres of pavement would receive water quality treatment within the project area, thereby satisfying the treatment goal for the project.

Fifteen potential stormwater BMP locations have been identified within the project area that could provide stormwater treatment for over 87 acres of pavement if all 15 locations are constructed. These potential BMP locations would be further evaluated during final to determine their feasibility, size and treatment capacity. These potential BMP locations are shown on the **Figures 4.2-1 through 4.2-8 Environmental Consequences.**

It is likely that not all 15 locations would be included in final design as some are outside of the existing right-of-way (ROW) and contain design challenges such as the presence of wetlands and existing surface or subsurface contamination. **Table 4.23 Potential Stormwater BMPs** summarizing the 15 potential BMP locations, the sub-watershed, the amount of impervious area that could be treated at each location, their purpose, if they are within the existing right-of-way (ROW), and if the BMP would impact a wetland.

Table 4.23 Potential Stormwater BMPs

Basin #	Watershed	Size of Treatment Area (Ac.)	BMP Purpose	Within ROW	Within a Wetland
1	Turkey River	2.0	Detention & Treatment	No	No
2	Turkey River	1.5	Detention & Treatment	Yes	No
3	Turkey River	1.5	Treatment Only	Yes	No
4	Bow Brook	1.7	Detention & Treatment	Yes	No
5	Turkey River	2.0	Treatment Only	Yes	No
6	Turkey River	12.1	Detention & Treatment	Yes	Yes
7	South End Marsh	5.8	Detention & Treatment	Yes	No
8	Mitigation Pond	5.6	Detention & Treatment	Yes	No
9	Mitigation Pond	4.0	Detention & Treatment	No	No
10	Merrimack River	12.6	Treatment Only	No	No
11	Merrimack River	4.5	Treatment Only	Yes	No
12	Merrimack River	6.1	Treatment Only	Yes	No
13	Fort Eddy Pond	23.5	Detention & Treatment	No	No
14	Merrimack River	2.2	Treatment Only	Yes	No
15	Wattanummon Brook	2.3	Detention & Treatment	No	No

The proposed project is committed to treating stormwater runoff that would be added as result of the project to mitigate any impacts to the water quality of receiving waterways.

4.5.4 Water Quantity Analysis

Additional pavement not only results in additional sediment and pollutants, but it also increases the quantity and intensity of stormwater overall. Increasing the quantity and intensity of stormwater can cause erosion in the receiving waterway and could also increase the flow in waterways to a point where the capacity of downstream structures, such as culverts and bridges, is exceeded causing damage. To mitigate these impacts, stormwater BMPs would be designed to detain peak stormwater flows (50-year storm event) to be at or below existing levels so that new erosion would not occur and peak stormwater rates at downstream structures would be maintained.

On the other hand, stormwater detention is typically not necessary when stormwater is discharged directly to a large receiving waterbody. This is due to the fact that the peak stormwater flow rates from the project area are typically well below the peak flow rate of the larger receiving waterway and the time of the peak flow from the project site occurs well before the peak flow rate would occur in the receiving waterbody. A general rule is projects can discharge directly to streams, rivers, and ponds without the need for detention if the receiving waterbody has a watershed area of at least 10 square miles. This would be the case for the Merrimack River and the Turkey River.

Of the 15 potential stormwater BMP locations, nine of these potential locations are needed to provide stormwater detention to limit the peak rate of discharge from the project area to existing levels. It is important to note that stormwater BMPs can be designed to provide water quality treatment as well stormwater detention.

4.5.5 Water Supply Areas

In areas where stormwater is discharged near drinking water wells, additional measures would need to be employed to avoid having pollutants from stormwater impact the quality of the drinking water supply. These additional measures are described in *NHDES' Recommendations for Implementing Groundwater Protection Measures when Siting or Improving Roadway* and could include increased distances between the bottom of the BMP and the groundwater table or installing liners to limit the amount of stormwater that can enter the groundwater. As the design of the project progresses, these measures would be employed where needed to comply with the recommendations set forth in NHDES Stormwater Manual.

4.5.6 Chloride Loading

As a result of increasing the number of travel lanes and auxiliary lanes within the project area under the preferred alternative, additional chloride would be generated due to the increased deicing applications required for winter maintenance. The No-Build alternative would not add any additional lane miles and would maintain the existing 41.7 lane miles. The preferred alternative would add 13.1 lane miles for a total of 54.8 lane miles.

Existing salt application rates were obtained over a ten-year period (2008-2017) from the NHDOT for the Merrimack maintenance facility that covers a portion of the turnpike. Based on this information road salt is applied at an average annual rate of 21.4 tons per lane mile per year. Using this application rate, the No-Build alternative would maintain an average quantity of road salt of 892.4 tons per year. The preferred alternative would increase the amount of road salt to 1,172.7 tons per year, or an additional 280.3 tons per year. **Table 4.24 Existing and Proposed Salt Application Load** provides a summary of the information.

Table 4.24 Existing and Proposed Salt Application Load

Project Segment	Existing Lane Miles	Existing Salt Load (Tons)	Proposed Lane Miles	Proposed Salt Load (Tons)	Net Increase in Lane Miles	Net Increase in Salt Load (Tons)
Interstate 93 Northbound	15.5	331.7	22.2	475.1	6.7	143.4
Interstate 93 Southbound	16.0	342.4	22.9	490.1	6.9	147.7
Interstate 89 Northbound	2.5	53.5	1.3	27.8	-1.2	-25.7
Interstate 89 Southbound	2.0	42.8	1.7	36.4	-0.3	-6.4
Interstate 393 Eastbound	2.2	47.1	2.3	49.2	0.1	2.1
Interstate 393 Westbound	2.2	47.1	2.3	49.2	0.1	2.1
New NH 3A to South St. Connector			0.8	17.1	0.8	17.1
Loudon Road	1.3	27.8	1.3	27.8	0	0
Totals		892.4		1,172.7		280.3

NHDOT currently employs measures to limit the amount of road salt utilized by performing salt use accounting at storage areas, pre-wetting pavement with brine, remote weather station monitoring, guidelines for application rates, spreading unit calibration, salt truck driver training, improved storage practices such as covering piles, and public outreach, such as variable message boards. Utilizing low salt zones within the project area is not feasible as the traffic volumes exceed NHDOT guidelines for the use of that practice. NHDOT would continue to explore options and methods that reduce the amount of road salt applied balanced with the needs of winter roadway maintenance.

4.6 Floodplain Impacts

The evaluation of floodplain impacts utilized information derived from the Federal Emergency Management Agency (FEMA) mapping for the project area, described in Chapter 3. The floodplain and floodway data were overlaid onto the footprint of the proposed preferred alternative and impacts were assessed. The Merrimack River and Turkey River are the only waterbodies in the project areas that have FEMA mapped 100-year floodplain and associated regulatory floodway (refer to Figure 3.13).

Based upon preliminary design, the proposed preferred alternative would result in temporary impacts to the 100-year floodplain and floodway necessary for the construction of retaining walls and bridge abutments. These temporary impacts would occur between I-93 and the Merrimack River south of Loudon Road and at along the Turkey River, where no bridges are proposed. Permanent impacts to floodplains or floodways are not anticipated, however, further analysis would be conducted during final design.

4.6.1 Mitigation

During final design, floodplain and floodway impacts would be further evaluated to assess the potential for permanent impacts as well as temporary. If permanent impacts are realized, mitigation measures would be incorporated and coordination in consultation with regulatory agencies. Impacts to floodplains would be minimized to the extent practicable.

4.6.2 Floodplain Finding

All projects potentially impacting floodplains require an evaluation under Executive Order 11988, *Floodplain Management* (May 24, 1977). The regulation that sets forth the policy and procedures of this order is entitled *Floodplain Management and Protection of Wetlands* (44 CFR Part 9), which is under the authority of FEMA. FHWA policies and procedures also cover the impact of projects on floodplains and floodways, and are found in *Location and Hydraulic Design of Encroachments on Floodplains* (23 CFR 650A).

The proposed project has been evaluated with respect to its effect on floodplains, practicable alternatives to such impacts and practicable mitigation measures as required under the provisions of Executive Order 11988 and 23 CFR 650A.

The proposed preferred alternative would involve encroachments on the 100-year floodplain and regulatory floodway of the Merrimack River and Turkey River. Based upon preliminary design, the proposed project would result in temporary impacts (ground disturbance during construction) to 100-year floodplain and regulatory floodway. Permanent impacts within the 100-year floodplain and regulatory floodway have been avoided by ensuring that all bridge work and the culvert extension proposed at Bow Brook provide the same or greater hydraulic openings. The proposed stormwater BMP areas along the highway would also provide additional flood storage for 50-year storms.

Based on the above considerations, FHWA will review the project to determine that there is no practicable alternative to the proposed construction in floodplains and the proposed preferred alternative includes all practicable measures to minimize impacts to floodplains. The agency's finding will be included in the Revised Environmental Assessment.

4.7 Wetland and Waterway Impacts

4.7.1 Wetland Impact

NEPA, Section 404 of the Clean Water Act, and Executive Order 11990 require consideration of impacts to wetlands and other Waters of the U.S., including direct impacts and impacts to functions and values. Other impacts considered include habitat fragmentation, the effects of runoff (erosion, sedimentation, flooding), other hydrologic modifications, and temporary disturbances associated with construction that may adversely affect wetland functioning.

As described in Section 3.5.2, a functional assessment of wetlands within the project area was performed in the field and office using the U.S. ACOE Highway Methodology (refer to Table 3.13)**.**

A total of 29 individual wetland areas were identified within the project area. Of these 29 wetland areas, eight would be impacted directly by the proposed preferred alternative, with one additional wetland area possibly impacted with a potential stormwater BMP. Impacts to these resource areas are described in the following sections. Compensatory mitigation to offset these proposed project impacts is also discussed.

4.7.2 Wetland Impact Analysis Methodology

The areas of wetland impacts were determined by measuring the wetland area to be permanently cut or filled. Project slope lines were overlaid with delineated wetland boundaries, and the total amount of permanent wetland impact or fill was determined for each wetland area.

4.7.3 Wetland Impact Analysis Results

Direct wetland impacts, i.e., the loss of wetland acreage due to proposed grading and other earthwork, totals 1.6 acres of palustrine wetlands (not including an additional 1.5 acres of potential wetland impact from one potential stormwater BMP.

Wetland impacts are summarized in **Table 4.25 Wetland Impact Areas**. Impacts to wetland functions and values are summarized in **Table 4-26 Wetland Function and Value Impacts**. Wetland impacts are shown in **Figures 4.2-2 through 4.2-8**.

Table 4.25 Wetland Impact Areas (approximate)

Wetland ID	Project Segment	Cowardin Classification	Impacts (square feet)	Impacts (acres)
C	Concept K	PEM1E	20,000	0.5
D	Concept K	R4SB2/PFO1E	7,500	0.2
P	Concept K	PFO1E	6,000	0.1
S	Concept F	PFO/SS1E	18,000	0.4
U	Concept F	PFO1E	4,000	0.02
V	Concept F	PEM1E	8,000	0.09
AA	Concept F2	PEM1E	16,000	0.4
GG	Concept F2	R3UBH	100	0.002
Total			**79,600**	**1.8**
H (Potential Impact)	Concept K	PEM1E	(69,696)	1.6
Total (Potential)			149,296	3.4

Table 4.26 Wetland Function and Value Impacts

Wetland ID	Impacts (ac)	Wetland Functions and Values												
		Groundwater Recharge/ Discharge	Floodflow Alteration	Fish and Shellfish Habitat	Sediment/ Toxicant Retention	Nutrient Removal/ Retention/ Transfer	Production/ Export	Sediment/ Shoreline Stabilization	Wildlife Habitat	Recreation	Education/ Scientific	Uniqueness/ Heritage	Visual Quality/ Aesthetics	Endangered Species
C	0.4				X	X			X					
D	0.2	X						X	X					
P	0.1	X	X	X			X	X	X					
S	0.4	X	X		X				X					
U	0.02				X				X					
V	0.09	X	X		X									
AA	0.4				X									
GG	0.002	X	X	X		X	X	X	X	X	X		X	
H	1.6								X					

Notes:

X – The function and value is present and impacted

Many of the wetland systems in the vicinity of the proposed project have already been impacted in some way by the original construction of the existing highway and interchanges. Most of the proposed wetland impacts are located along the edge of wetland systems that have experienced prior disturbance and modifications.

Indirect impacts to wetland systems can also result from highway construction. For example, hydrological changes can occur in wetland systems from drainage modifications and/or grading changes. Tree clearing can reduce forested habitat and remove or thin the forest overstory, thereby eliminating shading of wetlands or streams. This has the potential to increase water temperature and have an adverse effect on the ecological community. Increased sedimentation and pollution has the potential to adversely affect water quality in wetlands and streams if stormwater treatment BMPs are inadequate or not maintained.

The results of the wetland functional analysis demonstrate that most of the wetland systems that would be impacted by the proposed project serve to provide groundwater recharge/discharge, reduce flooding, retain sediment and toxicants, retain and remove nutrients, provide ecosystem production/export, and provide wildlife habitat. Direct wetland impacts would have some effect on the functions and values of the overall wetland systems. However, as previously discussed, most of the wetland impacts resulting from the proposed highway reconstruction are located along the edge of wetland systems previously impacted by the highways original construction. In most cases the area of impacts constitutes a relatively small percentage of the overall wetland acreage. Therefore, it is assumed that the incremental impacts would not result in the elimination of functions and values of the remaining wetland areas.

4.7.4 New Hampshire Prime Wetland Impacts

Prime Wetlands are areas designated by municipalities and NHDES that are given a higher level of regulatory protection through the State wetland process than non-designated wetland areas. As discussed in Section 3.5.4.2, the Town of Bow has designated Prime Wetlands; however, no Prime Wetlands are located in the vicinity of the project. The City of Concord has not designated any wetlands as Prime Wetlands.

4.7.5 Waterway Impacts

Waterways within the project area are also regulated and subject to the regulations discussed above that apply to wetlands. Temporary impacts during construction are anticipated to occur for the construction of retaining walls and bridge abutments along a portion of the Merrimack River and Turkey River. Temporary impacts to the Turkey River are anticipated for the construction of the new bridges. The proposed culvert extension, currently under I-93 that conveys Bow Brook, is anticipated to induce both permanent and temporary impacts to Bow Brook. These impacts would be coordinated with the regulatory agencies and the Bow and Concord Conservation Commissions throughout the final design process and permitting.

4.7.6 Compensatory Wetland (and Waterway) Mitigation

Mitigation for wetland impacts followed a sequential approach of 1) avoidance, 2) minimization, and 3) compensation. Avoidance measures were taken early in the design process. High quality and noteworthy wetlands were identified based on a variety of factors including size, functions and values, and potential for rare species habitat. Preliminary project slope lines were overlaid on delineated wetland mapping and areas were identified where impacts could be avoided or minimized by adjusting slope lines.

Compensation would be required for any permanent impacts to wetlands, channels and banks. As impacts are refined in final design, a proposed mitigation package would be developed through coordination with regulatory agencies, Bow and Concord Conservation Commissions, and other interested parties as appropriate.

4.7.6.1 Land Preservation

During final design, coordination with the Bow and Concord Conservation Commissions would be conducted to determine if land was available and desired for preservation. A desktop review of vacant land in the area was conducted to determine potentially suitable sites for preservation. One site immediately adjacent to the project corridor appears to have good habitat and conservation value and good wetland mitigation value. This site is located adjacent to the South End Marsh, a local conservation land and borders I-93, however, the parcel is separated from the South End Marsh by the Pan Am Railroad. It contains a mixture of upland forest, palustrine emergent and forested wetland and potential habitat for rare species. The proximity to the conservation area, as well as the proposed project area and associated impacts, and potential rare species habitat give this parcel high value as a potential mitigation site.

4.7.6.2 In-Lieu Fee

The NHDES established the Aquatic Resource Compensatory Mitigation (ARM) Fund in 2006 to provide an additional compensatory mitigation option available to applicants for impacts to wetlands and other aquatic resources. In-lieu fee payment is the U.S. Army Corps of Engineers preferred mitigation alternative, and the most common form of mitigation. The NHDES ARM Fund wetland payment amounts will be calculated for all palustrine wetland and stream channel impacts associated with the preferred alternative. The appropriate in-lieu fee will be arrived at based on the mitigation package agreed to in consultation with the ACOE, NHDES, Bow and Concord Conservation Commissions and other resource agencies as applicable.

4.7.7 Wetland Finding

The FHWA will review the social, economic, and environmental information contained in this document and the preceding summary to determine if (1) there is no practicable alternative to such construction and (2) that the construction of the proposed project contains all practicable measures to minimize harm to wetlands which may result from such use. The FHWA's finding will be included in the Revised Environmental assessment.

4.8 Land Resources

4.8.1 Farmlands

The majority of the proposed project is located within the Concord, NH Urban Cluster 2010 U.S. Census Bureau determination. However, areas of prime farmland are located in the vicinity of the project as discussed in Section 3.6.2 and shown on Figure 3.17. Impacts to these farmland areas are not anticipated to occur.

4.8.2 Conservation Lands

4.8.2.1 Impact Analysis Methodology

The New Hampshire Conservation/Public Lands GIS data layer was downloaded from NH Granit and the proposed project slope lines and clearing limits were overlaid on top of this layer to determine project impacts to conservations lands. Noise wall locations and stormwater BMP areas were also reviewed for impacts to conservation lands. The following programs were contacted regarding the location of conservation lands within or near the project area: Land and Community Heritage Investment Program (LCHIP); Conservation Land Stewardship (CLS) Program; Land and Water Conservation Fund (LWCF). (Appendix B, Exhibit 3)

4.8.2.2 Impact Analysis Results

In the I-89/Exit 1 Area the State of New Hampshire owns the Cilley State Forest that borders I-89 and the interchange with South Street/Logging Hill Road. The land consists of vacant forested lands under fee ownership with the State of New Hampshire. All three concepts (C, K and P) were presented to the NH Department of Conservation and Natural Resources (DCNR) as part of the consultation process. Concept K, the preferred alternative would impact approximately 0.7 acres of the Cilley State Forest. Concepts C and P proposed a larger impact estimated at up to 10 acres. In correspondence dated June 22, 2018, the DCNR is in agreement of the impact and the proposed mitigation for Concept K. The work would not adversely affect the Cilley State Forest conservation land.

4.8.2.3 Mitigation

Mitigation is proposed to take the form of a land swap with similar land owned by the NHDOT that is adjacent to the impacted area of the Cilley State Forest. Coordination with DCNR will continue throughout final design. (Appendix B, Exhibit 4)

The Cilley State Forest is not regulated under Section 4(f) of the U.S. Department of Transportation Act and not regulated under Section 6(f) of the Land and Water

Conservation Fund Act. Therefore, the proposed impact would not require a Section 4(f) or Section 6(f) evaluations.

4.8.3 Section 4(f) Properties

Resources afforded protection under Section 4(f) were identified through coordination with the NH State Historic Preservation Office (SHPO) and Federal Highway Administration (FHWA), as well as local organizations, local officials, and the public. Section 4(f) resources in the project area consist of properties eligible for the National Register of Historic Places and publicly owned recreation areas. There are no wildlife or waterfowl refuges in the project area.

The project area contains two publicly owned recreation trails and twelve historic sites located in three of the four project segments. Historic properties within and adjacent to the project area consist of nine residential and commercial buildings and three historic districts. All are eligible for listing on the National Register. Each property is described in detail in inventory forms that are on file at the SHPO and NHDOT.

Chapter 5 Section 4(f) Evaluation presents the properties and the impacts in detail. Refer to **Table 5.2 Section 4(f) Impacts from Proposed Alternative** and **Figure 5.1 Section 4(f) Resources Overview** as well as **Figures 5.2 to 5.10** for details on each 4(f) resource.

4.8.4 Section 6(f) Properties

The proposed preferred alternative would not affect any Section 6(f) properties, those which have received Land and Water Conservation Fund funding. There are no Section 6(f) properties within the project study area. (Appendix B, Exhibit 3)

4.9 Wildlife

4.9.1 Short-Term and Long-Term Impacts

Highway construction can have both short-term and long-term impacts on wildlife habitats and populations. Short-term impacts can result from disturbance caused by construction activities including increased noise levels, visual disturbances, tree clearing, earth disturbance, machinery, and the presence of humans. Long-term impacts related to highway construction can include permanent habitat loss. New highway construction on a new location can result in increased fragmentation and a loss of habitat connectivity. The proposed project is located within an existing highway corridor and the surrounding habitats have already been fragmented by the original construction of the highway and surrounding development.

4.9.1.1 Direct Mortality

Direct mortality due to construction impacts would potentially occur for fossorial (burrowing) mammals, reptiles, and amphibians, as well as breeding animals and their young, whose nests or dens may be destroyed by tree clearing and other construction activities. More mobile individuals and species would likely relocate to other habitats when disturbed by construction. These individuals may find habitat that has sufficient food and cover, assuming the adjacent habitats are not already at carrying capacity. Animals that are forced to relocate that are unable to find food or cover may fail to successfully breed, and eventually perish.

4.9.1.2 Tree Clearing

The areas of proposed tree clearing are depicted on **Figures 4.2-1 through 4.2-8**. The proposed project would require approximately 38 acres of tree clearing associated with proposed roadway widening, reconfiguration of interchanges, associated grading. The tree clearing required to construct all 15 of the potential stormwater BMP areas is estimated at 1.3 acres. In total, if all 15 stormwater BMPs are constructed, 39.3 acres of tree clearing would occur throughout the 4.5-mile project corridor.

Tree clearing associated with the project would typically remove trees and brush located immediately adjacent to the existing highway corridor. These forested habitats are typically edge habitats that have been disturbed by prior tree clearing associated with highway construction and maintenance. These areas are also exposed to higher levels of noise and disturbance given their proximity to the highway. The construction of stormwater BMP areas typically requires the clearing of larger, more contiguous patches of wooded areas. There are a total of 15 potential BMP areas proposed. It is anticipated that not all 15 would be viable and incorporated into final design. Many of these BMP areas are located entirely in highway right of way that have already been cleared.

Tree clearing may affect wildlife populations in several ways.

Noise and Disturbance – Animal species living in proximity to the existing highway habituate to the elevated levels of noise; however, construction activities could result in elevated noise levels as well as sudden loud noises that could potentially disturb wildlife.

Home Range Impacts – Animals with relatively small home range sizes such as amphibians, reptiles, and small mammals have a greater potential for impacts from the proposed highway widening. Medium-sized to large mammals generally have larger home ranges, and impacts would likely be less severe, given the larger area and their ability to move to other nearby habitats.

Wildlife-Vehicle Collisions – Increasing the number of lanes can lead to increased wildlife mortality due to potential collisions with vehicles as animals attempt to cross a wider highway.

Travel Corridors – Riparian corridors along streams and other waterbodies are important wildlife habitats and are often used as travel corridors. The project design has retained as much of the existing riparian corridors as possible by avoiding and minimizing impacts.

4.9.2 Highest Ranked Wildlife Habitat Impacts

The 2015 New Hampshire Wildlife Action Plan Highest Ranked Wildlife Habitat GIS data layer was overlaid with the proposed project slope limits and tree clearing limits to determine impacts to ranked wildlife habitats.

The proposed project would result in approximately 1.5 acres of impact to areas of Supporting Landscapes. The Supporting Landscapes impacted are located along the Merrimack River (south of Loudon Road) in Concord and near the Turkey River and Cilley State Forest in Bow. Impacts to Highest Ranked Wildlife Habitat and Highest Ranked Habitat in the Biological Region are not anticipated to occur. The total area of impacts to Wildlife Action Plan Ranked Wildlife Habitats is estimated at 1.5 acres.

4.9.3 Indirect Impacts

Indirect impacts to wildlife and wildlife habitats could include increased noise levels associated with the additional travel lanes. This increased disturbance could displace some animals currently living in the vicinity of the project area. Tree clearing would result in some habitat loss, particularly of the edge habitat along the existing highway corridor. While not high-quality habitat given its proximity to the existing highway and surrounding development, this habitat is important for some species. The proposed project would increase the width of the existing roadway by a lane in both the northbound and southbound direction. This additional distance created by the addition of two travel lanes could make wildlife crossing more difficult and possibly less successful, leading to increased wildlife-vehicle collisions or further isolating populations. Construction of proposed noise wall could also create barriers to wildlife passage, although the noise wall would be placed between the highway and the NHTI campus, where habitat value is limited.

4.9.4 Mitigation

There are no formal mitigation measures proposed for wildlife impacts associated with the proposed project. However, during final design, additional agency consultation would be conducted and measures may be incorporated to improve, enhance or preserve habitat and wildlife corridors along stream crossing.

4.10 Fisheries

4.10.1 Impacts to Fish Habitat

Direct impacts to fisheries resources may result from construction that places fill material, either temporary or permanent, in waterbodies or waterways and results in the loss of habitat. Highway construction can result in additional direct and indirect impacts including: stream channelization, loss of bank structural complexity, loss of stream flow complexity, shading from bridges or loss of shading from tree clearing, changes in water temperature, alterations in hydrology, and reduction of water quality from highway runoff.

Impacts to fisheries and other aquatic life were quantified by calculating the length of the proposed channel impacts, as well as comparing the existing and proposed structures at the locations of stream crossings.

4.10.2 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to conduct an EFH consultation with the National Marine Fisheries Service (NMFS) regarding any of their actions that may adversely affect EFH. An EFH Assessment Worksheet was completed for the project and concluded that any adverse effect on EFH would not be substantial. Therefore, an abbreviated consultation was requested with NMFS. The results of that consultation, including any conservation recommendations, will be provided in the Revised Environmental Assessment.

A total of three waterbodies in the project area that have been designated as EFH for Atlantic Salmon for all life cycle stages (eggs, larvae, juveniles, and adults). These include the Merrimack River, Turkey River, and Bow Brook.

There would be approximately 1,800 linear feet of temporary channel impacts in the Merrimack River, on the east side of I-93, south of Loudon Road. Cofferdams would likely have to be installed during the construction of a retaining wall. These impacts would be confined to the western edge of the Merrimack River. The majority of the channel would remain open and would not be impacted during construction.

4.10.3 Mitigation

There are no formal mitigation measures proposed for impacts to fisheries associated with the proposed project. However, prior to the publishing of the Revised EA additional agency consultation will be conducted. The results of the consultation will be included in the Revised EA. Measures may be incorporated during final design to improve, enhance or preserve habitat and wildlife corridors along stream crossing.

4.11 Threatened and Endangered Species

4.11.1 Plants

4.11.1.1 Federally Threatened and Endangered Plant Species

Small Whorled Pogonia (*Isotria medeoloides*)

According to the NH Natural Heritage Bureau document, Rare Plants, Rare Animals, and Exemplary natural Communities in New Hampshire Towns (July 2013), the Exit 1/I-89 Area may include occurrences of small whorled pogonia. This species most often occurs in hemlock-beech-oak pine forest and tends to prefer mesic/seasonally damp soils. A site inspection was conducted in June 2018 by NHB staff that resulted in the finding that it is not anticipated that the small whorled pogonia would impacted by the project. (Appendix B, Exhibit 5)

4.11.1.2 State Rare, Threatened and Endangered Plant Species

There are no known occurrences of state listed rare, threatened, or endangered species identified by the NH Natural Heritage Bureau.

4.11.1.3 New Hampshire Exemplary Natural Communities

Silver Maple – False Nettle – Sensitive Fern Floodplain Forest

The Silver Maple – False Nettle – Sensitive Fern Floodplain Forest is located along the Merrimack River near the northern end of the project area. A portion of this exemplary natural community is located adjacent to the project area, east of I-93 and south of the I-93 crossing over the Merrimack River at the northern project terminus. Only a small amount of slope work is proposed in this area, and this would not result in an adverse impact to this natural community. (Appendix B, Exhibit 6)

4.11.2 Wildlife

4.11.2.1 Federally Threatened and Endangered Wildlife Species

Northern Long-Eared Bat (*Myotis septentrionalis*)

Northern long-eared bats may occur in forested habitat throughout New Hampshire and may additionally use bridges for roosting. The project proposes clearing 39.3 acres of trees for road widening, construction of noise walls, and construction of stormwater BMP areas.

The Natural Heritage Bureau did not report any known winter hibernacula or maternity roost trees in the vicinity of the project. NH Fish & Game also has not indicated that known hibernacula or maternity roost trees exist in the vicinity of the project. An acoustic survey was completed in the summer of 2017 to assess the likelihood that northern long-eared bat is present in the project area. The survey resulted in no acoustic files manually identified as northern long-eared bat; therefore, the presence of this species is not considered probable.

FHWA is among the Federal transportation agencies that have entered into a programmatic consultation with U.S. Fish and Wildlife Service to streamline the Endangered Species Act consultation process and promote better conservation outcomes for rare bat species. The *Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat (*Version 3, May 2016) and was developed from the *Revised Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat* issued in 2016.

Based on the results of the acoustic survey, northern long-eared bat is considered absent from the project area; therefore, the project would result in a finding of “may affect - not likely to adversely affect” (NLAA). The project adheres to the criteria and conditions of the *Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat (*Version 3, May 2016). (Appendix B, Exhibit 7)

Coordination with USFWS would continue throughout final design to ensure compliance with applicable laws and agreements.

4.11.2.2 State Rare, Threatened, Endangered, and Special Concern Wildlife Species

A meeting with NH Fish & Game was held on May 8, 2018 to discuss any potential concerns with State-listed wildlife species. The results of this coordination are incorporated below for each species of concern.

Brook floater mussel (*Alasmidonta varicosa*)

The brook floater a NH-listed Endangered species, is known to occur in the Merrimack River in the vicinity of the project area. A retaining wall is proposed along the Merrimack River, south of Exit 14. Construction of this wall would likely require work in the channel (temporary impacts) of the Merrimack River. Additional coordination with NH Fish & Game will be required, including possible surveys to identify and/or relocate brook floaters from the proposed impact area. Appropriate soil erosion and sediment control practices would be implemented during construction to minimize introduction of sediment into downstream waterways, including the Merrimack River.

American eel (*Anguilla rostrata*)

American eel, a NH-listed species of Special Concern, has been documented in the Merrimack River watershed including the Merrimack River and Turkey River. During construction, American eels would likely temporarily relocate within the watercourses where work is to be performed. Cofferdams or other standard stream diversion methods would be utilized during construction to maintain stream flows. In addition, all replacement bridges and culverts would be designed in accordance with USACE guidelines to maintain aquatic life passage. Further coordination with the NHFG regarding additional avoidance and minimization measures will be conducted during the permitting process. As a result, impacts to American eel are not anticipated from the proposed project.

Bald eagle (*Haliaeetus leucocephalus*)

Bald Eagle, a NH-listed Threatened species, and is legally protected in New Hampshire. Wintering bald eagles have been documented along the Merrimack River. There are no known bald eagle nests located within 660 feet of the project site. Based on current USFWS bald eagle management guidelines, the project would not “disturb" or otherwise agitate or bother a bald eagle to a degree that it causes or is likely to cause injury to a bald eagle, a decrease in its productivity, or nest abandonment, based on the best scientific information available.

Spotted turtle (*Clemmys guttata*)

A single spotted turtle, a NH-listed Threatened species, was documented at the Concord Sewage Treatment Plant. Suitable habitats (wetlands and slow-moving streams) located within the vicinity of this area include the Merrimack River, Turkey River and the South End Marsh. Additional suitable habitat exists near the northern end of the project in the vicinity of Horseshoe Pond and Fort Eddy Pond. Coordination with NHFG will take place to determine whether construction mitigation measures should be implemented. There are no anticipated impacts to spotted turtle as a result of this project.

Wood turtle (*Glyptemys insculpta*)

Wood turtles, a NH-listed species of Special Concern, have been documented in the floodplain areas on the NHTI Campus near the northern limits of the project and in a wetland area associated with Bow Brook, just north of the I-93 and I-89 interchange. Potential suitable habitat is present within the project corridor including the Merrimack River, Turkey River, and Bow Brook, and their associated riparian wetlands and adjacent uplands. Coordination with NHFG will take place to determine whether construction measures should be implemented. While there could be impacts to wood turtle habitat, associated with bridge replacements, no direct impacts to the turtles are expected as a result of this project.

Northern Leopard Frog (*Lithobates pipiens*)

Northern leopard frogs, a NH-listed species of Special Concern, have been documented in multiple locations in the vicinity of the project area. The first location is west of the Merrimack River and east of I-93 in West Terrill Park. Northern leopard frogs have also been observed in the vicinity of Horseshoe Pond, Fort Eddy Pond, NHTI campus, and the boat launch under the I-93 bridge. Project impacts in these areas would be limited to the edges of the existing roadway, and impacts to northern leopard frogs or these habitats is not anticipated.

Common Nighthawk (*Chordeiles minor*)

Common nighthawks, a NH-listed species of Special Concern, have been observed flying over and nesting on rooftops in downtown Concord. The area where common nighthawks have been documented is west of North Main Street, over 1,000 feet away from the proposed project area. Therefore, the project is not anticipated to have an effect on common nighthawks.

State-Listed Bats

The acoustic survey completed in 2017 determined that the presence of little brown bat (*Myotis lucifugus*) and tricolored bat (*Perimyotis subflavus*) is considered probable. Both are NH-listed endangered species. Both species are also under review by the USFWS for potential future listing under the Endangered Species Act.

Coordination with NHFG will take place to determine if construction mitigation measures should be implemented to avoid or minimize impacts to these species. Should either species become a federally listed or candidate species prior to project construction, further review would be undertaken to evaluate potential impacts and additional coordination with the USFWS would be carried out.

4.11.3 Invasive Species

Invasive species are located throughout the project corridor and disturbance of these plants is likely to occur during construction. Appropriate BMPs would be summarized in an *Invasive Species Control and Management Plan* and implemented during construction to avoid spreading invasive plants to new sites. NHDOT Standard Specifications designate invasive plants as Type I or Type II based on the complexity of control measures that are required to prevent the spread of the plants during construction. In general Type II plants require a greater level of control due largely to their ability to spread from stem or root fragments. Of the invasive plants identified in the project area, purple loosestrife, Japanese knotweed, and common reed require Type II control measures. The remaining species require Type I controls.

4.12 Cultural Resources

4.12.1 Historic Architectural Resources

Architectural historians reviewed project plans showing project impacts within the Area of Potential Effect (APE) where National Register eligible properties occur. Potential impacts included property acquisition, tree clearing, placement of a noise wall, cut and fill slopes, and the potential construction of storm water BMPs.

The National Historic Preservation Act, at 36 CFR 800.5, provides criteria for evaluating the effects of federal actions on historic properties:

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Examples of adverse effects include:

- Physical destruction or damage to all or part of the property;
- Alteration of a property that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR 68);
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; and
- Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.

No adverse effect may be found when the undertaking's effects do not meet the criteria for adverse effect, i.e., do not alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register. No adverse effect may also apply when the undertaking is modified or conditions are imposed to avoid adverse effects. If a project would not affect a historic property in any way, it is determined to have no effect.

Effects on National Register eligible properties were determined by the FHWA, in consultation with NHDOT and SHPO (NHDHR), based on the Section 106 review process established by the National Historic Preservation Act of 1966 and outlined at 36 CFR 800.9. Two members of the public (one each from Bow and Concord) have participated as Consulting Parties during this consultation process. The project has received an Adverse Effect Determination for its impacts to National Register eligible properties and districts (Appendix B, Exhibit 8). The adversely effected properties are listed in **Table 4.27 National Register Eligible Properties with Adverse Effects.** The locations of the National Register Eligible sites evaluated for adverse effects are depicted on **Figures 4.2-1 through 4.2-8.**

Table 4.27 National Register Eligible Properties with Adverse Effects

Property	Address	Adverse Effect
Lamora's Garage	521 South Street / 1 Valley Road, Bow	Full acquisition for transportation use
Upton House and Store	2 Valley Road, Bow	Setting/Visual

Mitigation for the adverse effect will be coordinated by FHWA with the SHPO (NHDHR) and NHDOT and memorialized in a Memorandum of Agreement that will be included in the Revised Environmental Assessment.

4.12.2 Archaeological Resources

A Phase 1A archaeological sensitivity assessment was conducted to define all known or potential archaeological resources that may be impacted by the project. Potential archaeological resources include Native American sites as well as any subsurface features related to the eighteenth to early twentieth-century use within the APE. Potential effects include (but are not limited to) direct impacts from demolition, sediment, dredging, and realigned interchanges, ramps, shoulders and travel lanes.
The Phase IA assessment identified areas with moderate to high potential for undisturbed archaeological resources throughout the APE. These areas have been deemed as archaeologically sensitive with high potential for undisturbed ancient Native American cultural deposits based on data from the known Pre-Contact site distribution. A few areas may encompass intact Euroamerican deposits based on historic map review. In total, 27 potential Euroamerican resources were identified within the APE: 19 in Bow and 8 in Concord.

In order to determine the specific location of potential resources, a Phase IB Intensive Archaeological Investigation would be conducted during final design.

4.13 Socio-Economic Resources

4.13.1 Property Acquisitions

Property acquisitions, either full or partial, would occur throughout the project area. Most acquisitions are needed for areas of grading and some are needed to place stormwater BMP features for the treatment of stormwater runoff from the roadways. Property requiring acquisition would be appraised using techniques recognized and accepted by the appraising profession. Acquisitions would be carried out in conformity with the federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, and applicable New Hampshire state law. The dollar amount offered for partial acquisitions is the difference between the fair market value of the property before the project is constructed and its value after the portion needed for the project has been acquired. Completed appraisals are carefully reviewed by an independent appraiser to ensure that requirements of condemnation law and acceptable appraisal methods are met.

Table 4.28 Property Acquisitions lists those parcels with known acquisitions (partial and full) and parcels that are yet to be determined as acquisitions, but have been deemed “potential” acquisitions. The acquisition areas and acreages would not be final until the next phase of the project, final design. Final design would provide a greater level of detail relative to the project limits. Full acquisitions known at this time are highlighted in red.

Table 4.28 Property Acquisitions

Town / City	Tax Map Parcel #	Parcel Type	Acquisition Type	Reason for Acquisition
I-89/Exit 1 Area				
Bow	10-1 37A	Undeveloped	Partial	Grading
Bow	10-1 38	Undeveloped	Partial	Grading
Bow	15-1 24	Undeveloped	Partial	Grading
Bow	15-1 88	Residential	Partial	Grading
Bow	15-1 28	Undeveloped	Partial	Grading
Bow	15-1 25	Residential	Potential	Possible Grading
Bow	15-1 87	Residential	Potential	Possible Grading
Bow	15-1 26	Residential	Full	New Ramp
Bow	15-1 49	Residential & Auto Repair	Full	New Ramp
Bow	15-1 90	Undeveloped	Full	New Ramp
Bow	15-1 91	Residential	Potential	Possible Temporary Impacts
Bow	15-1 92	Residential	Potential	Possible Grading
Bow	15-1 148	Residential	Potential	Possible Grading
Bow	15-1 152	Residential	Potential	Possible Grading
Bow	15-1 151	Residential	Partial	Grading
Bow	15-1 150	Residential	Partial	Grading
Bow	15-1 147	Residential	Potential	Possible Grading
Bow	15-1 4	Undeveloped	Potential	Possible Grading
Bow	10-1 35-A	Undeveloped	Full	Stormwater Treatment Area
Bow	10-1 38-1	Undeveloped	Full	Stormwater Treatment Area
Bow	10-1 35	Cilley State Forest	Partial	New Ramp
Bow	N/A	Undeveloped	Partial	Stormwater Treatment Area
Bow	16-1 30	Restaurant	Partial	Possible Grading
Bow	11-1 31	Undeveloped	Partial	Grading
Bow	16-1 47	Bow Mobil	Full	New Ramp
Bow	11-1 46	Residential	Potential	Possible Grading
Bow	11-1 44	Baker Free Library	Potential	Possible Grading
Bow	11-1 42	Bow Mills Methodist Church	Potential	Possible Grading
Bow	11-1 43-A	Commercial	Potential	Possible Grading
Bow	11-1 32	Residential	Potential	Possible Grading
Bow	11-1 33-A	Dentist	Potential	Possible Grading
Bow	16-1 45	Hampton Inn	Partial	Grading
Bow	16-1 48	Pitco Frialator	Potential	Possible Grading
Bow	16-1 101-B	Commercial	Partial	Grading
Bow	16-1 85	Undeveloped (Town of Bow)	Partial	Grading

Table 4.28 Property Acquisitions

Town / City	Tax Map Parcel #	Parcel Type	Acquisition Type	Reason for Acquisition
Exit 12 Area				
Concord	4 4-2	Residential	Partial	Possible Grading
Concord	4 4-3	Residential	Potential	Possible Grading
Concord	4 4-4	Residential	Partial	Possible Grading
Concord	4 2-10	Residential	Partial	Possible Grading
Concord	4 2-9	Residential	Partial	Possible Grading
Concord	3 1-1	Residential	Potential	Possible Temporary Impacts
Concord	3 3-1	Residential	Partial	Grading
Concord	4 5-1	Residential	Partial	Grading
Concord	4 5-2	Undeveloped	Partial	Grading
Concord	5 3-1	Mitigation	Potential	Possible Grading
Concord	5 3-2	Commercial	Potential	Possible Grading
Concord	1-2 3	Days Inn	Potential	Possible Grading
Concord	1-2 2	Commercial	Potential	Possible Grading
Concord	1-2 4	Dunkin Donuts	Potential	Possible Grading
Concord	5-1 1	Commercial/Vacant	Potential	Possible Grading
Concord	5-1 4	Commercial/Vacant	Partial	Stormwater Treatment Area
Exit 13 Area				
Concord	14-1 7	Commercial	Potential	Possible Grading
Concord	N/A	Undeveloped	Full	New Cul-de-Sac
Concord	N/A	Utility Corridor	Partial	Grading
Concord	6-3 7	Commercial	Full	Stormwater Treatment Area
Concord	14-1 1	Commercial	Full	Stormwater Treatment Area
Concord	14-1 2	Commercial	Full	Stormwater Treatment Area

Table 4.28 Property Acquisitions

Town / City	Tax Map Parcel #	Parcel Type	Acquisition Type	Reason for Acquisition
Exit 14/15 Area				
Concord	N/A	Railroad (PAR)	Partial	Grading
Concord	45-A 1-2	Commercial (Ralph Pill)	Partial	Grading
Concord	644-Z 10	Undeveloped (City of Concord)	Partial	Grading
Concord	644-Z 43	Shopping Plaza	Partial	Grading
Concord	641-Z 44	Parking Lot	Potential	Possible Grading
Concord	46-A 2-1	Commercial (NHDOT)	Partial	Grading
Concord	46-A 2-3	Bus Terminal	Partial	Grading
Concord	644-Z 9	Undeveloped (City of Concord)	Potential	Possible Grading
Concord	641-Z 49	Commercial	Potential	Possible Grading
Concord	56-2 4	Residential	Full	New Road
Concord	56-2 5	Residential	Potential	Possible Temporary Impacts
Concord	56-2 6	Residential	Potential	Possible Temporary Impacts
Concord	56-2 7	Residential	Potential	Possible Temporary Impacts
Concord	56-2 8	Residential	Potential	Possible Temporary Impacts
Concord	56-2 9	Residential	Partial	New Road
Concord	56-2 10	Undeveloped (NHDOT)	Partial	Grading
Concord	56-1 4-T	Parking Lot	Partial	Grading
Concord	48-Z 110	Railroad (NHDOT)	Partial	Retaining Walls/Grading
Concord	594-Z 11	Commercial	Potential	Possible Grading
Concord	594-Z 10	Commercial	Potential	Possible Grading
Concord	594-Z 5	Commercial	Potential	Possible Grading
Concord	59-Z 8	NHTI	Partial	Grading
Concord	59-Z6 1-1	Commercial	Potential	Possible Grading
Concord	59-Z 5	Commercial	Potential	Possible Grading
Concord	59-Z 4	Commercial	Potential	Possible Grading
Concord	56-1 3	Commercial	Potential	Possible Grading

4.13.2 Property Value Impacts

With no new interchanges, no major improvements programmed at existing interchanges, and limited property acquisitions adjacent to the existing right-of-way, major property value impacts resulting from the proposed improvements are not anticipated. It is conceivable that with reduced congestion and improved safety, some positive property value impacts would be felt within the corridor communities in the face of easier movement among the communities. These impacts would probably be less serious than macro-economic factors unrelated to the project, such as interest rates and life style preferences.

Over the longer term, if the improvements were not undertaken, the LOS would decline to level E and F, which could have a negative effect on property values.

4.13.3 Impacts on Growth and Development

This section presents an overview of the anticipated land use impacts within the region and within each community impacted by this project. Profiles of the demographic and economic characteristics of the I-93 corridor were evaluated including a broad corridor influence area, extending some 15 miles from Bow and Concord (northern Manchester to the south and Franklin-Tilton to the north—Exits 10 and 20 respectively), and the immediate corridor communities of Bow and Concord.

The land use patterns in the project area have evolved over time along the highway, and the communities directly impacted are concerned with the current congestion and safety-related issues. Within the general project area, there is a sophisticated level of land use planning and regulation taking place in each of the communities, and little concern related to land use impacts of the project. More specifically, the consensus from interviews with town/city staff is that the improvements in the project area are important for improved safety and quality of life.

It was also determined that no substantial impact on growth or land use change is anticipated in the two communities. A review of the existing planning documents for the region identified support for the improvements whenever the topic was addressed. None of the professional planning staff interviewed had concerns related to their zoning or developable land areas when discussing the potential for additional lanes and capacity on I-93.

4.13.4 Analysis

The current traffic issues consist of peak hour delays and accidents, resulting in a perceptible negative impact on quality of life (and vehicular safety) within and passing through the corridor. The proposed improvements would accommodate current and expected future highway traffic more efficiently and safely, resulting in improved LOS and the shortening of commuting and overall travel times both north and south bound.

Most of the prime development sites in the corridor have already been developed. As a result, the improvements would not have a major impact on land development within the corridor. In the absence of the improvements, it is conceivable that the future LOS would deteriorate to the point where limited capacity would dilute future economic development among corridor communities.

Based upon the above findings, the project is not anticipated to generate significant economic and land development activity within the corridor.

4.13.5 Community Facilities

This section presents an overview of the anticipated impacts on community facilities, such as police and fire stations, schools, municipal buildings, post offices, libraries, public works facilities, etc. There would be no direct impacts to any of these types of community facilities from this project. During the construction phase of the project, when local bridges and roadways could be impacted, access to these facilities could be subject to delays. Construction of the preferred alternative would include traffic management measures to accommodate traffic during construction. A particular area of concern is the Bow Town Hall complex located on Grandview Avenue where access would need to be maintained at all times. Bicycle and pedestrian use on local roads during construction would also be considered and incorporated where possible.

4.13.6 Community Cohesion

The proposed improvements would be undertaken primarily within the existing right-of-way. There is a high degree of interaction among the corridor communities for shopping, job commuting, and for personal/business services. The proposed improvements would ease these interactions by improving traffic flow.

4.13.7 Environmental Justice

The proposed project has been evaluated pursuant to Title VI of the Civil Rights Act of 1964 and Executive Orders 12898 and 13166, which are intended to ensure fair and full participation and equal receipt of any benefits that may be realized from the proposed project. The Civil Rights Act of 1964 (Title VI) prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal financial assistance. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, specifically requires federal actions to be reviewed for the potential to have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, requires federal actions to translate public information meeting notices and to take appropriate measures to ensure language access.

In summary, projects having substantial effects on human health or the environment shall be undertaken in a manner that does not exclude anyone from participating in or benefiting from the project because of their race, color or national origin.

An inventory of potentially underrepresented groups has been conducted within a one-mile radius and within a three-mile radius of the project area. Underrepresented groups have been identified within these locations. The underrepresented groups listed in **Table 4.29 Environmental Justice Populations**. The groups that occur in numbers meaningfully greater than the surrounding area and constitute Environmental Justice populations are shown in bold text.

Table 4.29 Environmental Justice Populations

Study Area	Average % Elderly Population	Average % Minority Population	Average % Low Income Household Population**	Average % LEP***
1-mile radius from project area	**15.8%**	7.3%	**25%**	1.3%
3-mile radius from project area	7%	1.7%	**12.5%**	2%

Remarks:
** Low-income population for this analysis is defined as household income of less than $25,000.
***LEP (Limited English Proficiency): Individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English.

This project would not create new uses or changes in land use that would adversely impact elderly, low income, or LEP populations. The project does call for the acquisition of properties (full and partial) that are located adjacent to the existing highway right-of-way. These properties are spread out along the entire project corridor. EJ populations would not be disproportionately impacted by construction of the preferred alternative. The project does not alter public transit services. The project is consistent with the provisions of Title VI of the Civil Rights Act of 1964 and Executive Orders 12898 and 13166. Such

4.14 Visual Resources

The size and scale of the existing highway within the study area would increase due to the expansion of the pavement footprint, widened bridges, removal of vegetation, and the expansion of the current cut and fill slope lines that are generally maintained grass areas adjacent to the existing pavement limits. Some areas of vegetation removal would occur in existing vegetated buffers between the highway and development areas including residential neighborhoods, businesses, and commercial sites.

The proposed reduction of vegetation and expansion of the cut and fill slope lines may create an adverse visual impact for the residents and businesses that rely on the vegetated buffers that serve to screen the views to the highway. Similarly, portions of the proposed vegetation removal in forested areas may lessen the visual appeal of the rural sections for travelers.

Several visualization techniques were used within this Visual Impact Assessment to help illustrate the visual effect of the preferred alternative on the existing topography and surrounding uses. Illustrative roadway sections and photo simulation renderings of the preferred alternative were created and compared to the existing conditions (Refer to Appendix D).

The discussion below details the potential impacts of the preferred alternative to the visually sensitive resources identified in Chapter 3.

4.14.1 I-89/Exit 1 Area

A visual impact would be the removal (property acquisition) of the Bow Mobil gas station, located on South Street adjacent to the Hampton Inn. The gas station property would be replaced with a connector road from Route 3A to South Street. This proposed connector road consists of one vehicular travel lane in each direction. As it reaches South Street, the road widens to accommodate north and south turn lanes. Some existing vegetation would be removed.

Two new bridges are proposed to support a new ramp connecting southbound I-89 to southbound I-93 as it crosses over the proposed new Exit 1 ramp and Logging Hill Road. The new southbound ramp would be located closer to the residential area in Bow along Logging Hill Road, Valley Road and Grandview Road. One property, Lamora’s Garage, a National Register eligible property, would be removed (full acquisition) and replaced with the new ramp. The current visual setting for the adjacent National Register eligible property, the Upton House and Store, would be adversely effected by the location of the new ramp, located approximately 20 feet from the property line, at its closest point.

The proposed on-ramp to I-89 northbound from South Street would impact approximately 0.7 acres of Cilley State Forest due to property acquisition (partial). This portion of the Cilley State Forest would be acquired for the new on-ramp. The vegetation removal would be visual impact, but would be offset by adding forested area to the Cilley State Forest through a land swap between the NHDOT and the NH Division of Forests and Lands.

Some vegetation removal would occur along the edges of the existing highway right-of-way in numerous locations but it is not anticipated to visually impact the adjacent properties. Stormwater BMPs would be designed to minimize visual impacts and would be long-term features with vegetation.

4.14.2 Exit 12 Area

The proposed roundabouts to the north and south of I-93 would be utilized by vehicles entering and exiting to and from NH Route 3A. The central portion of these roundabouts would be vegetated. Proposed vegetation in this area would provide some color and texture to these areas of the project.

Along the south side of NH Route 3A, plantings would help to define the pedestrian movement and give some human scale to the roadway project. Some vegetation removal would occur along the edges of the existing highway right-of-way in numerous locations but it is not anticipated to visually impact the adjacent properties. Stormwater

BMPs would be designed to minimize visual impacts and would be long-term features with vegetation.

4.13.3 Exit 13 Area

The existing splitter island from the I-93 northbound exit ramp would become slightly larger but may be planted with vegetation to help screen this portion of the road from US Route 3. The main visual changes to the I-93 corridor in this portion of the project would be the removal of a centrally located planted zone with grass and some low shrub plantings. This landscaped area is replaced by two new passing lanes with interior shoulders; one northbound and one southbound. A proposed reinforced concrete traffic barrier would provide a safe separation of the north and southbound vehicular travel lanes and would replace the existing vegetation.

Some vegetation removal would occur along the edges of the existing highway right-of-way in numerous locations but it is not anticipated to visually impact the adjacent properties. Stormwater BMPs would be designed to minimize visual impacts and would be long-term features with vegetation.

4.14.4 Exit 14/15 Area

This area of the project is more urban in comparison to the others area and contains numerous property that are eligible for the National Register including: NH Highway Garage Complex located on Stickney Avenue; Ralph Pill Building and Concord Electric Company Building located on Bridge Street; and two historic districts, the Boston, Concord, Montreal Railroad corridor and the NHTI campus.

The visual impacts from the preferred alternative include the benefit of a greater view of the downtown area resulting from the proposed wider underpass on Loudon Road. This new wider opening provides an enhanced framed view of downtown Concord when approaching from the east along Loudon Road. This view may be further enhanced by new plantings.

The NHTI historic district may be adversely affected by the placement of a noise wall along the portion of I-93 that abuts the campus beginning at the southern portion of Fan Road and extending north to College Drive. The noise barrier is estimated at 1,700 feet in length. Coordination with NHTI on the disposition of the noise barrier is ongoing.

Some vegetation removal would occur along the edges of the existing highway right-of-way in numerous locations but it is not anticipated to visually impact the adjacent properties. Stormwater BMPs features would be designed to minimize visual impacts and would be long-term features with vegetation.

4.14.5 Mitigation

Efforts to mitigate the loss or reduction of the visual quality within the four segments would occur during the final design phase of the project. Mitigation measures may include the following:

- Planting natural vegetation within the disturbed areas along the highway and providing plantings to serve as screening for residences and business.
- Design considerations for drainage structures, bridges, and other hardscape features to enhance their visual appearance.
- Privacy fencing to minimize impacts to adjacent residential properties from increased views of the roadway.

In areas were visual impacts and noise impacts occur, noise walls would assist to mitigate the visual impact by creating a barrier to the view of the highway. Vegetation may be installed in conjunction with the noise walls.

4.15 Contaminated Properties and Structures

During construction, the project has the potential for encountering hazardous or contaminated materials at several locations.

NHDES currently maintains 19 open case files for properties within the project area. The locations of these open case files are depicted on Figures 4.2-2 through 4.2-8. Contaminated soil or groundwater may be encountered whenever excavation takes place within the boundaries, or near, of the open status sites. In addition, the case files that are currently closed would also be considered as this does not necessarily indicate that a parcel of land is free of contaminants.

As limits of ground disturbance are further refined during the final design phase of the project, the NHDOT would review design plans and cross sections to assess potential concerns and determine if further investigation of remediation sites is warranted. If necessary, appropriate measures would be implemented during construction to avoid adverse effects from potential contaminated materials.

Soil disturbance within the right-of-way is subject to the protocol set for by the “Limited Reuse Soils” (LRS) and must be addressed in accordance with applicable NHDES rules and/or waivers. The project may be subject to management through a Soils Management Plan. Roadside soils currently managed as LRS include all topsoil within the limits of the existing right-of-way, regardless of its depth. In those instances where there is no measurable topsoil, LRS would be measured from the top of the ground to a depth of six inches. During final design of the project, it would be determined if LRS would be generated by the project and, if generated, if the material would require reuse on-site, disposal, and/or temporary stockpiling. Any excess materials that result from the project within the operational right-of-way would be addressed in accordance with applicable NHDOT guidance and NHDES rules.

At the time of the NHDES PFAS database review, that there are three sites with PFAS detections just to the north of the I-89/I-93 interchange, but at concentrations well below the AGQS of 70 parts per trillion. It is assumed that the database is incomplete at this time. PFAS data collection within the corridor is on-going. In addition, the laws and regulations governing PFAS procedures evolving. During final design, further work would be necessary to develop a comprehensive database of the sites with PFAS contamination.

Evidence of asbestos or lead-based paint was not detected from a review of the as-built bridge plans; however, additional on-site investigation would be necessary during final design to determine the presence or absence of asbestos or lead-based paint prior to construction. Should these materials be encountered during construction, the Contractor would be required to implement necessary measures to ensure the proper handling and disposal in accordance with applicable laws and regulations.

4.16 Energy Impacts

The preferred alternative would require additional energy expenditures during construction in the form of consumable natural resources including diesel and gasoline fuels. The no-build alternative would not involve any additional energy expenditures. However, the existing highway infrastructure, including bridges and highway pavement, is deteriorating, and continued maintenance efforts would require energy-dependent work efforts over time.

The proposed project would reduce congestion and improve the flow of traffic through the project corridor. Therefore, the preferred alternative would reduce vehicular energy requirements.

The additional travel lanes associated with the preferred alternative would require greater energy expenditures in the future due to increases in routine maintenance activities. These fuel-requiring activities include plowing, sanding, bridge and drainage maintenance, and roadway surface repairs. However, the new roadway surface would be built to improved standards, which would incorporate the latest technology and materials, and would therefore require less maintenance in the future.

4.17 Indirect and Cumulative Impacts

The Council on Environmental Quality (CEQ) regulations (40 CFR 1500 -1508) require that indirect and cumulative effects of a project must be considered in the NEPA process in addition to the project's direct effects. CEQ regulations (40 CFR 1508.7 and 1508.8) define direct, indirect, and cumulative effects as follows:

> **Direct effects** are caused by the action itself and occur at the same time and place (40 CFR 1508.8). The direct effects of the proposed project are detailed above in **Section 4.2 through Section 4.16** of this chapter.

> **Indirect effects** are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. (40 CFR 1508.8)
>
> **Cumulative effect**s are the impacts on the environment resulting from the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future actions regardless of what agency, entity or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

According to FHWA's *Questions and Answers Regarding the Consideration of Indirect and Cumulative Effects in the NEPA Process*, indirect effects are caused by another action or actions that would not occur except for the implementation of a project.

Cumulative effects analysis is resource-focused, and involves considering the total of all impacts to a particular resource that have occurred, are occurring, and would likely occur as a result of any action, including the proposed project. Only cumulative effects to resources that are directly affected by the project are considered.

Both indirect and cumulative effects analyses consider "reasonably foreseeable" future actions and effects. According to FHWA's *Questions and Answers*, "reasonably foreseeable events, although still uncertain, must be considered probable. This means that those effects that are considered possible, but not probable, may be excluded from NEPA analysis. There's an expectation in the CEQ guidance that judgments concerning the probability of future impacts will be informed, rather than based on speculation."

4.17.1 Indirect Effects

Screening of Activities for Consideration of Indirect Effects

The need for indirect effects analysis is determined on a case by case basis for each project and resource. Potential indirect effects of the I-93 Bow Concord Improvement project may occur because of land disturbance activities necessary to construct the project and the increased footprint of the interstate system with the 4.5-mile project corridor.

The screening has resulted in the determination that indirect effects would occur. The indirect effects are addressed along with the direct effects in the applicable resource categories. Refer to the topics and sections listed below for a discussion on the indirect effects anticipated to occur:

- Wetlands (refer to Section 4.7.3)
- Wildlife (refer to Section 4.9.3)
- Fisheries (refer to Section 4.10)

4.17.2 Cumulative Impacts

Selection of Resources for Cumulative Impacts Analysis

Cumulative impacts are addressed in this section for resources which may be negatively or positively affected by the project. The following resources are being considered in the cumulative impacts analysis:

- Tree Clearing/Habitat Loss
- Wetlands/Surface Waters
- Historic Resources
- Land Use
- Traffic and Transportation

General stressors affecting the above resources in the vicinity of the alternatives corridor, including past, present, and foreseeable future activities, include: increase in impervious area, fragmentation of the landscape, loss of historic properties, and commercial and industrial development.

Tree Clearing/Wildlife Habitat: Tree clearing would occur throughout the 4.5-mile project corridor but would be primarily located within the existing highway right-of-way. Few areas of tree clearing would occur outside of the right-of-way. At most, tree clearing activities would result in the loss of approximately 39.3 acres of trees (including all 15 potential stormwater BMPs).

The project corridor is generally urban in nature, with the exception of a portion of the project area located in the Town of Bow, specifically the area west of I-93. Large areas of undeveloped land are present. The Town of Bow recently passed a new zoning district known as the Bow Mills Mixed Use District. Additional tree clearing would occur in this undeveloped area when development plans are approved and constructed. The acreage of additional tree loss is unknown at this time.

Tree loss and the conversion to transportation use would result in the loss of some wildlife habitat. Although much of the tree loss would occur in “edge” habitat (along the edge of the existing highway), moving the edge farther into the forested areas would result in the loss of viable habitats within and around the corridor, including foraging, breeding, daily or seasonal movements, etc. For the purposes of the cumulative impacts analysis, the study area includes the project corridor and the areas of habitat that are likely to be impacted in the future such as the Bow Mills Mixed Use District.

Major impacts to wildlife habitat in the specified study area and time period include ongoing impacts from residential and commercial development, with loss of habitat and increased fragmentation and human activity; road construction; and other land use changes. These changes do not affect all wildlife species equally and may be beneficial to certain species. Development and changes in land use is anticipated to continue incrementally in the broader study area as well.

The cumulative impacts of the project and other changes in the landscape affect the viability of wildlife species in many ways. Destruction of habitat reduces the total amount of habitat available and therefore limits wildlife population levels. Habitat alteration can change the suite of wildlife species able to use a habitat. Fragmentation of habitat can limit animal migration from one habitat to another, which in turn can result in local extirpation of sub-populations and lower genetic diversity of remaining populations. As development and other land use changes continue, habitat and wildlife populations would be affected.

For most species, however, there are still broad areas of similar habitat found through much of the area, so for the near term, these habitats and populations appear to be stable.

Wetlands/Surface Waters: Historical impacts to the wetlands and streams in the project area are predominantly from land development and construction of transportation infrastructure. Future foreseeable impacts to wetlands and surface waters within the project area are not quantifiable at this time but are anticipated to occur from additional development on undeveloped land within the Town of Bow and the City of Concord, including redevelopment and infill development, and transportation improvements throughout the immediate area.

Future wetland and surface water impacts in the area would most likely probably be incremental, as land is converted to residential, commercial, transportation, or other uses. Filling of wetlands, stormwater discharged into wetlands, culverting of streams for road crossings, and other impacts would likely continue to occur. The capacity for streams and wetlands to continue to perform their functions would depend both on the development pressure in the region and the regulatory environment in which development takes place.

Historic Resources: Most historic resources are located along area roadways, where the most rapid development is occurring. Historic structures may be modified, eliminated, or otherwise altered such that the contributing elements are no longer present and the structures are no longer eligible for the National Register.

There is some regulatory protection for these resources through the Section 106 process, but these regulations apply to projects with federal funding or permitting and do not extend to all projects and modifications. Aside from the adverse effect determination on specific resources the cumulative impacts of historical land use changes and the proposed project would result in continued changes to the setting of the historic resources. At some point these changes may cumulatively alter the setting or feeling of historic structures to the extent that they are not eligible for the National Register. Structural modifications of historic resources in and near the project area would also continue. In an effort to minimize the project's contribution to cumulative impacts on historic resources, during final design measures would be proposed to minimize impacts to the setting of historic resources within the project area.

Land Use: In the Exit 14/15 Area, I-93 has created a barrier between Downtown Concord and the Merrimack River. This issue has been addressed in Concord's land use plans. The 2020 Vision, Opportunity Corridor Master Plan, and the City-wide Master Plan both address the need for improvements to I-93 and anticipated impacts of those improvements to the city. The 2020 Vision, dated 2001, asks: "how can I-93 improvements enhance the city's relationship with the Merrimack River and open space connections?"

The proposed project has been the impetus for the 2020 Vision this planning process within the City of Concord. The 2020 Vision identifies the Downtown's proximity to the Merrimack River and the City's abundance of open space as assets presenting opportunities to create a vibrant, livable district adjacent to I-93 that would support the Downtown. I-93 severed the relationship between Downtown and the river, and the City would like to reconnect these areas of the community.

The proposed project addresses many of the concerns related to potential land use impacts raised by the City. This design preserves access to the Ralph Pill Building and adjacent land uses southwest of Exit 14, and of Stickney Avenue to the northwest. These are identified priorities for the City of Concord and enable the City to continue to work on the redevelopment of this portion of the Downtown. The addition of a new local road connecting Stickney Avenue to South Commercial Street, as proposed by the project, would help provide greater connectivity between the existing land uses along this portion of the corridor. The remaining changes proposed by the project are largely within the project area and do not appear to present any impacts to existing adjacent land uses or preclude any of the future plans of the City of Concord as outlined in the two studies including: construction of an esplanade over the highway in a location behind the Brixmor Shopping Plaza; and the creation of transit-oriented development off of Stickney Avenue.

Traffic and Transportation: There are a number of planned transportation improvements in the region. The cumulative effects from these projects are deemed as economically positive to the overall region. A summary of these proposed projects and the anticipated time frame (if known) for implementation are listed in **Table 4.30 Summary of Transportation Projects in the Foreseeable Future**:

Table 4.30 Summary of Transportation Projects in the Foreseeable Future

Project	Temporary Impacts to I-93	Overall Impact to I-93
Langley Parkway	There would be minimal impact as the Langley Parkway project is not immediately adjacent to the project. The current schedule for the City of Concord indicate the parkway would be constructed before the project. However, the Langley Parkway has been discussed for many years and it is unclear if and when it would proceed.	The purpose of the Langley Parkway is to improve circulation in Downtown Concord by providing a new corridor for traffic destined for the medical facilities, businesses, schools, and state government facilities located along Pleasant Street. The construction of the parkway is not anticipated to impact I-93 traffic as it focuses on traffic within the local street network.
Storrs Street north extension (City of Concord project)	The northern extension of Storrs Street proposes connecting Storrs Street to Commercial Street and Constitution Avenue. This new connection would be constructed before the project per the current schedule.	The Storrs Street extension north provides another north-south access from Downtown Concord to Route 202 and Exit 15. The long-term impacts to I-93 are minimal as the access points to I-93 remain the same.
Storrs Street south extension	The southern extension of Storrs Street proposes connecting Storrs Street to South Main Street. This new connection would be constructed before the project per the current schedule.	The Storrs Street extension south provides better access to Storrs Street from South Main Street. The long term impacts to I-93 are minimal as the access points to I-93 remain the same.
Whitney Road Extension	Whitney Road would be extended from its current dead-end south of US 4 to Sewalls Falls Road. There is no set date for its construction, but it is over 3 miles north of the project and is not anticipated to impact the project construction.	The extension of Whitney Road is not anticipated to impact I-93 traffic within the project area. The current access points remain the same.
Manchester Street Widening (City of Concord project)	The widening of Manchester Street (Route 3) to four lanes would begin approximately 900 feet from the Old Turnpike Road intersection and continue for approximately one mile to the Airport road intersection. This widening would be constructed before the project per the current schedule.	The widening of Manchester Street increases capacity on this major arterial in the City of Concord. Manchester Street is also the main point of access between I-93 and the Town of Pembroke. The increased capacity of Manchester Street would increase traffic on Exit 13.
I-89 Exit 2 Roundabouts	The two stop-controlled ramp junction intersections at Exit 2 on I-89 would potentially be replaced with roundabouts. This project would have no impact on the construction of I-93 as Exit 2 is about a mile from the project limits and its traffic does not affect I-93 traffic.	The I-89 Exit 2 roundabouts would have no long-term impacts to I-93.
McKee Square Roundabout	A roundabout would replace the signal at McKee Square (Broadway/West Street) and is scheduled to occur in 2026. This corresponds to the proposed I-93 construction, however, this intersection has minimal impact on I-93 traffic.	The McKee Square roundabout would have no long-term impacts to I-93.

Based upon these foreseeable projects, minimal cumulative impact is anticipated to occur in the region. The NHDOT would closely coordinate the construction of the project with other projects in the region to minimize impacts to the traveling public.

4.18 Construction Impacts

4.18.1 No Build Alternative

There would be no proposed improvements associated with the No Build Alternative; however, there would be construction impacts related to required actions to maintain the transportation system within the 4.5-mile corridor. There are currently six Red List bridges within the project limits. These bridges, as well as those bridges expected to be added to the Red List during the coming years, would need to be repaired, rehabilitated, or replaced. In addition, pavement, guardrail, signing and other elements of the corridor would need to be replaced.

4.18.2 Preferred Alternative

4.18.2.1 Traffic and Transportation

Traffic control plans would be developed that detail the requirements for maintaining I-93 traffic lanes, access at each interchange, and traffic lanes on local streets as well as bicycle and pedestrian accommodation during construction.

Two lanes of traffic in each direction (northbound and southbound) would be maintained on I-93 during daytime hours. Lane closures and traffic detours would occur during nighttime hours. It is anticipated the widening of I-93 and the replacement of bridges would be done in phases with traffic shifting several times before reaching their final configuration. Some inconvenience and delay is unavoidable as roadwork and bridge construction is conducted.

Access from I-93, I-89 and I-393 at the seven project interchanges would be maintained during construction, however, some short-term detours are anticipated. These detours are required to construct new ramps adjacent to existing ramps.

Businesses and residents along local roads within the project limits would experience some inconvenience due to construction activities. Work adjacent to these private properties would be coordinated with the owners to ensure access is maintained to their properties throughout construction.

A Transportation Management Plan (TMP) would be developed to ensure safe and efficient travel through the proposed construction work zone. The elements of the TMP include Traffic Control Plans, Public information, and Transportation Operations. The Traffic Control Plans provide detailed sequencing of construction and traffic activities. Traffic would be protected from the work zone to ensure safe travel for the public. Public Information would inform users of the I-93 construction activities via press releases, news stories and electronic message boards. Transportation Operations seek to mitigate the impacts of the construction by managing travel through the work zone. This is achieved through programs to encourage car-pooling, Park-and-Ride use, surveillance of the work zone, and increased enforcement through police presence.

4.18.2.2 Other Construction Related Impacts

Impacts caused by construction activities would occur with the proposed preferred alternative. These impacts would be short-term and temporary in nature, but could potentially result in adverse effects during construction. The primary concerns include air quality, soil erosion and sediment control, traffic, and noise impacts.

Construction equipment and machinery powered by diesel and gasoline engines can emit air pollutants such as nitrogen oxides, carbon monoxide, hydrocarbons, and particulates. These emissions could potentially result in elevated ambient concentrations in the immediate vicinity of construction activity.

Particulate matter can also be emitted as dust as a result of excavating, hauling, grubbing, grading, and blasting operations. Dust emitted during construction can be minimized and controlled by wetting unpaved areas in the construction zone, covering loads on all open trucks, and seeding and revegetating all disturbed areas as soon as practicable. These methods would be implemented during construction of the Build Alternative in order to help minimize and avoid impacts.

Activities associated with the proposed construction would likely require the blasting of bedrock material in some areas requiring extensive grading. The grading would include the stripping of existing vegetation, followed by extensive excavation and filling. This construction would likely result in the complete reworking and/or removal of existing surficial and subsoils along the turnpike.

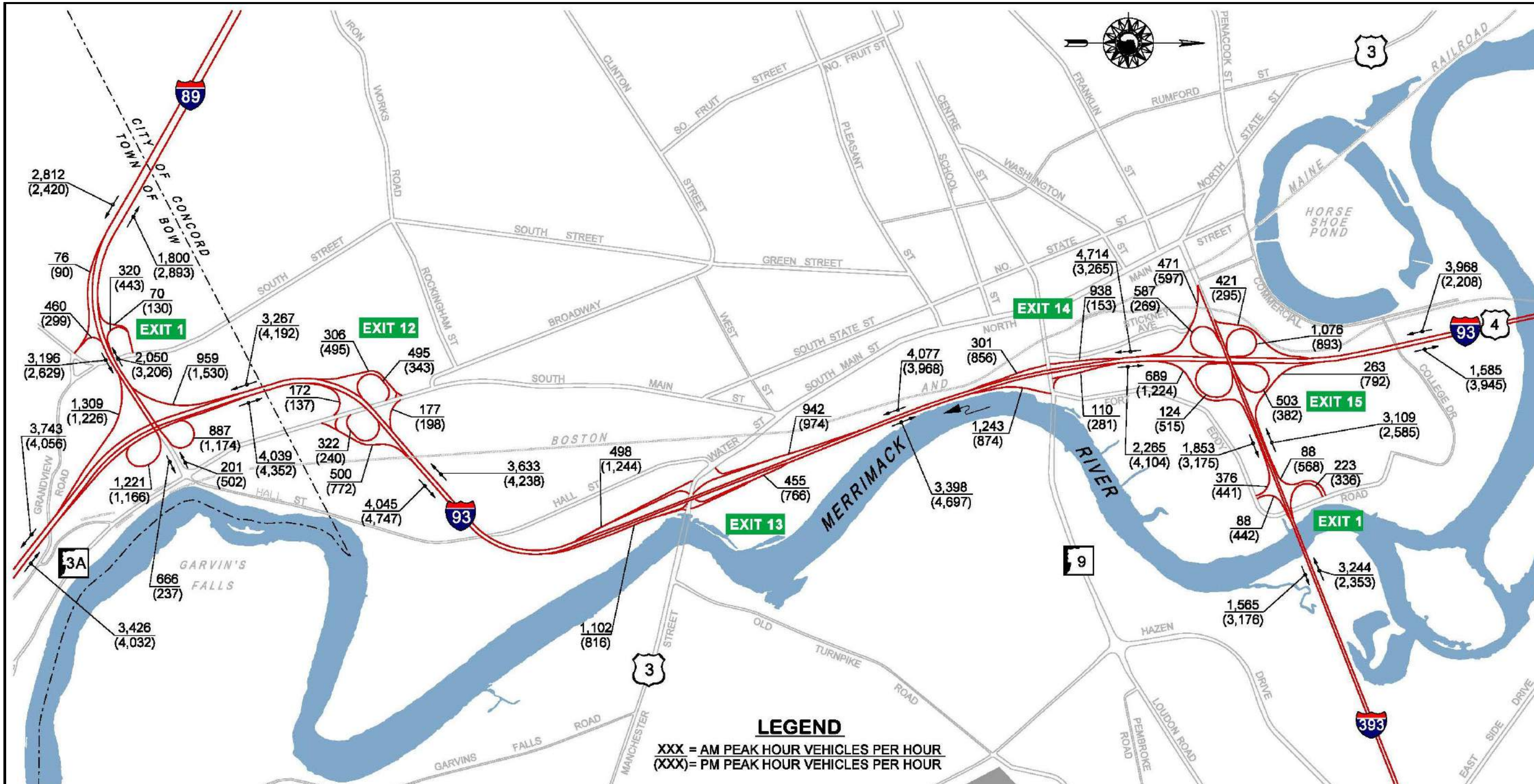
The removal of existing vegetation and the exposure of previously vegetated soils could potentially lead to erosion if not properly controlled. Increased erosion could lead to increased sedimentation in surrounding wetlands and streams. Increased runoff could also have a negative impact on water quality.

Construction activities can also result in impacts associated with elevated noise levels from construction equipment and machinery.

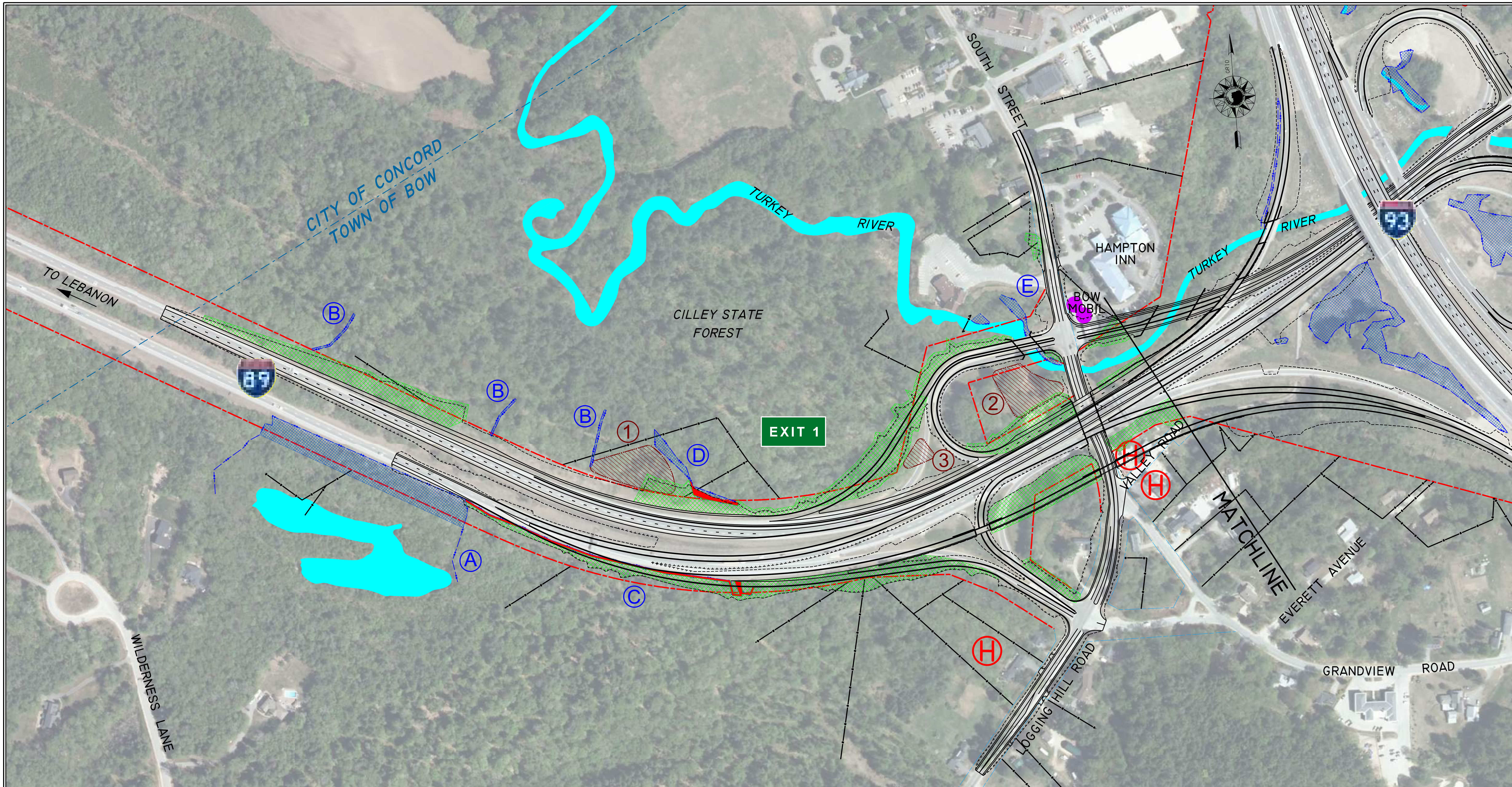
4.18.2.3 Mitigation

To mitigate potential sedimentation impacts from construction, a drainage and erosion control program, including BMPs, would be developed. The Contractor would be required to prepare a Storm Water Pollution Prevention Plan prior to the commencement of construction activities in compliance with the EPA Construction General Permit. In addition, the contractor would also be required to utilize properly maintained equipment with the appropriate emission control measures.

Figure 4.1: Design Year 2035 AM and PM Peak Hour Traffic Volumes



Note: The projected volumes are demand volumes that represent true demand and not just the volume that can be accommodated by the existing roadway system.



LEGEND

LIMITED ACCESS RIGHT-OF-WAY		HISTORIC SITE EFFECTED	H	WETLAND IMPACT	
CONTROLLED ACCESS RIGHT-OF-WAY		WETLAND ID	B	POTENTIAL STORM WATER TREATMENT SITE	
RIGHT-OF-WAY		DELINEATED WETLAND		POTENTIAL STORM WATER TREATMENT SITE ID	1
PROPERTY LINES	ℙ ℙ	TREE CLEARING		POTENTIAL CONTAMINATED SITE	
RAILROAD TRACKS		CUT SLOPE			
		FILL SLOPE			

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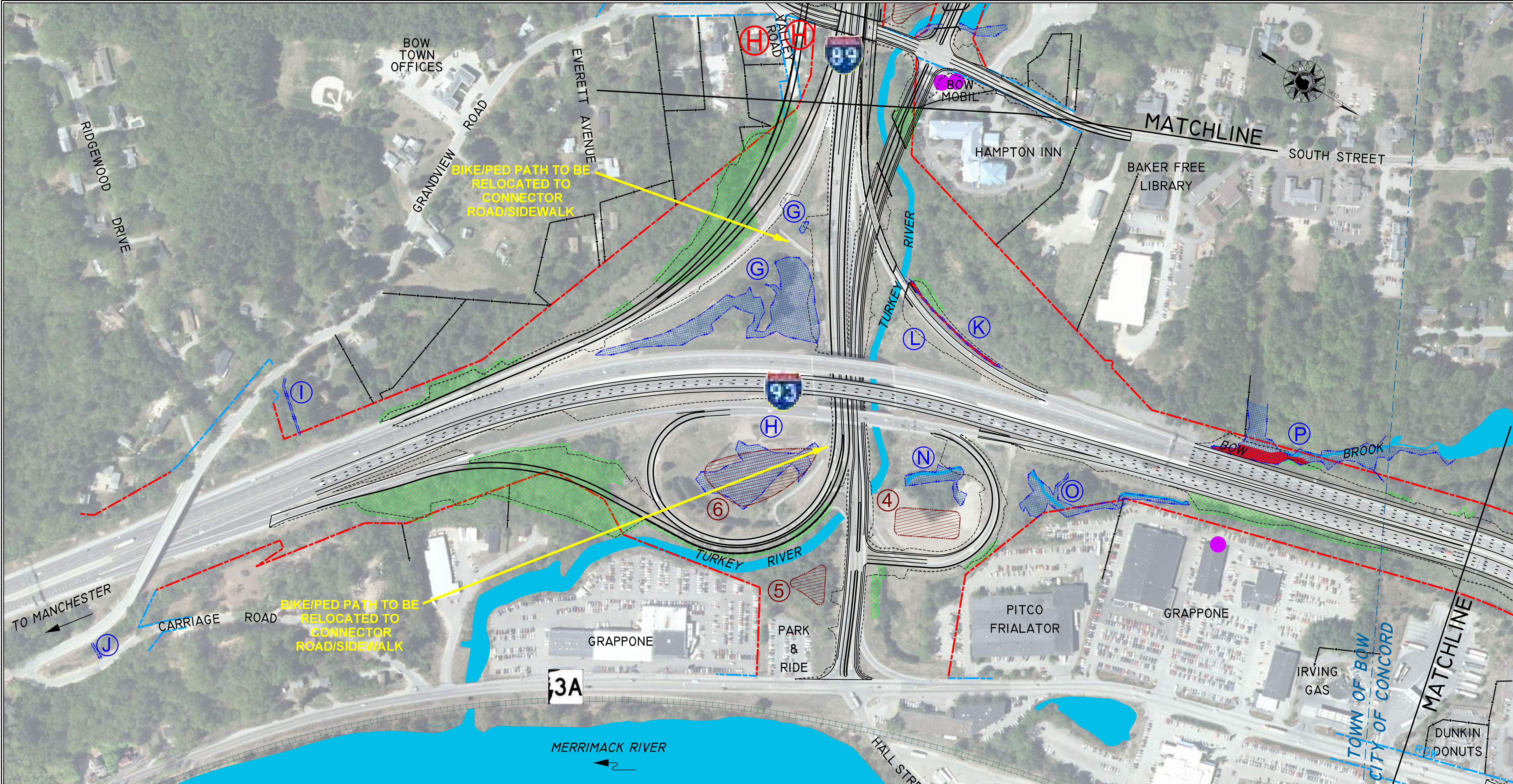
BOW-CONCORD I-93 IMPROVEMENTS

ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "K")
I-89 / EXIT 1 AREA

FIGURE 4.2-1

DATE: AUGUST 2018 SCALE: 1" = 300'



LEGEND

LIMITED ACCESS RIGHT-OF-WAY	HISTORIC SITE EFFECTED	(H)	WETLAND IMPACT		
CONTROLLED ACCESS RIGHT-OF-WAY	WETLAND ID	(B)	POTENTIAL STORM WATER TREATMENT SITE		
RIGHT-OF-WAY	DELINEATED WETLAND		POTENTIAL STORM WATER TREATMENT SITE ID	(1)	
PROPERTY LINES	TREE CLEARING		POTENTIAL CONTAMINATED SITE		
RAILROAD TRACKS	CUT SLOPE				
	FILL SLOPE				

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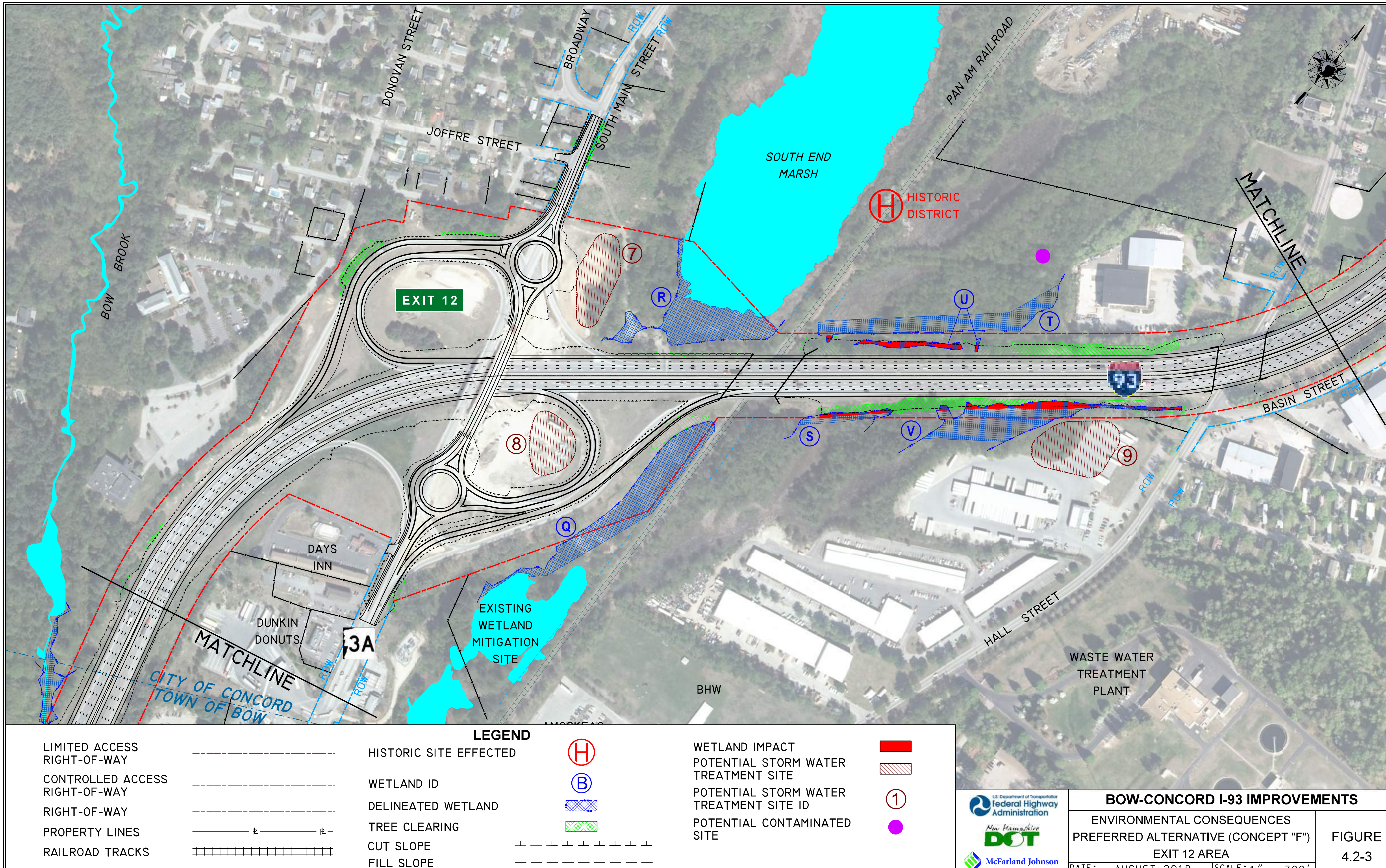
BOW-CONCORD I-93 IMPROVEMENTS

ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "K")
I-89 / EXIT 1 AREA

FIGURE 4.2-2

DATE: AUGUST 2018

SCALE: 1" = 300'



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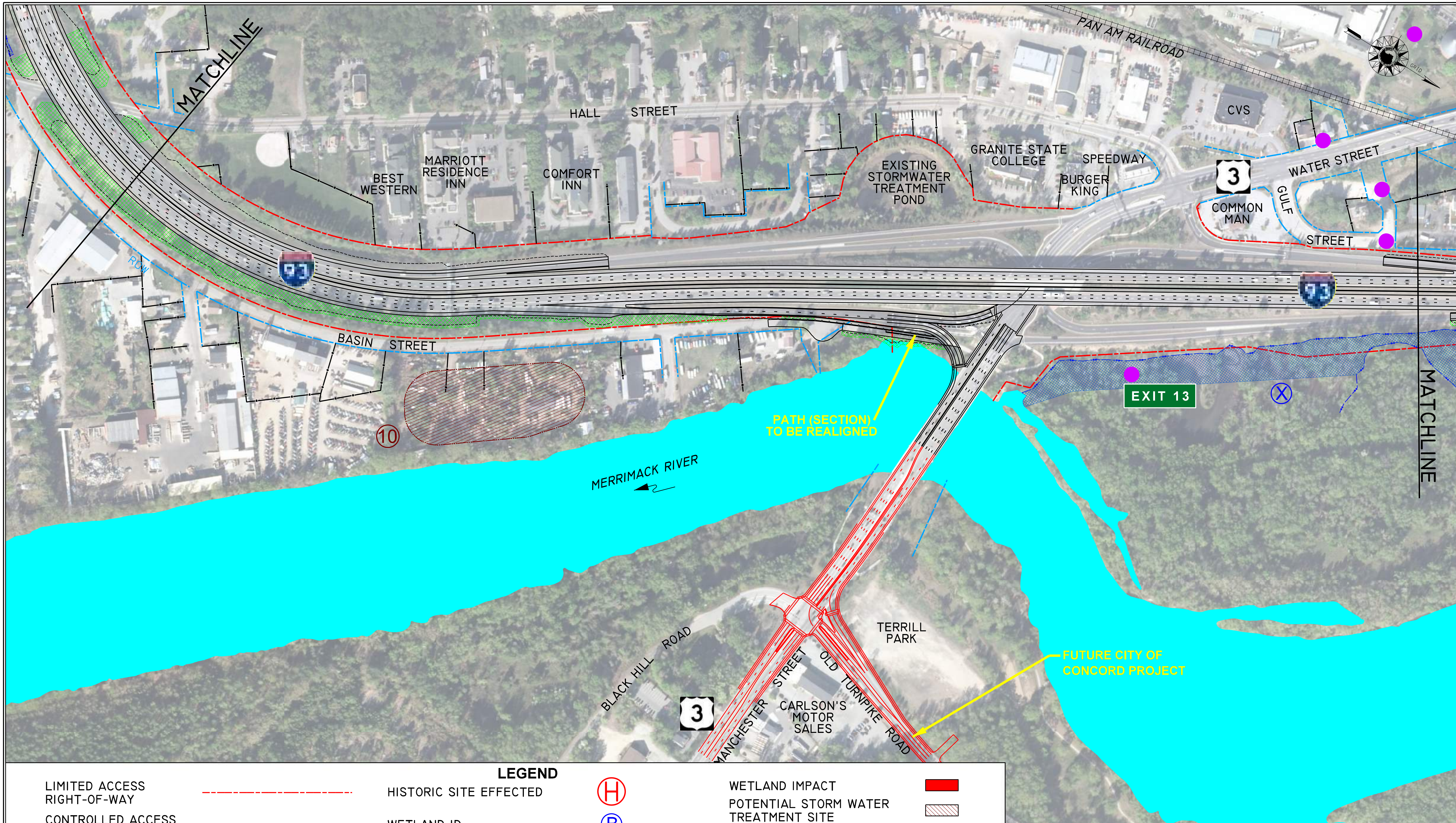
BOW-CONCORD I-93 IMPROVEMENTS

ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "F")
EXIT 12 AREA

FIGURE 4.2-3

DATE: AUGUST 2018

SCALE: 1" = 300'



LEGEND

LIMITED ACCESS RIGHT-OF-WAY

CONTROLLED ACCESS RIGHT-OF-WAY

RIGHT-OF-WAY

PROPERTY LINES

RAILROAD TRACKS

HISTORIC SITE EFFECTED — H

WETLAND ID — B

DELINEATED WETLAND

TREE CLEARING

CUT SLOPE

FILL SLOPE

WETLAND IMPACT

POTENTIAL STORM WATER TREATMENT SITE

POTENTIAL STORM WATER TREATMENT SITE ID — 1

POTENTIAL CONTAMINATED SITE

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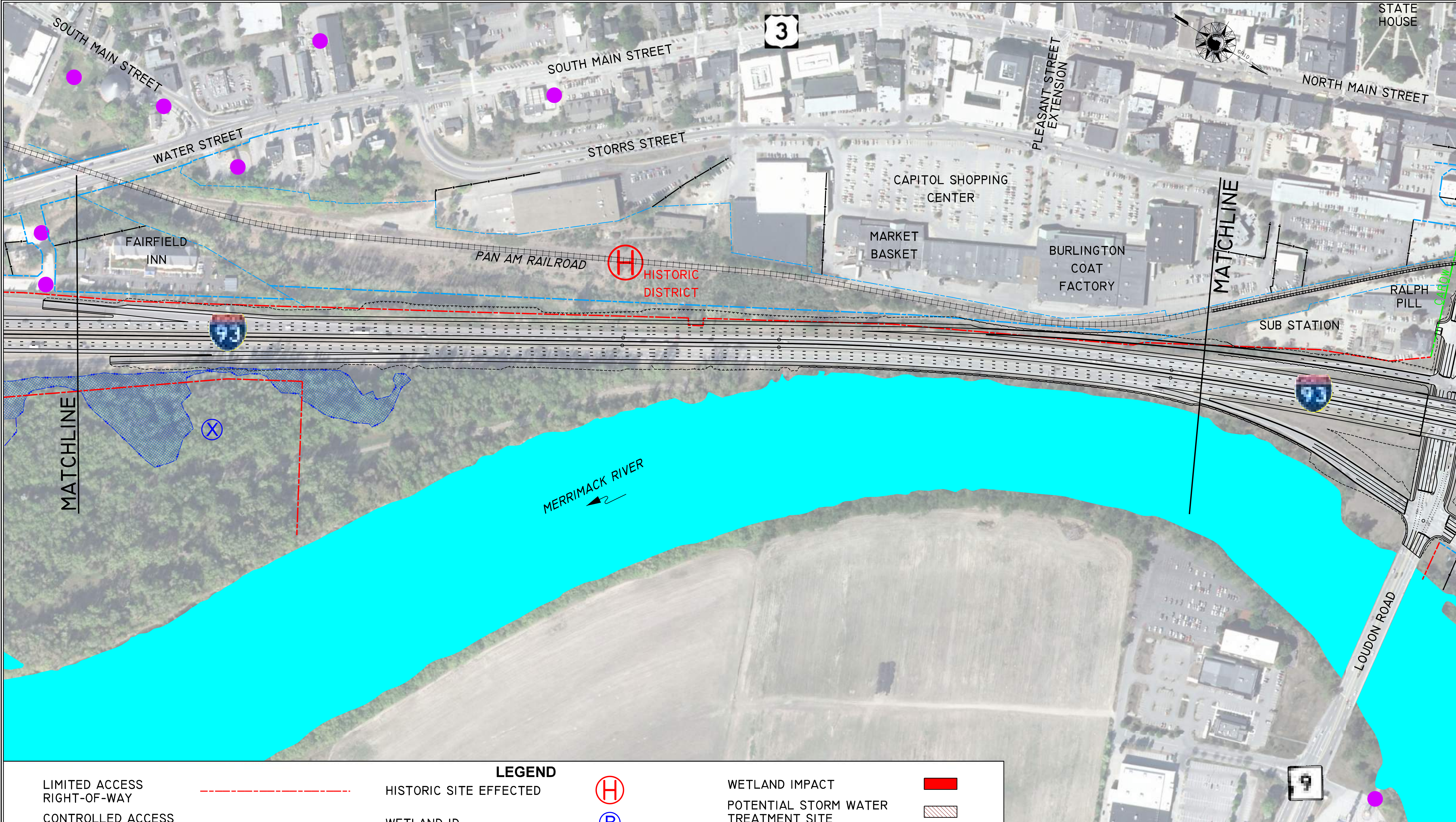
BOW-CONCORD I-93 IMPROVEMENTS

ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "B")
EXIT 13 AREA

FIGURE 4.2-4

DATE: AUGUST 2018

SCALE: 1" = 300'



LEGEND

LIMITED ACCESS RIGHT-OF-WAY		HISTORIC SITE EFFECTED	H	WETLAND IMPACT	
CONTROLLED ACCESS RIGHT-OF-WAY		WETLAND ID	B	POTENTIAL STORM WATER TREATMENT SITE	
RIGHT-OF-WAY		DELINEATED WETLAND		POTENTIAL STORM WATER TREATMENT SITE ID	1
PROPERTY LINES		TREE CLEARING		POTENTIAL CONTAMINATED SITE	
RAILROAD TRACKS		CUT SLOPE			
		FILL SLOPE			

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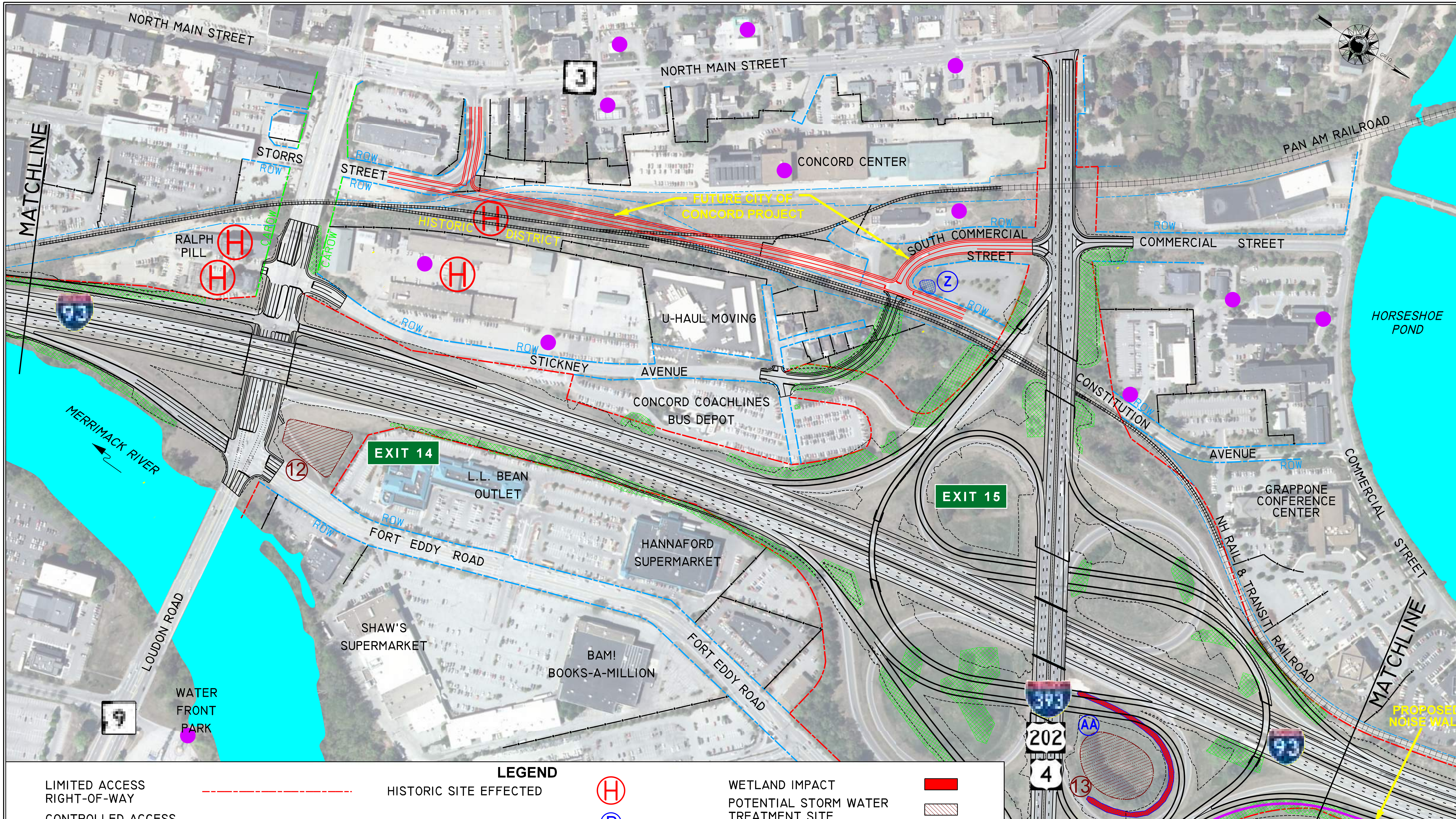
BOW-CONCORD I-93 IMPROVEMENTS

ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "F2")
EXIT 14 & 15 AREA

FIGURE 4.2-5

DATE: AUGUST 2018

SCALE: 1" = 300'



LEGEND

LIMITED ACCESS RIGHT-OF-WAY
CONTROLLED ACCESS RIGHT-OF-WAY
RIGHT-OF-WAY
PROPERTY LINES
RAILROAD TRACKS
HISTORIC SITE EFFECTED (H)
WETLAND ID (B)
DELINEATED WETLAND
TREE CLEARING
CUT SLOPE
FILL SLOPE
WETLAND IMPACT
POTENTIAL STORM WATER TREATMENT SITE
POTENTIAL STORM WATER TREATMENT SITE ID (1)
POTENTIAL CONTAMINATED SITE

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BOW-CONCORD I-93 IMPROVEMENTS

ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "F2")
EXIT 14 & 15 AREA

DATE: AUGUST 2018 | SCALE: 1" = 300'

FIGURE 4.2-6

LEGEND

LIMITED ACCESS RIGHT-OF-WAY		HISTORIC SITE EFFECTED	H	WETLAND IMPACT	
CONTROLLED ACCESS RIGHT-OF-WAY		WETLAND ID	B	POTENTIAL STORM WATER TREATMENT SITE	
RIGHT-OF-WAY		DELINEATED WETLAND		POTENTIAL STORM WATER TREATMENT SITE ID	1
PROPERTY LINES	ℙ ℙ	TREE CLEARING		POTENTIAL CONTAMINATED SITE	
RAILROAD TRACKS		CUT SLOPE			
		FILL SLOPE			

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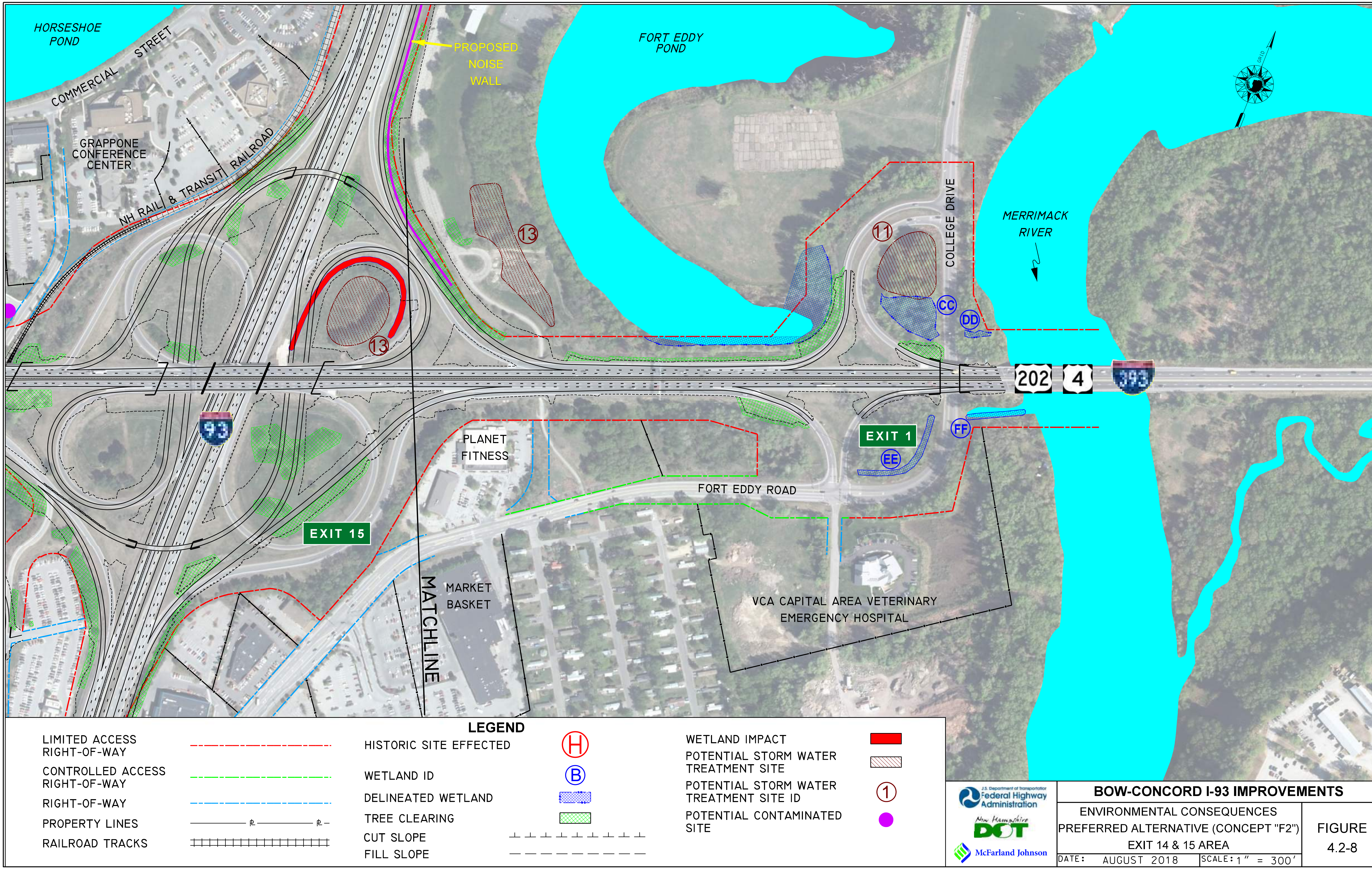
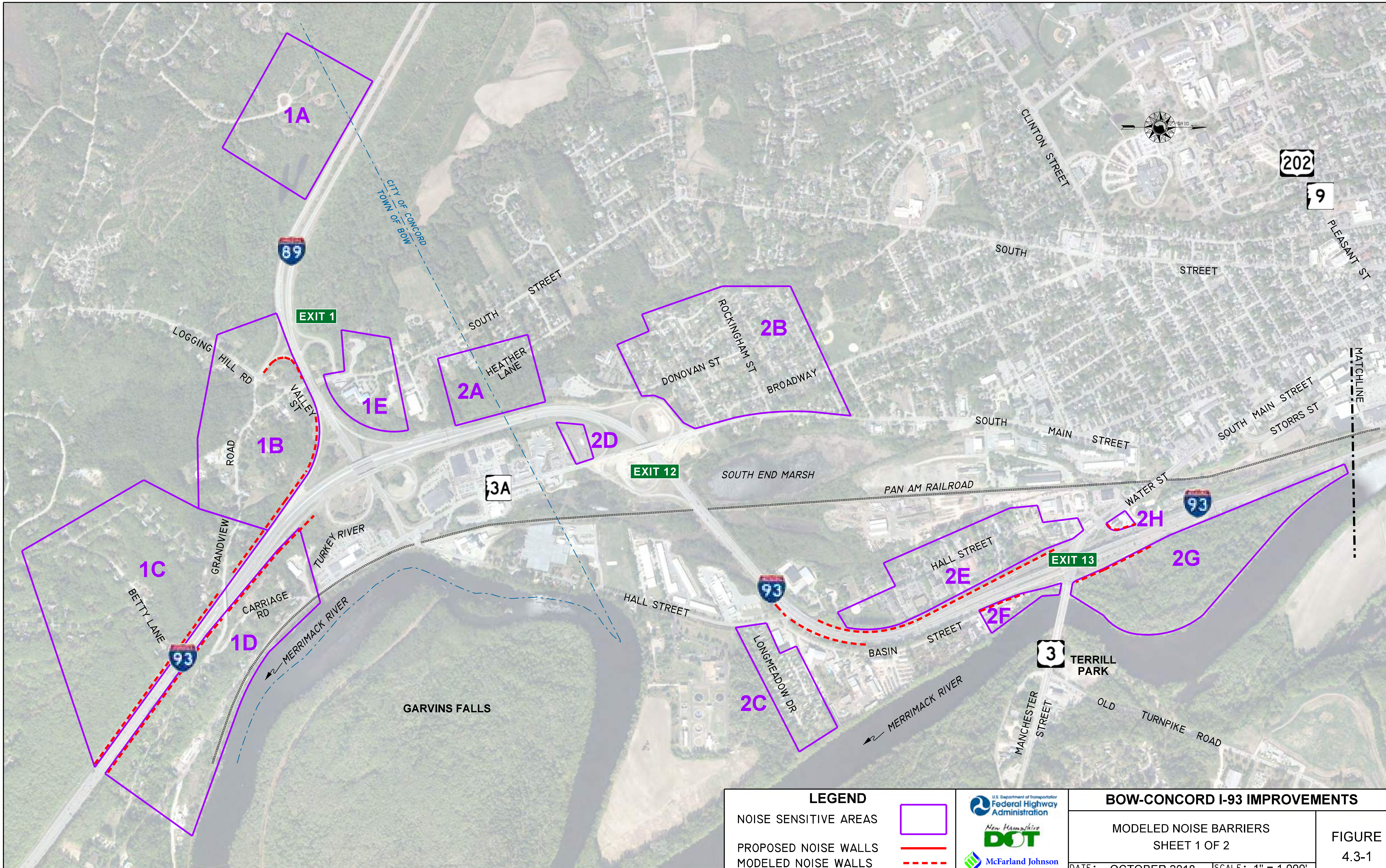
BOW-CONCORD I-93 IMPROVEMENTS

ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "F2")
EXIT 14 & 15 AREA

FIGURE 4.2-7

DATE: AUGUST 2018 SCALE: 1" = 300'


HORSESHOE POND
COMMERCIAL STREET
GRAPPONE CONFERENCE CENTER
NH RAIL & TRANSIT RAILROAD
PROPOSED NOISE WALL
FORT EDDY POND
COLLEGE DRIVE
MERRIMACK RIVER
13
13
11
CC
DD
EE
FF
202
4
393
93
EXIT 1
EXIT 15
PLANET FITNESS
FORT EDDY ROAD
MARKET BASKET
MATCHLINE
VCA CAPITAL AREA VETERINARY EMERGENCY HOSPITAL
LEGEND
LIMITED ACCESS RIGHT-OF-WAY
CONTROLLED ACCESS RIGHT-OF-WAY
RIGHT-OF-WAY
PROPERTY LINES
RAILROAD TRACKS
HISTORIC SITE EFFECTED
WETLAND ID
DELINEATED WETLAND
TREE CLEARING
CUT SLOPE
FILL SLOPE
WETLAND IMPACT
POTENTIAL STORM WATER TREATMENT SITE
POTENTIAL STORM WATER TREATMENT SITE ID
POTENTIAL CONTAMINATED SITE
U.S. Department of Transportation Federal Highway Administration
New Hampshire DOT
McFarland Johnson
BOW-CONCORD I-93 IMPROVEMENTS
ENVIRONMENTAL CONSEQUENCES
PREFERRED ALTERNATIVE (CONCEPT "F2")
EXIT 14 & 15 AREA
FIGURE 4.2-8
DATE: AUGUST 2018
SCALE: 1" = 300'



LEGEND

NOISE SENSITIVE AREAS

PROPOSED NOISE WALLS

MODELED NOISE WALLS

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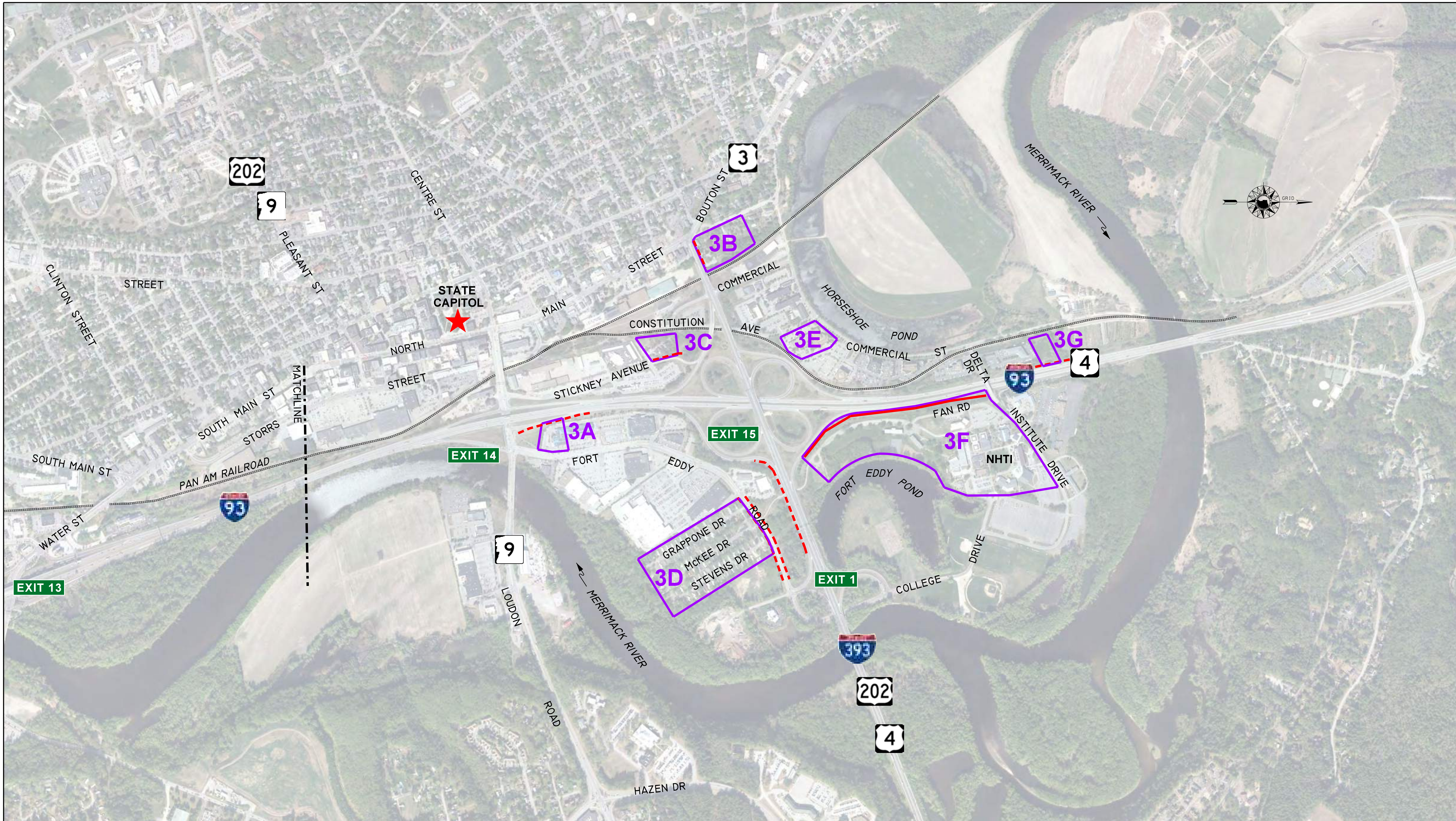
BOW-CONCORD I-93 IMPROVEMENTS

MODELED NOISE BARRIERS
SHEET 1 OF 2

FIGURE 4.3-1

DATE: OCTOBER 2018

SCALE: 1" = 1,000'



LEGEND	
NOISE SENSITIVE AREAS	
PROPOSED NOISE WALLS	
MODELED NOISE WALLS	

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BOW-CONCORD I-93 IMPROVEMENTS

MODELED NOISE BARRIERS
SHEET 2 OF 2

FIGURE 4.3-2

DATE: OCTOBER 2018 SCALE: 1" = 1,000'

Figure 4.4: Preferred Alternative Year 2035 Peak Hour Traffic Volumes

Chapter 5
Draft Section 4(f) Evaluation

5.1 Introduction

The project proposes improvements to the Interstate Route 93 (I-93) corridor between the Town of Bow and the City of Concord, Merrimack County, New Hampshire, a distance of approximately 4.5 miles from just south of the I-93/Interstate Route 89 (I-89) Interchange in Bow to just north of the I-93/Interstate Route 393 (I-393) Interchange (Exit 15) in Concord.

Under Section 4(f) of the Department of Transportation Act as amended by the Federal-Aid Highway Act of 1968 (Public Law 90-495, 49 USC 1653), the Secretary of Transportation shall not approve any program or project that “requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance as so determined by federal, state, or officials having jurisdiction thereof, or any land from a historic site of national, state or local significance as so determined by such officials unless (1) there is no feasible and prudent alternative to the use of such land, and (2) such program includes all possible planning to minimize harm to such park, recreation area, wildlife and waterfowl refuge, or historic site resulting from such use.”

A “use” of a Section 4(f) resource, as defined in 23 C.F.R. § 774.17, occurs 1) when land is permanently incorporated into a transportation facility (a direct use); 2) when there is a temporary occupancy of land that is adverse in terms of the statute’s preservationist purpose (a direct use), as determined by the criteria in 23 C.F.R. § 774.13(d); or 3) when there is a constructive use of land as determined by the criteria in 23 C.F.R. § 774.15. A constructive use of a Section 4(f) resource occurs when the transportation project does not incorporate land from the Section 4(f) resource, but the project’s proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features, or attributes of the resource are substantially diminished (23 C.F.R. § 774.15).

Resources afforded protection under Section 4(f) were identified through coordination with the NH State Historic Preservation Office (SHPO) and Federal Highway Administration (FHWA), as well as local organizations, local officials, and the public. Section 4(f) resources in the project area consist of properties eligible for the National Register of Historic Places and publicly owned recreation areas. There are no wildlife or waterfowl refuges in the project area.

This Section 4(f) Evaluation provides the required documentation to demonstrate that there is no prudent and feasible alternative to the use of Section 4(f) resources. This evaluation also outlines coordination that has occurred, and the measures proposed to minimize harm to these resources.

5.2 Purpose & Need

Purpose

The purpose of the Interstate Route 93 Bow-Concord project is to address the existing and future transportation needs for all users of this 4.5-mile segment of I-93, while balancing the needs of the surrounding communities, by providing a safe and efficient transportation corridor for people, goods, and services.

Need

The need for this project is demonstrated by deficiencies in capacity that result in increased congestion and increased travel times, as well as geometric deficiencies that create safety concerns. The project need is described in detail in Section 1.7.2 of the Environmental Assessment.

5.3 Existing Conditions

The segment of I-93 under study is located in central New Hampshire within the Town of Bow and the City of Concord, Merrimack County. This 4.5-mile segment of I-93 and the adjoining land area comprises the I-93 study area. The study area is depicted on **Figure 1.1**. This section of I-93 extends from south of the I-89/I-93 Interchange to north of I-393 where I-93 crosses over the Merrimack River. I-93 is a limited (fully controlled) access highway originally constructed in the late 1950s and early 1960s. This segment of I-93 is fed by a network of state and local roadways. Major roads include I-89, NH Route 3A, US Route 3 (Manchester/Water Street), NH Route 9 (Loudon Road), and I-393.

5.3.1 Capacity Concerns

I-93 through Bow and Concord is a four-lane divided urban principal arterial highway, a major roadway whose primary purpose is to move high volumes of traffic, with limited access provided only at interchanges. An additional lane exists southbound from Exit 12 and extends south of I-89. South of the project limits, I-93 is a six-lane divided urban arterial highway. The posted speed limit within the project area is 55 miles per hour (mph). The design speed within the project limits varies but exceeds 60 mph in most cases. The 60-mph design speed is acceptable for urban freeways according to the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Design Standards – Interstate System* and *A Policy on Geometric Design of Highways and Streets*.

I-93, as originally constructed in the late 1950s and early 1960s, was expected to carry 20,000 vehicles per day within its design life of 20 years. This 4.5-mile segment now serves almost 75,000 vehicles per day with peak summer travel at over 85,000 vehicles per day. While the traffic on I-93 has leveled over the last decade, 2016 had the highest AADT on record.

Just south of the I-93/I-89 Interchange, I-93 is reduced from six lanes to four lanes. This lane reduction, coupled with the traffic from I-89, results in congestion on I-93 entering and through Concord during peak periods. The traffic backup on northbound I-93 during peak periods can stretch as far south as the Hooksett Toll Booth, a distance of about seven miles from the interchange. The traffic backup on southbound I-93 during peak periods can stretch as far north as Exit 17, a distance of about five miles from the Merrimack River.

There are seven existing interchanges within the project limits. Details of each, as well as additional details on the roadway network, are provided in Section 1.4 of the Environmental Assessment.

5.3.2 Safety and Roadway Geometry Issues

There are several safety issues that exist along I-93 within the project limits. Many of these issues are to be expected with a transportation system that is approaching 60 years of age. The primary safety concerns involve inadequate weaving lengths and inadequate deceleration distances at exit ramps.

Inadequate weaving lengths occur in several places and are a result of interchanges located too close to one another. Inadequate deceleration distances exist at all four exit ramps at Exit 12. The four exit ramps have curved geometry with posted speed limits of 25 mph. The exit ramps leading to these curves are not of sufficient length for vehicles to comfortably decelerate outside the main flow of traffic on I-93 from 55 mph to 25 mph.

For the ten-year period from January 2007 to December 2016, a total of 2,195 crashes were reported to the NHDOT within the study area limits. These crashes occurred on I-93, I-89, I-393, the on and off ramps to each interstate, the intersections where the ramps terminate with other roadways, and these other roadways, all within the project limits. Of the 2,195 crashes, 512 resulted in 622 injuries, and there were 6 fatalities.

Section 1.6 of the Environmental Assessment provides additional information on safety concerns.

5.4 Overview of Build Alternatives

Within the project area there are seven full access interchanges that would be impacted by the widening of I-93. Each of these interchanges has its own issues and deficiencies that must be addressed to fully meet the project's purpose and need. Some of these interchanges are in close proximity to each other and must be evaluated together due to their interaction. Therefore, for the purposes of alternatives development, the project area has been separated into four segments:

- I-89 Area (Includes Exit 1 on I-89)
- Exit 12 Area
- Exit 13 Area
- Exit 14/15 Area (Includes Exit 1 on I-393)

Chapter 2 of the Environmental Assessment describes the multi-phased development of alternatives. The final range of build concepts that was considered is summarized below in **Table 5.1 Range of Build Alternatives**.

All build alternatives developed for the project include the widening of I-93 to a basic six-lane interstate from south of I-89 through Exit 15, as well as auxiliary lanes between interchanges.

Table 5.1 Range of Build Alternatives

Segment	Concept	Description
I-89 Area	C	Shifted I-89 Exit 1.
	K (Preferred)	Eliminate weaving between I-89 Exit 1 and I-93.
	P	Same as Concept K with all directional ramps between I-89 and I-93.
Exit 12 Area	E	Partial cloverleaf with signalized intersections.
	F (Preferred)	Partial cloverleaf with hybrid roundabout intersections.
Exit 13 Area	A	Retain Exit 13 with new signal for northbound exit ramp.
	B (Preferred)	Retain Exit 13 with new signal and dual right turn for northbound exit ramp.
Exit 14/15 Area	D2	Retain Exit 14 and 15 configurations except eliminate northbound entrance ramp at Exit 14.
	F	SPUI[1] at Exit 14 and cloverstack at Exit 15 with C-D[2] Roads between Exits 14 & 15.
	F2 (Preferred)	Retain Exit 14 configuration except eliminate northbound entrance ramp and cloverstack at Exit 15.
	O3	Flip Exit 14 orientation, depress I-93, directional ramps at Exit 15, C-D Road southbound between Exits 14 & 15.
[1] Single Point Urban Interchange [2] Collector-Distributor Road		

5.5 Description of Proposed Action

The proposed action within each project segment is summarized below. More details can be found in Chapter 2 of the Environmental Assessment.

5.5.1 – Interstate 89 Area/Exit 1 Concept K

Concept K retains the basic configuration of the I-89 Exit 1 and the I-93/I-89 interchanges; however, it proposes “braided” ramps between the two interchanges. The term “braid” refers to a grade separated crossing that occurs at an acute angle that resembles braids. The braided ramps eliminate the weaving section between the two interchanges. Additional ramps are proposed to allow retention of all the existing accesses, but without the need for vehicles to cross each other in a weave. See **Figure 2.6** for a plan of I-89 Area Concept K.

Concept K proposes a C-D Road for southbound I-89 traffic that would accommodate traffic utilizing Exit 1 and travelling southbound on I-93. The Exit 1 ramp would diverge from the C-D Road, which would continue and cross over the Exit 1 entrance ramp via a bridge. The Exit 1 entrance ramps would later split to accommodate traffic destined for northbound I-93, along I-89 south to the existing loop ramp area, and southbound I-93. Concept K proposes a connector road between Route 3A and South Street to accommodate northbound I-89 traffic. This connector road would provide access to South Street from Bow Junction. The southbound exit ramp from I-93 to northbound I-89 would cross, or braid, the connector road, thereby eliminating the existing northbound weave. A signal would be necessary at the intersection of South Street, the new connector road, and the I-89 northbound ramps. All improvements proposed by Concept K would be accommodated by the recently replaced bridges that carry I-93 over I-89 and the Turkey River as well as the existing bridge that carries the C-D Road over I-89 and the Turkey River. New bridges would be needed to realize the braided ramps for both I-89 segments between I-93 and Exit 1.

Concept K would include construction of a new directional ramp for northbound I-93 to northbound I-89 traffic. The new directional ramp proposed in Concept K would have a 40-mph design speed as compared to the existing loop ramp that has a 25-mph design speed. While the existing northbound C-D Road would remain, a significant portion of the traffic volume in the weave would be diverted since the northbound I-93 to northbound I-89 traffic would use the new directional ramp. The reduced traffic would result in an improvement of the weave from LOS F/F to LOS D/B by 2035. The existing loop would be reconfigured to terminate at the new connector road, which would provide an access route to Bow Junction from I-93 that currently does not exist. This connection also perpetuates the connection for northbound I-93 traffic to access South Street.

Providing the new directional ramp for northbound I-93 to northbound I-89 traffic would result in the elimination of the direct connection of the I-89 extension to Bow Junction. This traffic could still access Bow Junction, but would have a longer route to do so, using Exit 1 on I-89, Exit 12 on I-93, or the proposed I-93/I-89 interchange. This diversion of traffic is of concern, including for local businesses, as Route 3A is a truck route and many trucks use the Bow Junction intersection to access I-89. The additional traffic on South Street and Logging Hill Road would require that both Exit 1 ramp intersections be signalized. Improvements to Logging Hill Road would also be included to provide adequate sight distance near the southbound ramps intersection.

There are two structures within the I-89/Exit 1 Area that do not need to be modified to accommodate Concept K, but which would have routine preservation work conducted by the project. Routine preservation includes, but is not limited to, new pavement, new joints and protective membrane for bridges and concrete repairs for the culvert. The structures are:

- I-93 northbound C-D Road bridge over I-89 and the Turkey River
- I-89 over the Turkey River (box culvert)

Retaining walls would be required along several of the ramps to minimize property impacts and impacts to the Turkey River. These walls would be between 6 feet and 25 feet in height and would be adjacent to homes and businesses.

The total cost for Concept K is estimated at $70.0 million.

5.5.2 – Exit 12 Area Concept F

This alternative would consist of a partial cloverleaf with single exit and entrance ramps as hybrid roundabouts. A hybrid roundabout is one that has some two-lane movements and some one-lane movements. The southbound Route 3A traffic would have two lanes and the northbound traffic would have one lane. The northbound ramp intersection roundabout would also include a slip ramp for northbound Route 3A traffic entering northbound I-93. See **Figure 2.10** for a plan of Exit 12 Area Concept F.

The LOS at the southbound intersection roundabout would be LOS A/C and the northbound intersection roundabout would be LOS B/B by 2035.

Retaining walls would be required along southbound I-93 near the South End Marsh to avoid impacts to the City of Concord's sewer main and wetlands. Retaining walls would be required along the northbound entrance ramp to avoid impacts to the railroad, wetlands, and an existing wetland mitigation site.

The sidewalk along the west side of Route 3A would be retained. Also, shoulder/bike lanes would be provided in both directions of Route 3A within the project limits.

The total cost for Concept F is estimated at $33.9 million.

5.5.3 – Exit 13 Area Concept B

Concept B proposes retaining the existing configuration of Exit 13 with widening the northbound exit ramp to Manchester Street and the right turn would be signalized. The widening of the ramp would allow for a dual right turn onto Manchester Street to address the heavy volume of traffic. The backup issue on the ramp would be eliminated. See **Figure 2.13** for a plan of Exit 13 Area Concept B.

The widening of the ramp requires an approximately 160-foot bridge from the shore connecting to the existing bridge that carries Manchester Street over the Merrimack River. Property acquisition is also required. The existing bridge can accommodate the proposed ramp bridge. Retaining walls would also be required to avoid impacts to the river.

The total cost for Concept B is estimated at $39.0 million. Most of the cost for the Exit 13 Area Concept B is for the widening of I-93.

5.5.4 – Exit 14/15 Area Concept F2

Concept F2 includes a modified diamond interchange at Exit 14 where the northbound entrance ramp would be eliminated. The elimination of the entrance ramp at Exit 14 would also eliminate the northbound weave between Exits 14 and 15. This alternative would also include a southbound C-D Road between Exits 14 and 15, and a cloverstack interchange at Exit 15 where two of the loop ramps would be eliminated. The directional ramps for Concept F2 would have a design speed of 30 mph in order to eliminate impacts to the bus depot on Stickney Avenue. See **Figure 2.18** for a plan of Exit 14/15 Area Concept F2.

A retaining wall would be required along the east side I-93 south of Exit 14 at the “pinch point” to avoid impacts to the Merrimack River.

The total cost for Concept F2 is estimated at $125.0 million.

5.6 Description of Section 4(f) Properties

The project area contains publicly owned recreation trails and twelve historic sites located in three of the four project segments. Properties are listed in **Table 5.2** and shown in **Figure 5-1 Section 4(f) Resources Overview**. Refer to **Figures 5.2 to 5.10** for details on each 4(f) resource.

Historic properties within and adjacent to the project area consist of nine residential and commercial buildings and three historic districts. All are eligible for listing on the National Register. Each property is described in detail in inventory forms that are on file at the SHPO and NHDOT.

The project area contains two public recreational trail systems. The first trail system is a two-mile trail network located within Healy and Terrill Parks. A paved bicycle/pedestrian path located off Manchester Street at Exit 13 provides access to this trail system. The second trail system consists of approximately 3 miles of trails located between Exits 15 and 16 and includes both off-road and on-road sections of the New Hampshire Heritage Trail. Only a portion of this trail system is located within the project area. One trail segment starts off College Drive along the Merrimack River, continues on Institute Drive on the NHTI campus, crosses over I-93 on Delta Drive, and continues on Commercial Street along Horseshoe Pond. Another section of the Heritage Trail continues along the bike path that crosses the river between Delta Drive and Portsmouth Street. All sections of the Heritage Trail within the project area follow roads and a paved bicycle/pedestrian path that are all part of the existing transportation network. The Heritage Trail is a Statewide initiative that started in 1988 and seeks to provide a continuous trail corridor through New Hampshire from Massachusetts to Canada. It is the responsibility of communities along the corridor to identify and designate local trail segments. Currently, the Heritage Trail exists in only a few communities, and the segments in Concord remain discontinuous within the City.

The project also contains sections of paved bicycle/pedestrian paths that were constructed as part the interstate system to provide multi-modal connectivity. These segments are not continuous through the project area and do not function as recreational sites. One section of path is located in Bow at the I-89/I-93 interchange. The path starts at the end of Valley Street, which once connected to Route 3A prior to the construction of I-89. This path was constructed with the interstate to restore that connectivity for pedestrians and bicyclists. The path is within the I-89 ROW and is part of the transportation network. The Town of Bow identifies this bike path as a proposed connection to a proposed section of the Heritage Trail; however, the town has not begun any implementation of establishing the Heritage Trail and does not currently own or maintain the path. The path is not identified as a destination for recreation and was not constructed for recreation. There is no indication that the path could be considered a significant public recreational resource and, therefore, is not subject to Section 4(f) protection.

5.7 Impacts to Section 4(f) Properties

5.7.1 Historic Sites

Table 5.2 Section 4(f) Impacts from Proposed Alternative provides a summary of impacts, as well as avoidance and minimization measures.

Effects on historic properties were determined by the FHWA, NHDOT, and SHPO based on the Section 106 review process established by the National Historic Preservation Act of 1966 and outlined at 36 CFR 800.9. Based on that review, it has been determined that the proposed action would result in an adverse effect to two historic properties: Lamora's Garage and House and the Upton House and Store.

The proposed alternative would result in full or partial acquisition of three historic properties (Lamora's Garage and House; NH Highway Garage Historic District; and the NH Technical Institute Historic District) and would require permanent easements on one historic property (Boston, Concord & Montreal Railroad Historic District), resulting in a direct use of these 4(f) resources from the permanent incorporation of land into the transportation facility.

The proposed alternative would result in temporary impacts to two historic resources: The Concord Shoe Company/Ralph Pill Building and the Concord Electric Light Station. The boundary for each of these National Register eligible resources is each building and its immediate surroundings. It has been determined that impacts to both resources would meet the criteria for a temporary occupancy exception and, therefore, would not constitute a 4(f) use. According to 23 CFR 774.13(d), a temporary occupancy does not constitute a Section 4(f) use when all of the following conditions are satisfied:

1) Duration must be temporary, i.e., less than the time needed for construction of the project, and there should be no change in ownership of the land;

2) Scope of the work must be minor, i.e., both the nature and the magnitude of the changes to the Section 4(f) property are minimal;
3) There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis;
4) The land being used must be fully restored, i.e., the property must be returned to a condition which is at least as good as that which existed prior to the project; and
5) There must be documented agreement of the official(s) with jurisdiction over the Section 4(f) resource regarding the above conditions.

Loudon Road would be approximately seven feet closer to the Ralph Pill Building and eight feet closer to the Concord Electric Light Station but would remain within the existing Bridge Street right-of-way. Temporary impacts would be required for minor modifications to the shared driveway into the property on which these two resources are located. The duration of this work would be less than the time needed for construction of the project. The proposed driveway modifications would not require the purchase of property or permanent easements. This work would result in negligible change to the shared driveway and no adverse impacts to the features, activities, or attributes that make the resources eligible for the National Register. The driveway would be fully restored and repaved. The concurrence of the SHPO is documented in the Section 106 effect memo.

5.7.2 Parks and Recreation Areas

The proposed project would temporarily impact recreational trails. The first impact consists of the relocation of a 20 to 30 foot section of path within the Healy Park trail system. The trail would be relocated approximately 10 feet to the east to accommodate the widening of the Exit 13 NB off-ramp widening. The City of Concord Planning Department has no concerns with the proposed relocation (Appendix B, Exhibit 19). Trail connectivity would be maintained, and the proposed relocation would not constitute a 4(f) use.

The second impact consists of the replacement of the Delta Drive bridge over I-93. The bridge is on a section of an on-street trail identified as part of the Heritage Trail by the City of Concord. Although the City has designated the sidewalk on this bridge as part of the Heritage Trail, it is part of the local transportation system and functions primarily for transportation. Therefore, this section of the Heritage Trail is not subject to Section 4(f) protection and the proposed bridge replacement would not constitute a 4(f) use.

5.7.3 *De Minimis* Impact Determinations

The FHWA has made a *de minimis* impact finding for proposed impacts on three historic properties: the Boston, Concord, & Montreal Railroad Historic District; the NH Highway Garage Complex; and the NH Technical Institute Historic District. A *de minimis* impact is one that, after taking into account any measures to minimize harm (such as avoidance, minimization, mitigation, or enhancement measures), results in either: 1) a Section 106 finding of no adverse effect or no historic properties affected on a historic property; or 2) a determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or refuge for protection under Section 4(f).

Avoidance and minimization measures that were relied upon to make the *de minimis* impact findings are summarized in Table 5.2.

The concurrence of the SHPO is documented in the Section 106 effect memo (Appendix B).

Table 5.2 Section 4(f) Impacts from Proposed Alternative

Property	Project Segment	Property Location	Size of Property	Section 106 Effect Finding	Impact	Section 4(f) Use	Measures to Minimize Harm	Section 4(f) *de minimis* Impact Finding
Historic Sites								
Lamora's Garage and House	I-89	521 South St/1 Valley Rd, Bow	0.31 ac	Adverse Effect	Full acquisition	Permanent Incorporation	Impacts could not be minimized or avoided.	N/A
Upton House and Store	I-89	2 Valley Rd, Bow	0.5 ac	Adverse Effect	Visual setting	No Use – The impact to the visual setting would not result in substantial impairment to the property's activities, features, or attributes that make this property eligible for the National Register.	Direct use of the property was avoided; a new ramp would be located approximately 20' from the property boundary at its nearest point. A potential mitigation measure would consist of providing an aesthetic façade on the retaining wall.	N/A
8 Logging Hill Road	I-89	8 Logging Hill Rd, Bow	1.4 ac	No Effect	No Impact	No Use	All work near this resource would be limited to the existing right-of-way and will entail only minor roadway improvements.	N/A
Boston, Concord, & Montreal RR Historic District	Exit 14/15	Concord (adjacent to I-93 SB)	1.63 mi	No Adverse Effect	Permanent easement for slope grading and/or utilities (strip easement up to 1,500 linear feet)	Permanent Incorporation	Impacts to the rail line and associated structures were avoided.	*De minimis*
NH Highway Garage Complex Historic District	Exit 14/15	Stickney Ave, Concord	6.08 ac	No Adverse Effect	Partial acquisition for slope grading, sidewalk relocation (250 sq ft)	Permanent Incorporation	Impacts to the buildings on this property were avoided.	*De minimis*
NH Technical Institute Historic District	Exit 14/15	31 College Dr, Concord	196 ac	No Adverse Effect	Partial acquisition or permanent easements for slope grading and stormwater BMP (1.8 ac); proposed noise wall adjacent to property	Permanent Incorporation	All impacts will be located along the perimeter of the property and no buildings will be impacted. The proposed stormwater treatment area would be more than 1,000' from the campus buildings. The proposed noise wall would be located within existing right-of-way and NHDOT would continue to consult with the NHTI on an appropriate design and aesthetic treatment for the wall.	*De minimis*
Concord Shoe Company/Ralph Pill Building	Exit 14/15	22 Bridge St, Concord	Building and immediate surroundings	No Adverse Effect	Temporary impacts for driveway modifications	No Use - Exception for temporary occupancy	Loudon Road would be approximately 7' closer to the resource but would remain within the existing Bridge St. right-of-way. Driveway modifications would extend onto the property on which the resource is located.	N/A
Concord Electric Light Station	Exit 14/15	24 Bridge St, Concord	Building and immediate surroundings	No Adverse Effect	Temporary impacts for driveway modifications	No Use - Exception for temporary occupancy	Loudon Road would be approximately 8' closer to the resource but would remain within the existing Bridge St. right-of-way. Driveway modifications would extend onto the property on which the resource is located.	N/A
Robert J. Hart Building	Exit 14/15	50 Storrs St	3.49 ac	No Effect	No Impact	No Use	Project activities would be over 150' from this property.	N/A
207 North Main Street	Exit 14/15	207 North Main St, Concord	0.95 ac	No Effect	No Impact	No Use	Project activities would be over 1,200' from this property.	N/A
Carrigain House	Exit 14/15	224-246 North Main St, Concord	0.47 ac	No Effect	No Impact	No Use	Project activities would be over 1,200' from this property.	N/A
Rumford Arms	Exit 14/15	248-250 North Main St, Concord	0.75 ac	No Effect	No Impact	No Use	Project activities would be over 1,000' from this property.	N/A
Public Recreation Areas								
Bike/Pedestrian Path	Exit 13	Concord	2 mi	N/A	Relocation	No Use	Approx. 20'-30' of trail will be relocated approx. 10'. The continuity of the trail will be preserved	N/A
East Concord Heritage Trail	Exit 14/15	Concord	3 mi	N/A	Bridge replacement	No Use	The portion of the trail that will be impacted by the project consists of an existing public road and sidewalk (Delta Drive); the proposed bridge replacement on this road does not constitute a 4(f) use.	N/A

5.8 Avoidance Alternatives

An avoidance alternative is prudent and feasible if it avoids using the Section 4(f) property and does not cause other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) property. An avoidance alternative is not feasible if it cannot be built as a matter of sound engineering judgment. According to 23 CFR 774.117, an alternative is not prudent if:

(i) It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need (i.e., the alternative doesn't address the purpose and need of the project);
(ii) It results in unacceptable safety or operational problems;
(iii) After reasonable mitigation, it still causes:
 (a) Severe social, economic, or environmental impacts;
 (b) Severe disruption to established communities;
 (c) Severe disproportionate impacts to minority or low income populations;
 (d) Severe impacts to environmental resources protected under other Federal statutes;
(iv) It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;
(v) It causes other unique problems or unusual factors; or
(vi) It involves multiple factors in paragraphs (3)(i) through (3)(v) of this definition, that while individually minor, cumulatively cause unique problems or impacts of extraordinary magnitude.

A variety of concepts were studied in the Part A *Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study*. While many of these alternatives would avoid the use of the Section 4(f) resources described in this Section 4(f) Evaluation, they would result in the use of Section 4(f) resources located elsewhere along the corridor and would increase impacts to other protected resources.

The only project segment where more than a *de minimis* impact to Section 4(f) resources would occur under the proposed action is the I-89 Area. Alternatives that would avoid the use of Section 4(f) resources within the I-89 Area are described below.

De minimis use of Section 4(f) resources occurs in three of the four project segments. A *de minimis* impact determination is made after consideration of measures that have been incorporated into the project to minimize harm to the 4(f) resource. A use of Section 4(f) property having a *de minimis* impact can be approved by FHWA without the need to develop and evaluate alternatives that would avoid using the Section 4(f) property. For these reasons, avoidance alternatives are not included below for properties with *de minimis* impacts. Measures to minimize harm are summarized in Table 5.2.

5.8.1 Corridor Alternatives

5.8.1.1 – No Build

The No Build alternative assumes that no improvements would be made to the I-93 corridor or its interchanges to address capacity and operational issues within the project area. It is assumed that traffic volumes for the corridor would continue to increase based on projections prepared by the Central NH Regional Planning Commission (CNHRPC), and the increased volumes would result in increased congestion, especially during peak periods. Crashes would likely increase with the higher traffic volumes and existing deficiencies. Other aspects of the No Build alternative include the continued deterioration of Red List and other bridges.

This alternative would not address safety or capacity concerns in the corridor and would, therefore, not meet the purpose and need of the project. For these reasons, the no build alternative is not a feasible and prudent avoidance alternative and was eliminated from further consideration.

5.8.1.2 – Passenger Rail Service

There is currently no passenger rail service in the Concord region. Although a rail corridor exists for freight service, implementing passenger service would require large-scale, regional improvements to the rail line itself and to stations that would provide access to the line. For the purpose of this Section 4(f) Evaluation, it is assumed that these improvements would not necessitate the use of 4(f) resources.

The only passenger rail service currently in New Hampshire is Amtrak's Downeaster between Boston, MA and Portland, ME, which has stops in Exeter and Durham, NH, and the Vermonter between Washington, DC and St. Albans, VT, which has a stop in Claremont, NH. The potential for passenger rail from the Massachusetts border to Manchester has been under regional study but has not been actively pursued to date. Although passenger rail would address a portion of the congestion projected for the corridor, it would not address it completely. With a system-wide 10% reduction in trips, which would represent a highly successful transit/rail system, traffic model results indicate that there is enough background demand that congestion along I-93 would only marginally diminish. This alternative would also not address existing safety concerns that result from geometric deficiencies and would not fully meet the purpose and need of the project. For these reasons, this alternative is not a feasible and prudent avoidance alternative and was eliminated from further consideration

5.8.1.3 – Travel Demand Management/Travel System Management

Travel Demand Management (TDM) strategies aim to reduce the demand for travel during peak travel periods such as the morning and afternoon commuting times, rather than increase the capacity of the transportation system. These strategies require changing travel behavior during peak travel periods to reduce the number of vehicles on the road. By eliminating trips, shortening trips, or shifting trips out of the peak periods, there is less demand for the transportation network to accommodate. Typical TDM strategies include:

- Expanded Transit Service
- Park and Ride Facilities
- Work from Home
- Flexible Work Hours
- Toll Pricing
- Increased Law Enforcement
- High Occupancy Vehicle Lanes
- Car-Pooling

Transportation Systems Management (TSM) refers to low cost easy to implement measures to address safety and congestions issues. These measures typically can be implemented without significant impacts or cost. Typical TSM measures include:

- Intelligent Transportation Systems
- Ramp Metering
- New Traffic Signals
- Re-timing Traffic Signals
- Turn Lanes
- New Lane Striping
- Signage

On their own, these strategies do not fully address safety, capacity, and mobility concerns in the corridor. Therefore, TDM/TSM strategies do not constitute a feasible and prudent avoidance alternative. Although eliminated from further consideration as an avoidance alternative, TDM/TSM strategies have been incorporated into the proposed alternative where practicable.

5.8.2 Interstate 89/Exit 1 Area Alternatives

5.8.2.1 – Interstate 89/Exit 1 Area Concept C

Concept C proposes shifting Exit 1 further to the west to lengthen the weave between Exit 1 and the I-93 ramps to approximately 1,000 feet, which is less than the 2,000 feet recommended by AASHTO. Providing a longer weaving length does improve the operations of both the northbound and southbound weaves. The southbound weave would improve from LOS F/E to LOS D/C in 2035. The northbound weave would improve from LOS F/E to LOS B/B in 2035. Concept C does not address the weave for the northbound C-D Road within the I-93/I-89 Interchange. This concept replaces the I-89 Bridge over South Street, which is on the Red List. See **Figure 2.5** for a plan of I-89 Area Concept C.

The total cost for Concept C is estimated at $34.1 million.

The Upton House & Store, and Lamora's Garage and House would not be impacted. This alternative would, however, impact approximately 10 acres of Cilley State Forest, which is a substantial increase in impacts to this conservation land. Furthermore, this alternative would not address one weave, which would perpetuate safety concerns at that location and would not fully meet the project's purpose and need.

For these reasons, this alternative is not a feasible and prudent avoidance alternative and was eliminated from further consideration.

5.8.3 Avoidance Alternatives Summary

There are no feasible and prudent alternatives to the use of Lamora's Garage and House, a property that qualifies for protection under Section 4(f) as a National Register-eligible historic site.

5.9 Use Alternatives

Only alternatives considered for the I-89 Area are included below, since this is the only project segment with more than *de minimis* impacts to Section 4(f) resources. For detailed descriptions of alternatives considered for the remaining project segments, see Chapter 2.

5.9.1 Interstate 89/Exit 1 Area Concept P

Concept P is identical to Concept K (Proposed Action) except that it proposes new 50 mph directional ramps to replace both loop ramps at the I-93/I-89 Interchange. The northbound I-93 to northbound I-89 directional ramp proposed in Concept K would have a 40-mph design speed. All of the results discussed above in Section 5.5.1 for Concept K, concerning Exit 1 and the weaving between Exit 1 and I-93, would be the same for Concept P. The proposed southbound I-89 to northbound I-93 directional ramp would be a third level flyover bridge. See **Figure 2.7** for a plan of I-89 Area Concept P.

The new directional ramps at the I-93/I-89 Interchange eliminate the need for the existing C-D Road and eliminate the weave within the interchange. Concept P also proposes a ramp off the northbound I-93 to northbound I-89 ramp to the new connector road. This provides access to Bow Junction from I-93 that currently does not exist. The area once utilized for the northbound I-93 to northbound I-89 loop ramp could be used as a Park and Ride lot as shown in the plan for Concept P, **Figure 2.7**.

Retaining walls would be required along several of the ramps to minimize impacts to properties and impacts to the Turkey River. These walls would be between 6 feet and 25 feet in height and would be adjacent to homes and businesses. The proposed flyover ramp for Concept P would require a 40-foot high retaining wall along I-89 to allow the flyover ramp to rise adjacent to I-89. A retaining wall would also be required along I-93 northbound to minimize impacts to properties and impacts to Bow Brook.
This alternative would result in the same impacts to the Upton House & Store and Lamora's Garage and House as Concept K. This alternative would more than double wetland impacts.

The total cost for Concept P is estimated at $92.8 million.

5.10 Least Harm Analysis

No feasible and prudent alternative exists that would avoid the use of Section 4(f) resources in the project area and meet the project's purpose and need. When there are no feasible and prudent alternatives that avoid harm to a Section 4(f) resource, then only the alternative that causes the least overall harm in light of the statute's preservation purpose can be chosen. If the net harm to Section 4(f) resources in all the alternatives considered is equal, then any of the alternatives may be selected. In accordance with 23 CFR 774.3(c)(1), the least overall harm is determined by balancing the following seven factors:

1. Ability to mitigate adverse impacts to each Section 4(f) resource;
2. Relative severity of the remaining harm, after mitigation, to the protected activities and attributes or features;
3. Relative significance of each Section 4(f) property;
4. Views of the officials with jurisdiction over each Section 4(f) property;
5. Degree to which each alternative meets the purpose and need;
6. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f); and
7. Substantial differences in costs among alternatives.

Each of these seven factors is considered in **Table 5.3 Least Harm Analysis** for the feasible and prudent alternatives that were considered for the I-89 Area.

Table 5.3 Least Harm Analysis

Factor	I-89 Area Concept K (Proposed Action)	I-89 Area Concept P
1. Ability to mitigate adverse impacts	Mitigation for adverse impacts to Lamora's Garage & House and the Upton House & Store will be developed through consultation with SHPO and Consulting Parties and will be documented through an MOA signed by NHDOT, FHWA, and SHPO. Specific elements of mitigation have not yet been discussed. Potential mitigation could consist of providing further property documentation of the resources and/or aesthetic design elements.	Mitigation for adverse impacts would consist of the same potential components as would be considered under Concept K.
2. Relative severity of remaining harm after mitigation	This alternative would require the demolition of Lamora's Garage and House. Remaining harm to the Upton House & Store would be minimal since potential aesthetic design elements would reduce impacts to the visual setting of this property.	This alternative would require the demolition of Lamora's Garage and House. Remaining harm to the Upton House & Store would be minimal since potential aesthetic design elements would reduce impacts to the visual setting of this property.
3. Relative significance of each Section 4(f) property	The property on the east side of the road immediately south of I-89 includes a mid-20th century automotive garage (Lamora's Garage) at 521 South Street and a small, late nineteenth century, single family dwelling at 1 Valley Road. The house on this property was built in the 1880s, while the auto service garage was built c. 1947. This appears to be the only known example of auto-centric service needs of this type in the Town of Bow, which is a disappearing business model property type in the state. Although some post-1980 changes have occurred to the building, it retains a high level of integrity through its 1950s expansion and conveys the building's significance under Criterion A. Both buildings on the property contribute to the National Register-eligible property. The Upton House & Store is a well-preserved late19th-century building. The Queen Anne style dwelling has a basement-level commercial space and an ell with attached carriage barn topped by a cupola. It retains architectural details such as porches, bay windows, patterned cut shingles, stick work and gable ornament. The Upton House & Store is significant under Criteria A and C.	
4. Views of officials with jurisdiction	SHPO concurred that an adverse effect would result from the acquisition of the Lamora's Garage property and the construction of a ramp closer to the Upton House & Store.	SHPO concurred that an adverse effect would result from the acquisition of the Lamora's Garage property and the construction of a ramp closer to the Upton House & Store.
5. Ability to meet purpose and need	Both alternatives fully meet the project's purpose and need.	
6. Magnitude of impacts to non-4(f) resources	This alternative would result in approximately 0.7 acres of wetland impacts, 0.7 acres of impact to Cilley State Forest, and acquisition of 5 full parcels and 14 partial parcels.	This alternative would result in approximately 1.8 acres of wetland impacts, 0.7 acres of impact to Cilley State Forest, and acquisition of 5 full parcels and 16 partial parcels.
7. Substantial cost Differences	$70.0 million	$92.8 million

As detailed in Table 5.3, Concept K and Concept P would have the same impacts to two Section 4(f) resources: both alternatives would require the complete demolition of the structures on the Lamora's Garage property, and both alternatives would result in a Section 106 Adverse Effect to the Upton House & Store due to impacts to the visual setting. The most substantial differences between the two alternatives consist of cost and impacts to non-Section 4(f) resources. Concept K would result in less impact to private property and less impact to wetlands. Concept K would also cost $22.8 million less than Concept P. For these reasons, the I-89 Area Concept K would result in the least overall harm of the feasible and prudent alternatives that were considered for the I-89 Area.

5.11 Measures to Minimize Harm

When there is no feasible and prudent alternative to the use of a Section 4(f) resource, the project must include all possible planning to minimize harm to the Section 4(f) property. The design of the proposed action has been developed with the intent of minimizing the potential impacts to properties that are eligible for the National Register of Historic Places and to public recreational areas. Impacts to ten historic properties have been minimized or avoided altogether. However, it was determined that avoidance of a Section 4(f) adverse use of one historic property was not feasible and prudent.

Measures to minimize harm to each Section 4(f) resource are summarized in Table 5.2.

Much of the proposed widening of I-93 is symmetric, meaning the centerline of the corridor is retained and the widening occurs equally on both sides. This allows the widening to be completed within the existing right-of-way in most areas. Retaining walls are proposed in several locations to avoid additional impacts to environmental and cultural resources and to reduce impacts outside of the existing right-of-way.

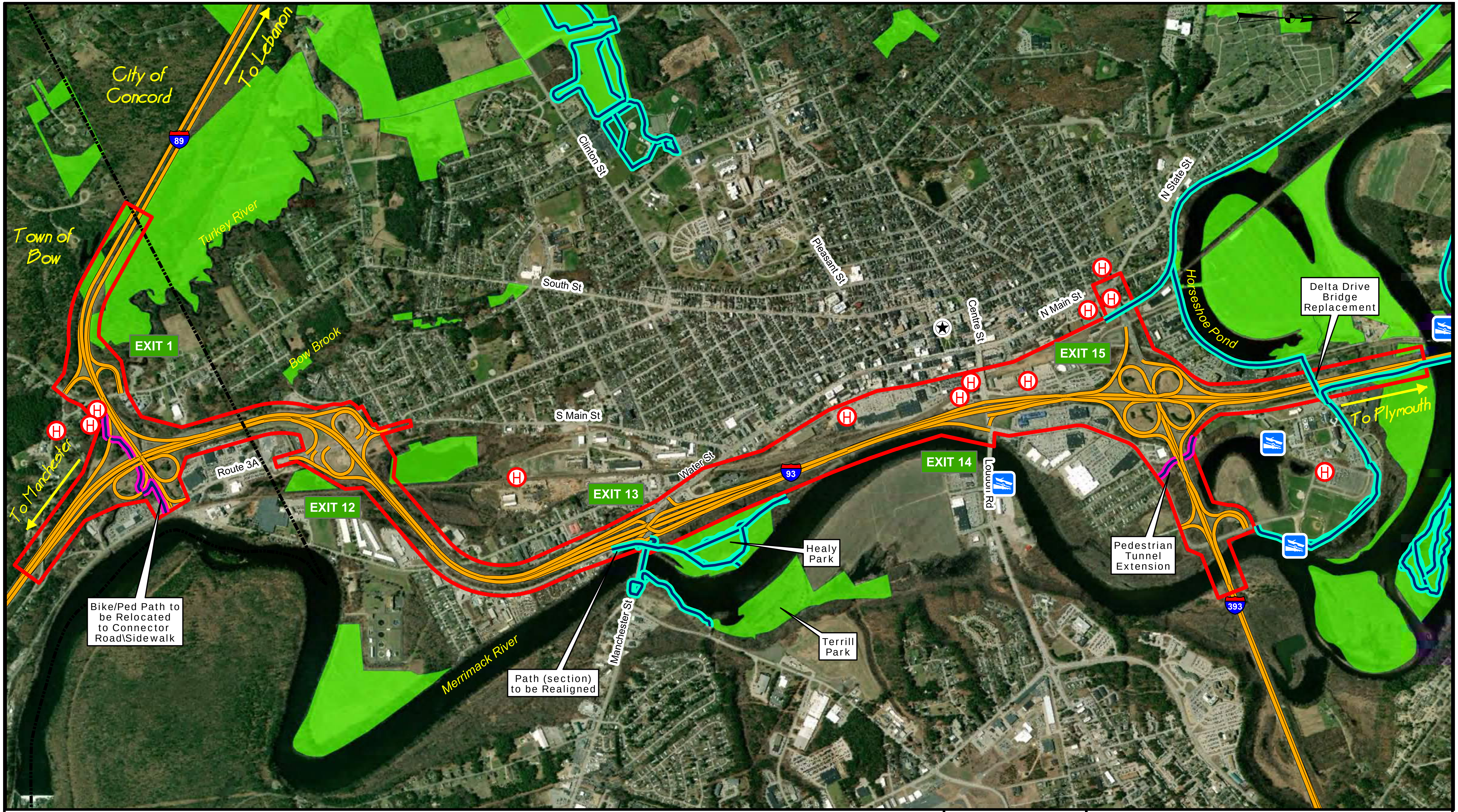
Measures to mitigate for the proposed impacts to historic sites will be documented in a Memorandum of Agreement (MOA) that will be submitted to the Advisory Council on Historic Preservation and signed by NHDOT, FHWA, and SHPO.

5.12 Coordination & Public Participation

The Department has coordinated with SHPO, FHWA, Consulting Parties, and City officials to discuss alternatives and measures to minimize harm to Section 4(f) resources. To date, the project has been reviewed at seven NHDOT Cultural Resource Agency Coordination Meetings. There has also been extensive public involvement throughout the development of this project. Chapter 7 of the Environmental Assessment summarizes public involvement.

5.13 Concluding Statement

To be completed in the Final 4(f) Evaluation.



Legend

- ★ State Capital
- Public Water Access
- Bike/Ped Path
- Trails
- Study Area
- Conservation Lands
- Historic Property

0 500 1,000 2,000 Feet

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

McFarland Johnson

BOW-CONCORD I-93 IMPROVEMENTS

SECTION 4(f) RESOURCES OVERVIEW

FIGURE 5.1

DATE: AUGUST 2018

SCALE: 1"=1500'

\\Mjnh-fs\m\17841.00 Bow Concord 193 Part B\Draw\GIS\EA Figures\5-1 Section 4(f) Resources.mxd

Figure 5.2: Lamora's Garage and House

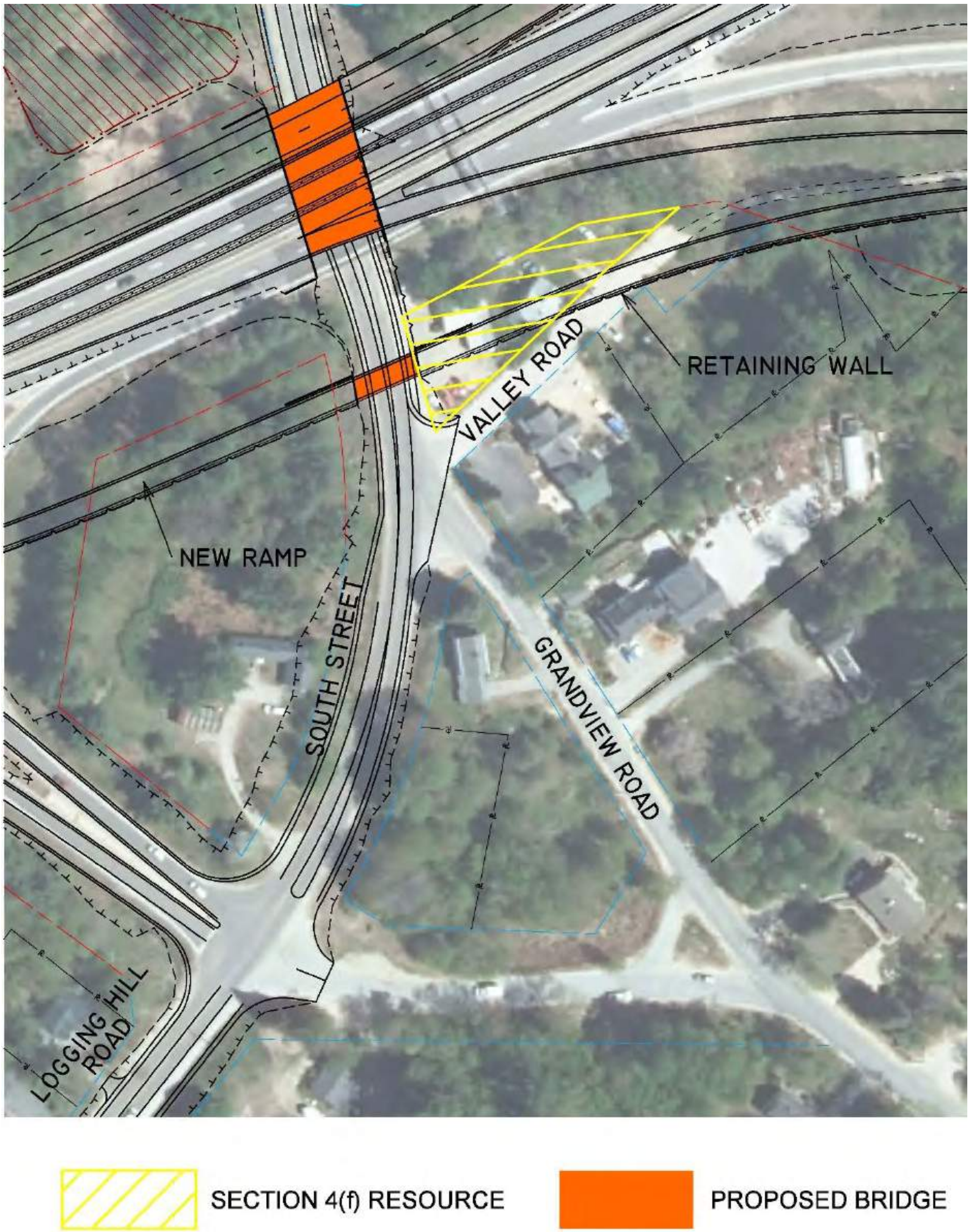


Figure 5.3: Upton House and Store

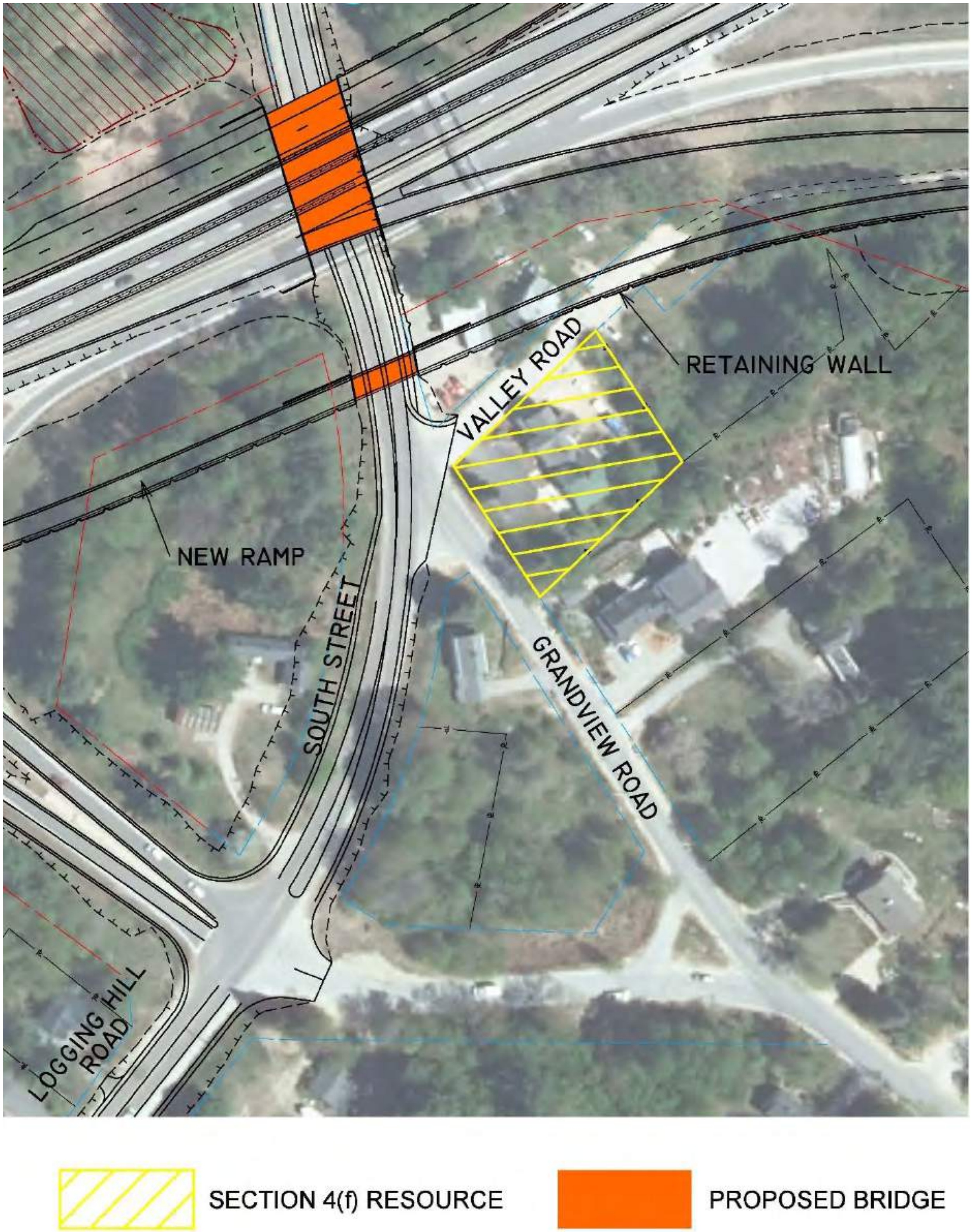


Figure 5.4: Boston, Concord, & Montreal Railroad Historic District

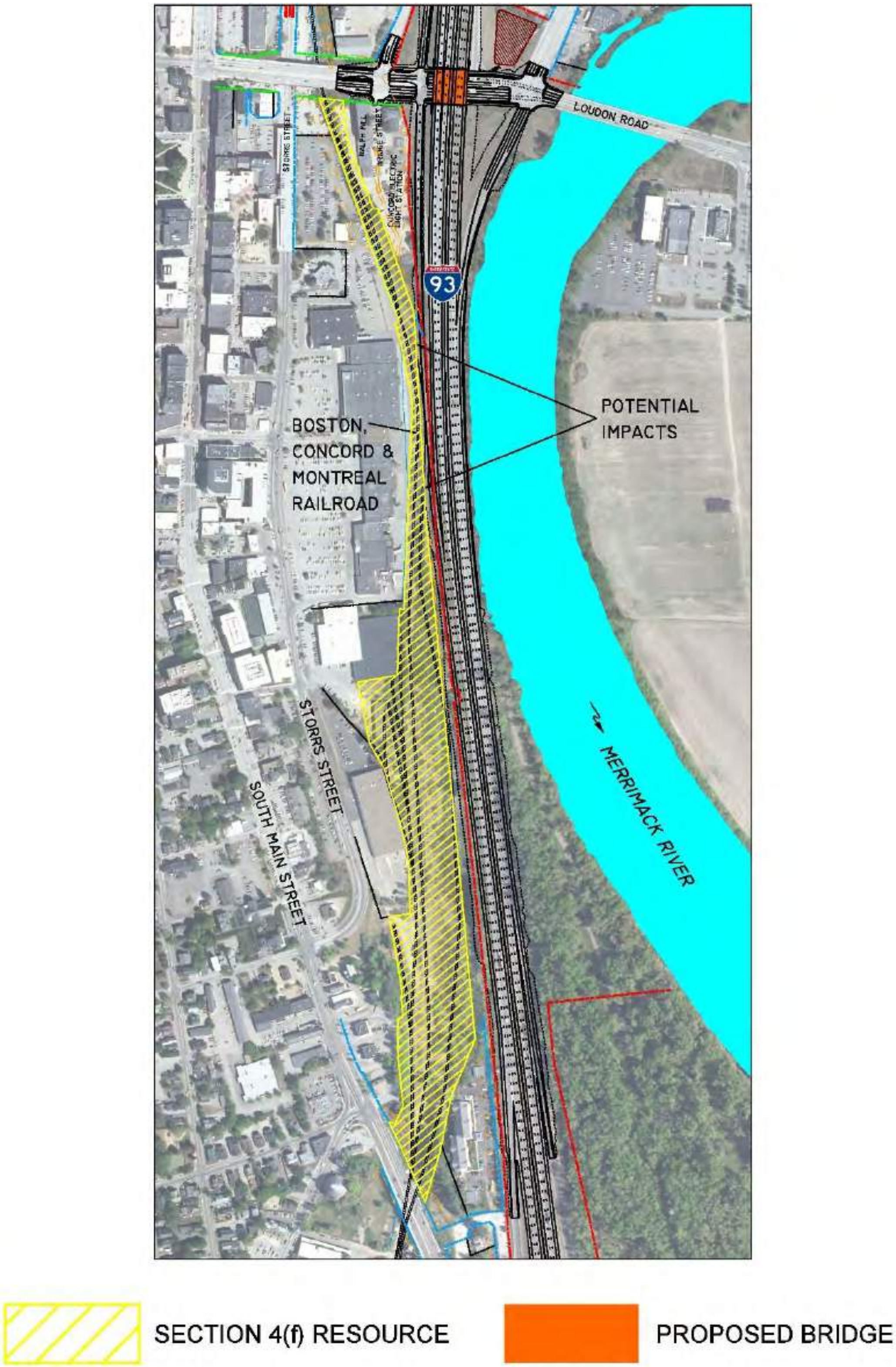


Figure 5.5: NH Highway Garage Complex Historic District

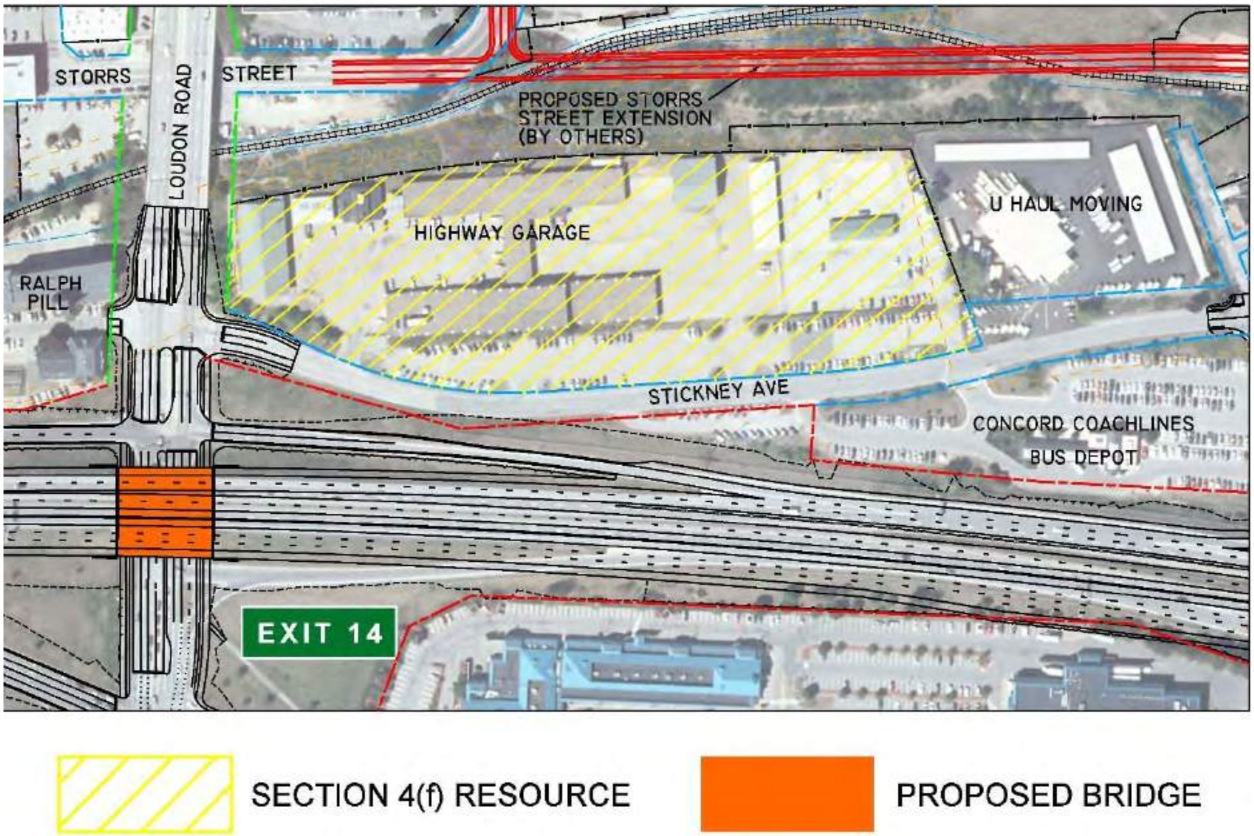


Figure 5.6: NH Technical Institute Historic District

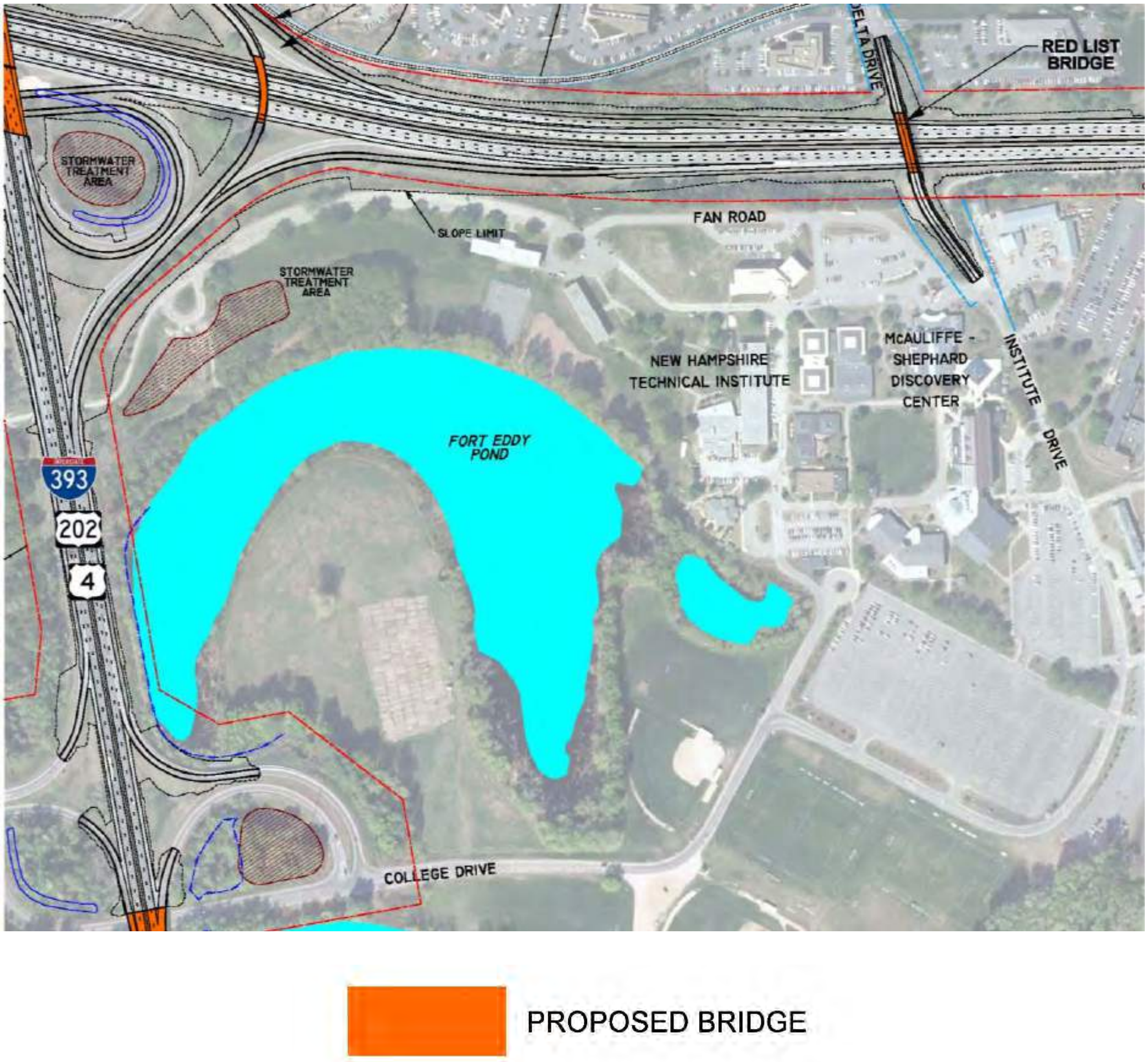


Figure 5.7: Concord Shoe Company/Ralph Pill Building

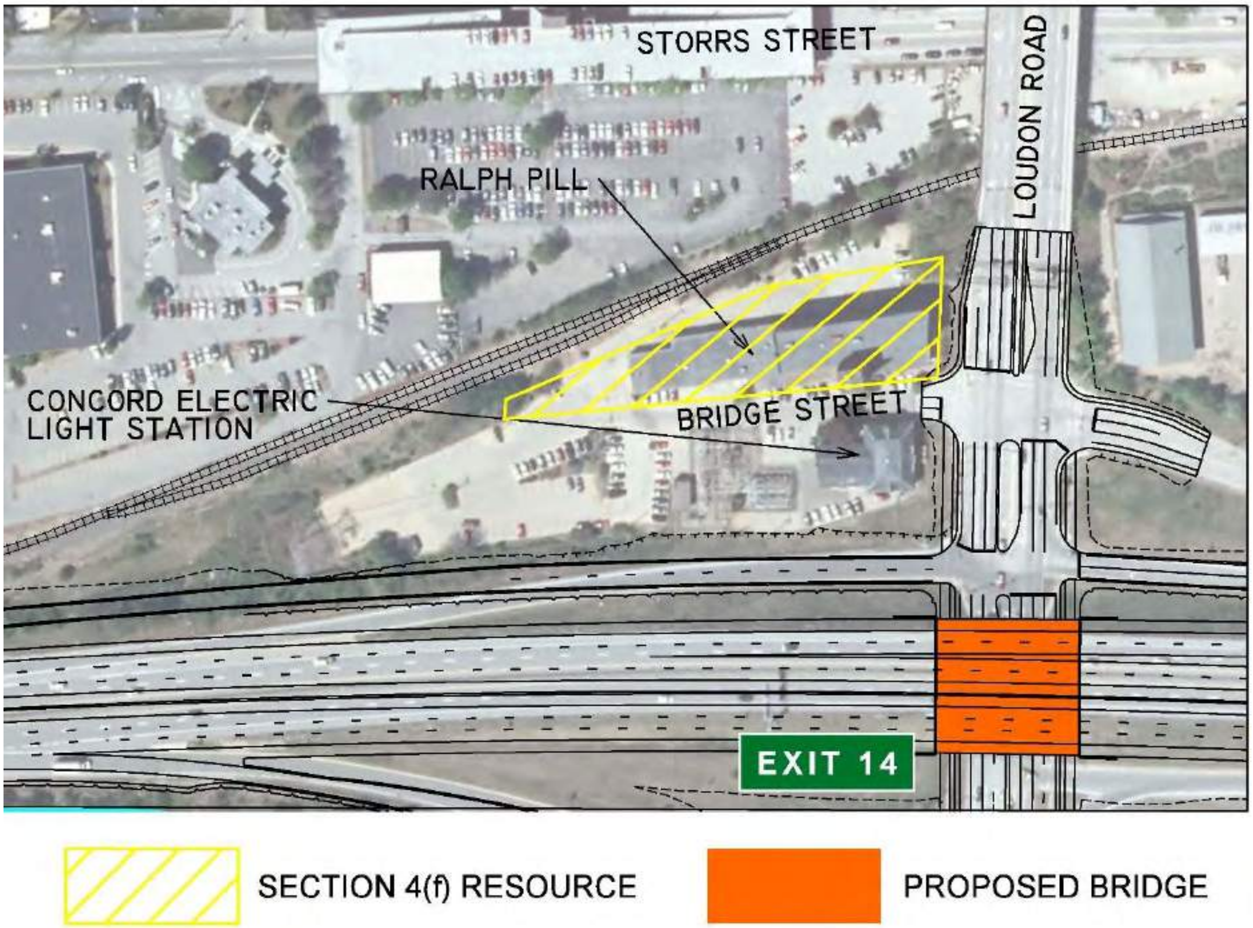


Figure 5.8: Concord Electric Light Station

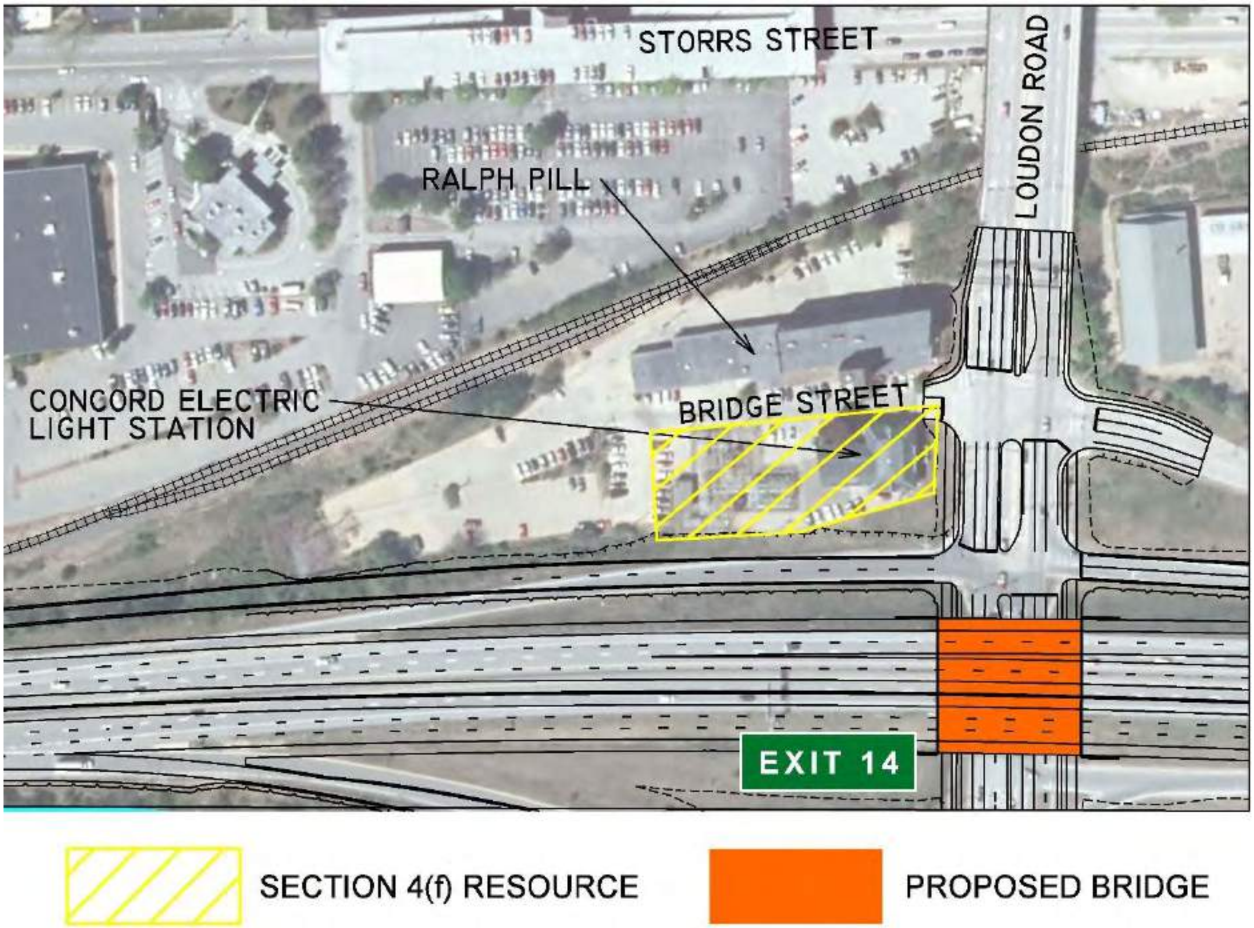


Figure 5.9: Bike/Pedestrian Path

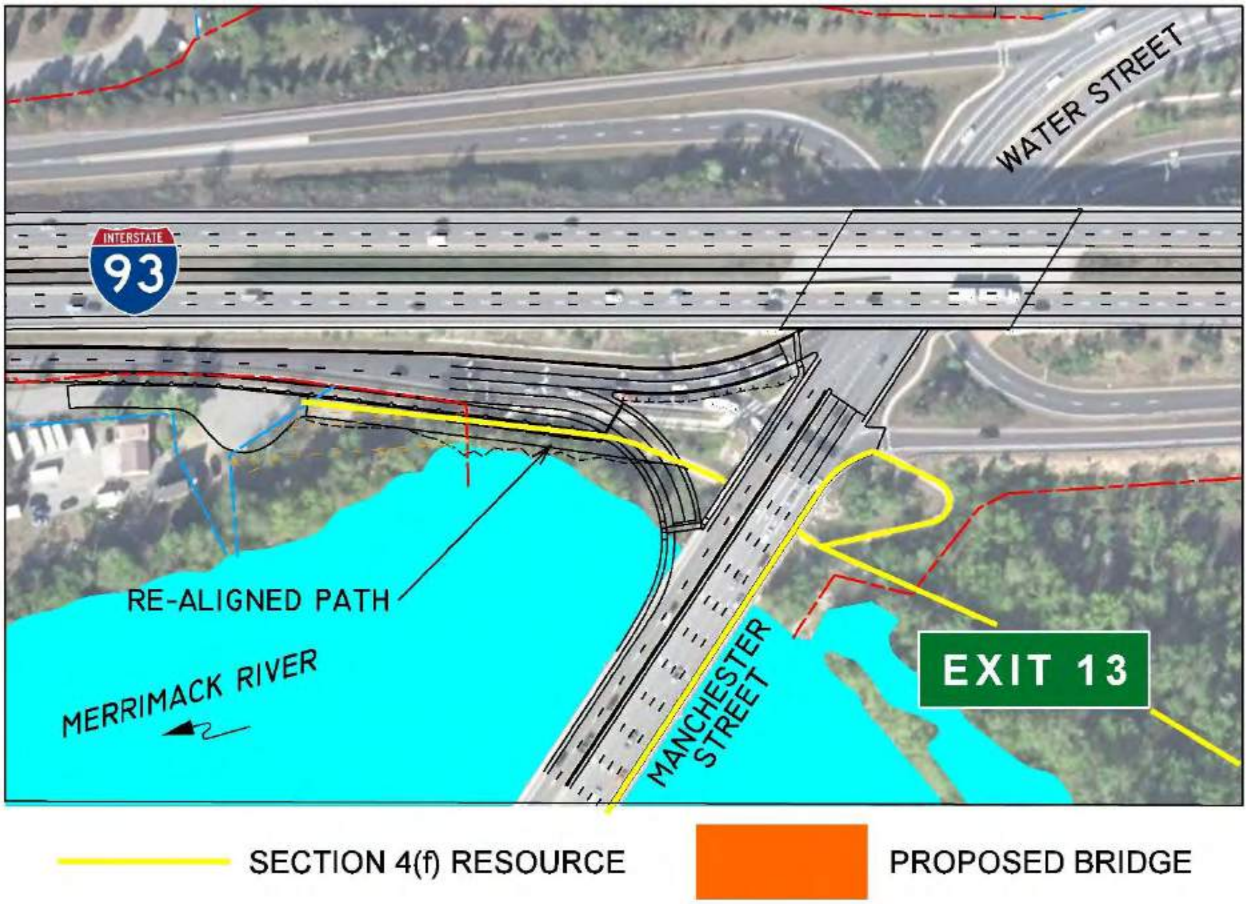
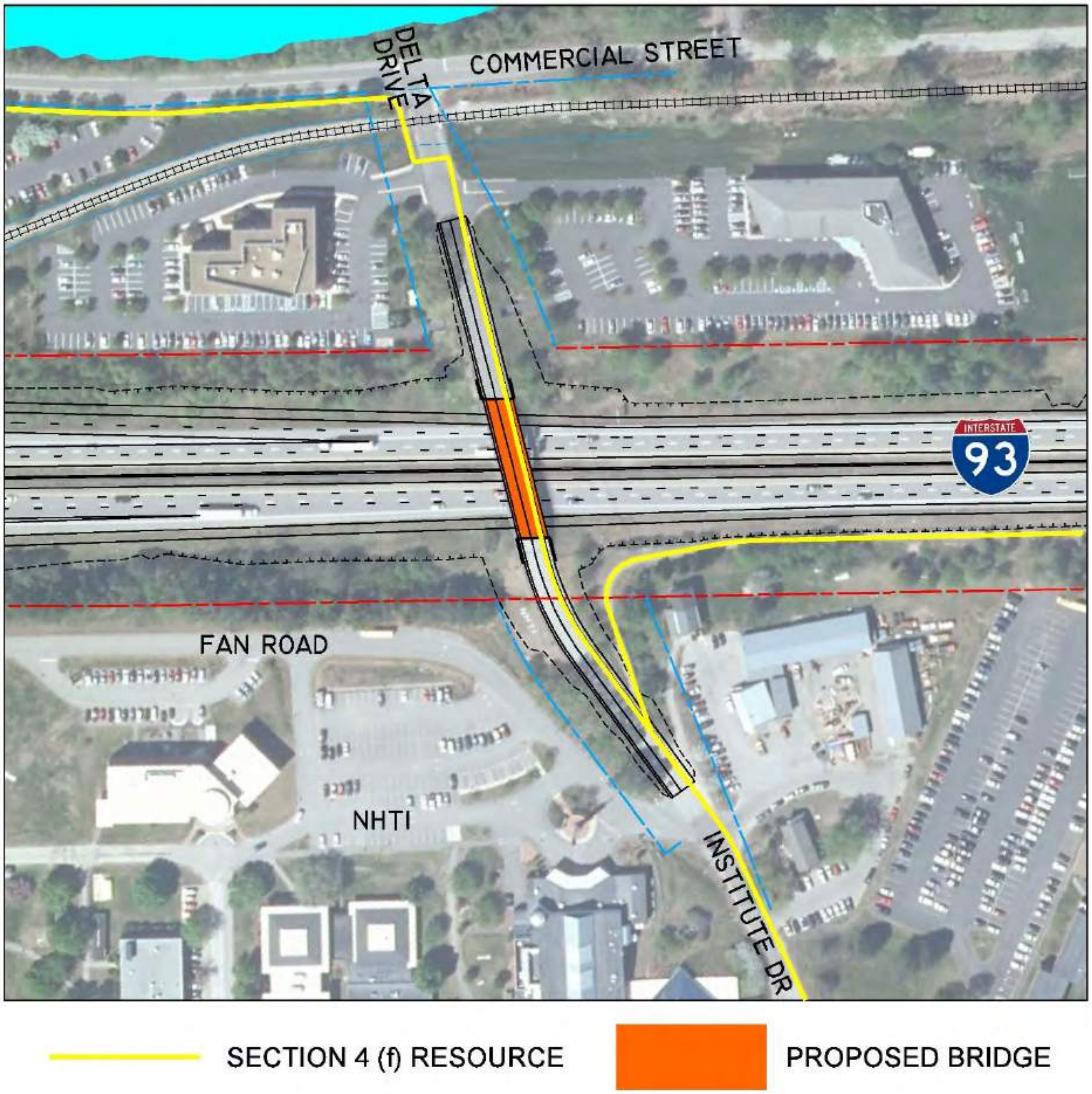


Figure 5.10: East Concord Heritage Trail



Chapter 6
Environmental Commitments

The following commitments have been made to ensure that environmental impacts are avoided or minimized and that the project remains in compliance with applicable regulations as the project progresses through Final Design and Construction. The NHDOT Bureau responsible for ensuring successful implementation of each commitment is shown in parentheses.

6.1 Commitments to be Carried Out During Final Design

NHDOT shall continue to coordinate with NH DES, the Town of Bow and City of Concord Conservation Commissions, and other municipal staff as appropriate, for the purpose of determining the appropriate wetland mitigation for the project and whether local wetland mitigation sites are available. In addition, local conservation organizations, shall be contacted to determine if appropriate wetland mitigation projects exist in the vicinity of the project. If appropriate projects are not identified, mitigation will be in the form of an in-lieu fee payment into the NHDES Aquatic Resources Mitigation Fund. (Environment) (Section 4.7)

The project is located within Public Water Supplies Wellhead Protection Areas and over an aquifer. Coordination shall occur with the NH DES Drinking Water and Groundwater Bureau to implement, as appropriate, measures to avoid adverse impacts to these resources from the proposed action. (Environment/Design) (Section 4.5)

All floodway and floodplain impacts, temporary and permanent, shall be reviewed with the Bureau of Environment and the NH Floodplain Management Program (OSI) to determine if further coordination with the US Army Corps of Engineers is warranted. (Environment/Design) (Section 4.6)

Impacts to conservation land shall be coordinated with the appropriate agencies/entities and mitigation measures shall be incorporated. (Right-of-Way/Environment/Design) (Section 4.8)

All appropriate wetland and shoreland permits from the NH Department of Environmental Services and US Army Corps of Engineers shall be obtained prior to the commencement of any work within jurisdictional wetlands, surface waters or the 250’ protected shoreland of the Turkey River and the Merrimack River. (Environment/Design) (Section 4.7)

Any EFH conservation recommendations received from NOAA shall be considered in the final design of the project. (Environment/Design) (Section 4.10)

Coordination with the NHDOT Contamination Program shall occur in regard to: 1) depth and extent of excavation adjacent to remediation sites within the corridor; 2) the need for further investigations into potentially contaminated sites that may be disturbed; 3) the need for further investigations regarding Limited Reuse Soils; and 4) the need for further investigations regarding the presence of Per- and Polyfluoroalkyl Substances (PFASs). (Environment/Design) (Section 4.15)

Appropriate water quality treatment and coordination with the NHDES Watershed Management Bureau shall occur prior to construction as the project area that is located within the City of Concord may be subject to MS4 requirements prior to the commencement of construction (Environment/Design). (Section 4.5.3)

Right-of-Way negotiations for acquisitions and/or easements on potentially contaminated parcel(s) shall not begin until the NHDOT Contamination Program has completed its review of the parcel(s). (Environment/Right-of-Way/Design) (Section 4.13.1)

Contract documents shall contain language to ensure proper handling and disposal of any Asbestos Containing Material found on bridges, structures or other locations within the project limit. (Environment/Design) (Section 4.15)

Appropriate language shall be included in contract documents to require the Contractor to provide public notice in advance of any necessary closures of any recreational use or public facility. (Environment/Design) (Section 4.13.5)

All stipulations of the Section 106 Memorandum of Agreement shall be carried out in accordance with the time frame specified in the Agreement. (Environment) (Section 4.12)

Bicycle and pedestrian connections shall be maintained. (Right-of-Way/Design) (Section 4.13.5)

NHDOT will continue to coordinate with stakeholders during final design to incorporate aesthetically appropriate landscaping into the proposed project. (Design/Environment) (Section 4.14)

Additional consultation and/or studies shall be conducted to determine if the brook floater, a state endangered species, is located within the Merrimack River near the project area. (Environment) (Section 4.11.2.2)

NHDOT shall continue to coordinate with NH F&G during final design regarding potential impacts to state listed species, including any newly listed species that may be within the project area. (Environment) (Section 4.11.1.2 and 4.11.2.2)

NHDOT shall continue to coordinate with USFWS during final design regarding potential impacts to Federally listed species, including any newly listed species that may be within the project area. (Environment) (Section 4.11.1.1 and 4.11.2.1)

NHDOT has identified one feasible and reasonable noise barrier adjacent to the NHTI campus. Coordination with the benefitted receptors on the design and reasonableness of this barrier is ongoing and shall be considered during final design. Should this barrier remain feasible and reasonable, it shall be incorporated into the design of the project. (Environment) (Section 4.4)

6.2 Commitments to be Carried Out Prior to Earth Disturbance

This project will require a Notice of Intent and Storm Water Pollution Prevention Plan (SWPPP) under the NPDES Construction General Permit. There shall be provisions in the contract requiring the Contractor to prepare the SWPPP and NOI. (Environment/Construction) (Section 4.5)

The project area contains plants that are on the NH List of Prohibited Invasive Species (AGR PART 3802.01) (purple loosestrife, bush honeysuckle, and Japanese knotweed). Locations of these plants shall be shown on construction plans. The Contractor shall prepare an Invasive Species Control and Management Plan, for the Department’s approval, to summarize all appropriate BMPs to be implemented during construction to manage and prevent spreading the plants to new sites. (Environment/Construction) (Section 4.11.3)

The Northern Long-Eared Bat Flyer shall be shared with all operators, employees, and contractors working on the project and operators, employees, and contractors shall be made aware of all applicable environmental commitments. (Environment/Construction) (Section 4.11.2.1)

The project will impact Limited Reuse Soils. The contractor will prepare a Soil Management Plan. Any spillage of oil or oil-based products during construction shall be promptly reported to the regulatory agencies as appropriate. (Environment/Construction) (Section 4.4)

6.3 Commitments to be Carried Out During Construction

The project is located within Wellhead Protection Areas and over an aquifer. Stringent best management practices shall be utilized to prevent adverse impacts to water quality. (Construction) (Section 4.5)

Construction of this project is anticipated to cause temporary increases in noise and dust levels within the project area. Standard measures shall be employed to ensure such increases are minimized to the extent practicable and limited to the construction period. (Construction) (Section 4.18)

Access to all homes and businesses shall be maintained throughout construction. (Construction) (Section 4.18)

All forested habitat within the project area is potential habitat for the northern long-eared bat. Therefore, tree removal shall be limited to what is specified on project plans and clearing limits shall be marked with flagging or fencing to ensure that all construction personnel stay within clearing limits. (Construction) (Section 4.9.1.2)

All sightings of dead or sick bats shall be immediately reported to the Bureau of Environment (603- 271-3226). (Construction) (4.9.1.2)

NHDOT shall continue to coordinate with regulatory agencies on the appropriate measures to be taken during construction to avoid adverse impacts to water quality for impacts within and adjacent to waterways containing Essential Fish Habitat (EFH). (Construction) (Section 4.10)

NHDOT shall incorporate wildlife friendly erosion control measures into the project design and require the contractor to comply with these measures. (Design/Construction) (Section 4.18)

The contractor shall be required to recycle pavement millings. (Construction) (Section 4.18)

Chapter 7
Coordination and Consultation

The following is a summary of the coordination and consultation that has occurred with the resource agencies, Town of Bow, City of Concord, other stakeholders, and the general public during development of the project alternatives and the preparation of the EA.

Table 7.1 Part B Public Participation Activities chronologically lists the public participation activities and their purpose. The dates, locations and purpose of these meetings are included.

Table 7.1 Part B Public Participation Activities

Activity	Date	Purpose
Project Website	2010 to present	Informed the public on project details and provided contact information for the Project Manager.
City of Concord Officials Meeting	August 26, 2016	Presented the project and the alternatives under study. Solicited feedback from City Officials.
Town of Bow, Town Planning Department	Sept 12, 2016	Presented the project and the alternatives under study. Solicited feedback from Town Officials.
Town of Bow, Planning Board Meeting	October 6, 2016	Presented the project and the alternatives under study. Solicit feedback from Planning Board members.
Central New Hampshire Regional Planning Commission	December 7, 2016	Presented the project and the alternatives under study including the traffic data. Solicited feedback from Commission members.
Concord Chamber of Commerce	December 12, 2016	Presented the project and the alternatives under study including the traffic data. Solicited feedback from the Chamber members.

City of Concord Transportation Advisory Committee	December 15, 2016	Presented the project and the alternatives under study including the traffic data. Solicited feedback from Committee members.
Central New Hampshire Regional Planning Commission Annual Full Commission Meeting	January 12, 2017	Presented the project and the alternatives under study. Solicited feedback from Commission members.
City of Concord Officials Meeting	February 17, 2017	Presented the project and the alternatives under study. Solicited feedback from City Officials.
City of Concord Officials Meeting	March 10, 2017	Presented the project and the alternatives under study. Solicit feedback from City Officials.
Town of Bow, Public Informational Meeting	May 31, 2017	Presented the project, its purpose and need, the alternatives under study, the NEPA process and the environmental, cultural and social resources in the study area. Feedback was solicited from the general public, officials and stakeholders in attendance. The project schedule was presented.
City of Concord, Public Informational Meeting	June 1, 2017	Presented the project, its purpose and need, the alternatives under study, the NEPA process and the environmental, cultural and social resources in the study area. Feedback was solicited from the general public, officials and stakeholders in attendance. The project schedule was presented.
Natural Resource Agency Meeting held at NHDOT	August 16, 2017	Presented the project and the alternatives under study in relation to the natural resources within the corridor and the anticipated impacts and mitigation measures. Feedback was solicited from the agency representatives.

City of Concord Officials Meeting	November 17, 2017	Presented the project and the alternatives under study. Solicit feedback from City Officials.
Town of Bow, Public Information Meeting	February 14, 2018	Presented the project, its purpose and need, and the selection of the preferred alternative. The NEPA process and the environmental, cultural and social resources in the study area, as well as the anticipated impacts to resources were presented. Feedback was solicited from the general public, officials and stakeholders in attendance. The project schedule was also presented.
City of Concord, Public Informational Meeting	February 15, 2018	Presented the project, its purpose and need, and the selection of the preferred alternative. The NEPA process and the environmental, cultural and social resources in the study area, as well as the anticipated impacts to resources were presented. Feedback was solicited from the general public, officials and stakeholders in attendance. The project schedule was also presented.
Natural Resource Agency Meeting held at NHDOT	February 21, 2018	Presented the project and the selection of the preferred alternative in relation to the natural resources within the corridor and the anticipated impacts and potential mitigation measures. Feedback was solicited from the agency representatives.
Cultural Resource Agency Meeting at NHDOT	March 12, 2018	Presented the project and the alternatives under study in relation to the cultural resources within the corridor and the anticipated impacts and mitigation measures. Feedback was solicited from the agency representatives.

NHTI	April 6, 2018	Presented the project and the potential noise implications related to the NHTI campus.
City of Concord, engineering staff	May 1, 2018	Presented the preferred alternative to the Engineering staff of the City of Concord.
City of Concord Officials Meeting	May 4, 2018	Presented the preferred alternative to the Engineering staff of the City of Concord
NHF&G	May 8, 2018	Presented the project and the selection of the preferred alternative in relation to the natural resources within the corridor and the anticipated impacts and potential mitigation measures. Feedback was solicited from the agency representatives.
City of Concord Transportation Advisory Committee	May 24, 2018	Presented the preferred alternative to the City of Concord TPAC. Addressed questions raised by members of the committee.
Town of Bow, Board of Selectmen and Planning Board	June 7, 2018	Presented the project, the alternatives considered, and the preferred alternative within the Town of Bow. Addressed questions raised by members of the two town boards.
Cultural Resource Agency Meeting at NHDOT	June 14, 2018	Specific impacts to historic resources were discussed with agency representatives.
Bow Rotary Club	June 22, 2018	Presented the project, the alternatives considered, and the preferred alternative within the Town of Bow. Addressed questions raised by members of the Rotary Club.
NHDOT Public Hearing	November 14, 2018	Formal presentation of the project to the public.

Appendix A
List of Preparers

The following includes a list of document preparers including their qualifications, years of experience and responsibilities.

Federal Highway Administration

Jamison Sikora
NH Division Environmental Program Manager
B.S., Civil Engineering, Norwich University
A.S., Architectural and Building Engineering Technology, Vermont Technical College
Responsibilities: Document Review/NEPA Compliance

New Hampshire Department of Transportation

Donald Lyford, P.E.
Project Manager
B.S., Civil Engineering, University of New Hampshire
Responsibilities: Project Management

John Butler, P.E.
Project Engineer
B.S., Civil Engineering, University of New Hampshire
Responsibilities: Design Review

Rebecca Martin
Senior Environmental Manager
B.S. Ecology & Environmental Science, University of Maine
M.S. Ecology & Environmental Science, University of Maine
Responsibilities: Principle Environmental Reviewer/NEPA Compliance

Marc Laurin
Senior Environmental Manager
B.A., Biology, Potsdam State University of New York
Responsibilities: Principle Environmental Reviewer/NEPA Compliance

Jonathan Evans
Air & Noise Program Manager
B.S., Environmental Science, Coby-Sawyer College
Responsibilities: Air and Noise Review

Stephanie Monette
Contamination Program Manager
B.S. Biology & Environmental Science, Muhlenberg College
M.S. Environmental Science, Rochester Institute of Technology
M.S. Civil (Geotechnical) Engineering, Syracuse University
Responsibilities: Hazardous Materials Review

McFarland Johnson, Inc.

Eugene W. McCarthy, P.E.
Senior Project Manager
B.S., Civil Engineering, San Jose State University
Responsibilities: Overall Project Manager and Lead Engineer

Brian Colburn, P.E., CPESC
Senior Transportation Manager
B.S., Civil Engineering, Rensselaer Polytechnic Institute
Responsibilities: Project Engineer

Scott Ozana, EIT
Junior Engineer
B.S., Civil Engineering, University of New Hampshire
Responsibilities: Alternatives Development

Jed Merrow, CWS
Senior Environmental Analyst
M.S. Natural Resources Science, University of Rhode Island
B.A. Anthropology, Middlebury College
Responsibilities: Environmental Analysis, QAQC

Jennifer L. Zorn, AICP
Senior Planner
M.A., Environmental Management, Montclair State University
B.S., Environmental Planning and Design, Rutgers University
Responsibilities: NEPA/Environmental Manager

Christine Perron, CWS
Senior Environmental Analyst
B.S., Biology, Plymouth State University
Responsibilities: NEPA Compliance, Section 4(f)

Stephen Hoffmann
Environmental Analyst
B.S., Environmental Science, Wildlife Biology minor, University of Vermont
Responsibilities: NEPA Compliance

Jordan Tate
Environmental Analyst
B.S., Environmental Science, University of New England
Responsibilities: NEPA Compliance/Report Assistance

Robert Luchini, P.E.
Assistant Engineer
B.S., Civil Engineering, University of Massachusetts, Dartmouth
Responsibilities: Air Quality

Elizabeth Colburn
Environmental Analyst
M.S., Building Conservation, Rensselaer Polytechnic Institute
B.A., History, Keene State University
Responsibilities: Cultural Resources

Applied Economic Research

Russell Thibeault, Economist and Real Estate Analyst
President
M.A. Regional Planning, University of North Carolina
B.A., Planning/Economics, University of New Hampshire
Responsibilities: Prepare growth projections and Analyze economic and real estate implications of the alternatives

Carol R. Johnson and Associates

Johnathan Law, L.A.
Senior Associate
Graduate Diploma in Landscape Architecture, Leeds Metropolitan University, UK
B.A., Landscape Architecture, Leeds Metropolitan University, UK
Responsibilities: Visual Resources

Independent Archeological Consultants

Jacob Tumelaire, MA, RPA
Project Archaeologist
M.A., Anthropology, Northern Arizona University
Responsibilities: Pre-Contact Native American sensitivity

Jessica Cofelice, MA, RPA
Project Archaeologist
M.A., American and New England Studies, University of Southern Maine
Responsibilities: Historic Euroamerican sensitivity assessment

Kathleen Wheeler, PhD, RPA
Principal Investigator
PhD., Anthropology, University of Arizona
Responsibilities: Principal Investigator and Senior Cultural Research

Nobis Engineering

James P. Ricker, P.G.
Director, State and Municipal Services
B.S., Geology, University of New Hampshire
Responsibilities: Hazardous materials survey

Nicholas Zanchi, EIT
Staff Engineer
B.S., Civil and Environmental Engineering, UMass Amherst;
M.S., Environmental Engineering, UMass Amherst
Responsibilities: Hazardous materials survey

Joshua R. Stewart, ADS
Project Scientist
B.S., Environmental Science, University of Vermont
Responsibilities: Hazardous Materials Evaluation Report

Preservation Company

Lynne Emerson Monroe
Principal
Advanced Studies in Historic Preservation: Boston University
B.F.A., University of Pennsylvania
Responsibilities: Project Historian

Laura B. Driemeyer
Architectural Historian
Ph.D., American and New England Studies, Boston University,
MA., Art History, San Francisco State University
B.A., Smith College
Responsibilities: Project Historian

Kari Ann Laprey,
Architectural Historian
M.A., Preservation Studies from Boston University (1991)
B.A., Anthropology, University of Massachusetts
Responsibilities: Project Historian

Reagan B. Ruedig
Historian
M.S., Historic Preservation, University of Pennsylvania
M.A., Art History and Archaeology, The Institute of Fine Arts at New York University
B.A., Duke University
Responsibilities: Project Historian

Resilience Planning & Design, LLC

Steven Whitman, AICP
Principal
Years of Experience: 20
Doctoral Candidate, Master of Arts in Regional Planning, UMass Amherst
B.A., Marine Affairs, University of Rhode Island
Responsibilities: Land Use and Impacts Inventory and Analysis

Resource Systems Group

Erica Wygonik, P.E.
Director
PhD, Civil & Environmental Engineering, University of Washington
M.S.E., Civil & Environmental Engineering, University of Washington
B.E., Engineering, Dartmouth College
B.A., Cognitive Science, Dartmouth College
Responsibilities: Regional and Project Traffic Modeling

Ben Swanson
Traffic Modeler
B.A., Astrophysics, Connecticut College
Responsibilities: Regional and Project Traffic Modeling

Transystems

Evan Lowell, P.E.
Senior Vice President
B.S., Civil Engineering, University of Massachusetts-Lowell
Responsibilities: QA/QC for Rail and Transit Assessment Report and Noise Analysis

Allene Rieger, P.E.
Senior Civil Engineer, Boston Office Rail Team Leader
B.S., Civil Engineering, Virginia Polytechnic University
Responsibilities: Principle for development of Rail and Transit Assessment Report

Larissa Brockman
Civil Engineer
B.S., Civil Engineering, Moscow University of Civil & Structural Engineering
Responsibilities: Development of Rail and Transit Assessment Report

Amber Taylor, MA, RPA
Senior Environmental Scientist
M.A., Historical Archaeology – Illinois State University
B.A., History and Anthropology – Ohio State University
Responsibilities: Noise Analysis

William Grace
Environmental Planner
B.S., Forest Management, University of New Hampshire
Responsibilities: Wetland Delineation

APPENDIX B

Exhibit 1

Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

To: Christine Perron, McFarland Johnson
53 Regional Drive
Concord, NH 03301

From: Amy Lamb, NH Natural Heritage Bureau
Date: 4/16/2018 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau

NHB File ID: NHB18-1058

Town: Bow, Concord

Location: I-93 Improvement Project from Bow (beginning south of the I-93/I-89 interchange) to Concord (ending north of Exit 15 prior to crossing Merrimack River), approximately 4.5 miles in length. NHDOT #13742.

Description: I-93 through Bow and Concord is a four-lane divided urban principal arterial highway with limited access, meaning access is provided only at interchanges. South of the project limits, I-93 is a six-lane divided urban arterial highway. The basic purpose of the project is to improve transportation efficiency and reduce safety problems within this approximately 4.5-mile segment of highway.

cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: Please note: Common Nighthawk and Bald Eagle were included in this review, but were not included in the previous NHB review for this project (NHB16-1357). Please also note that the *sugar maple - silver maple - white ash floodplain forest* included in the previous review was recently re-evaluated and determined to not be exemplary. This site is within an area flagged for possible impacts on the state-listed *Alasmidonta varicosa* (brook floater) in the Merrimack River. Please contact the NH Fish & Game Department.

Invertebrate Species	**State[1]**	**Federal**	**Notes**
Brook Floater (*Alasmidonta varicosa*)	E	--	Contact the NH Fish & Game Dept (see below).

Natural Community	**State[1]**	**Federal**	**Notes**
Silver maple - false nettle - sensitive fern floodplain forest	--	--	Threats are primarily changes to the hydrology of the river, land conversion and fragmentation, introduction of invasive species, and increased input of nutrients and pollutants.

Vertebrate species	**State[1]**	**Federal**	**Notes**

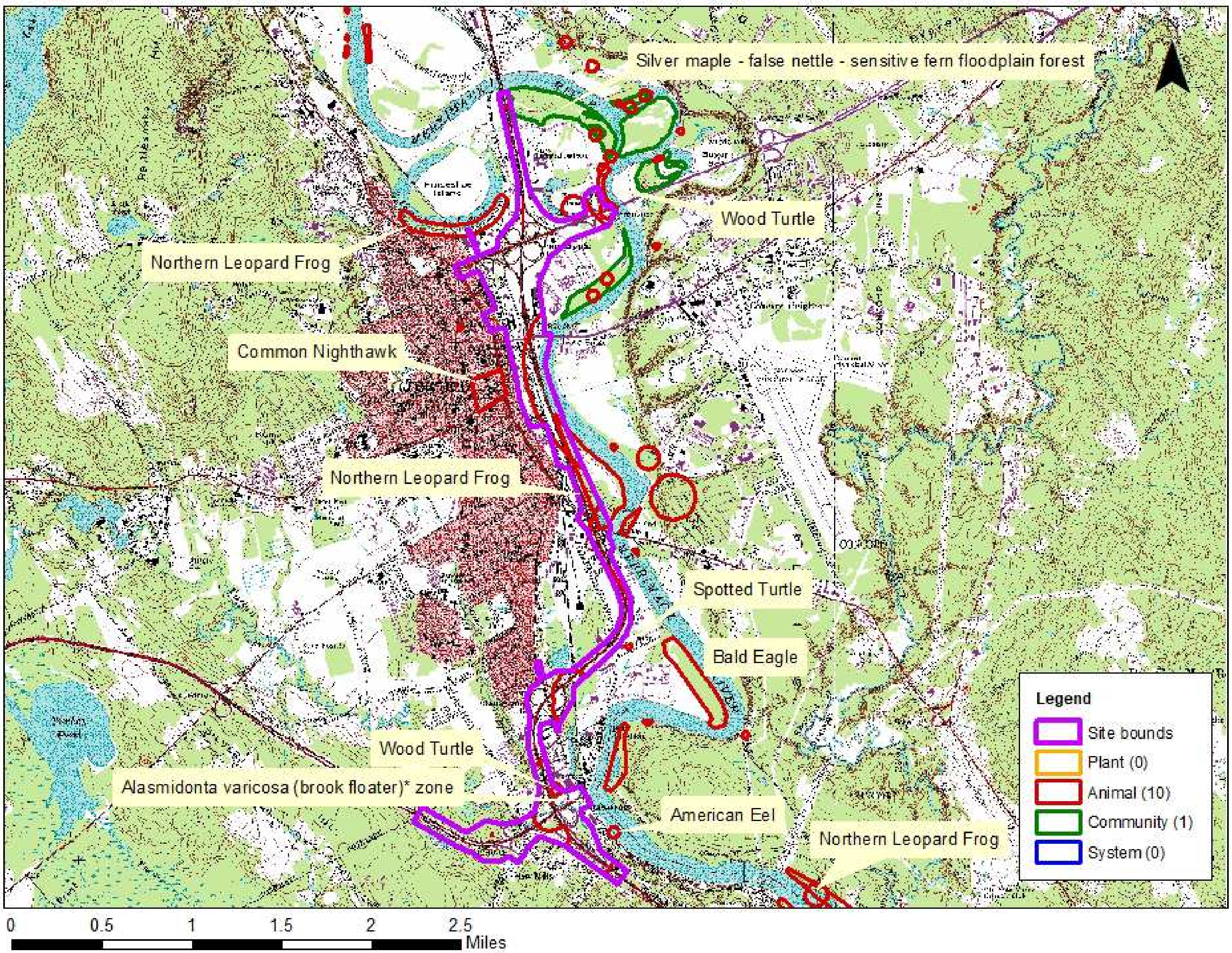
American Eel (*Anguilla rostrata*)	SC	--	Contact the NH Fish & Game Dept (see below).
Bald Eagle (*Haliaeetus leucocephalus*)	SC	--	Contact the NH Fish & Game Dept (see below).
Common Nighthawk (*Chordeiles minor*)	E	--	Contact the NH Fish & Game Dept (see below).
Northern Leopard Frog (*Lithobates pipiens*)	SC	--	Contact the NH Fish & Game Dept (see below).
Spotted Turtle (*Clemmys guttata*)	T	--	Contact the NH Fish & Game Dept (see below).
Wood Turtle (*Glyptemys insculpta*)	SC	--	Contact the NH Fish & Game Dept (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, “SC” = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

NHB18-1058



Silver maple - false nettle - sensitive fern floodplain forest
Wood Turtle
Northern Leopard Frog
Common Nighthawk
Northern Leopard Frog
Spotted Turtle
Bald Eagle
Wood Turtle
Alasmidonta varicosa (brook floater)* zone
American Eel
Northern Leopard Frog
Legend
Site bounds
Plant (0)
Animal (10)
Community (1)
System (0)
0
0.5
1
1.5
2
2.5
Miles

New Hampshire Natural Heritage Bureau - Community Record

Silver maple - false nettle - sensitive fern floodplain forest

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Excellent quality, condition and landscape context ('A' on a scale of A-D).

Comments on Rank:

Detailed Description: 2009: Area 2: Mature silver maple forest, with overstory trees ranging from 16-36 inches diameter in interior areas (smaller diameters on trees around the margins of the island). While the interior portions of the island have vegetation that is typical for this community, a ~50m wide band of floodplain forest around the periphery of the island (presently included as part of this community type) exhibits floristic and ecological differences that warrant consideration of it as a separate type [an *ad hoc* name for such a separate type would be *silver maple grassy levee floodplain forest*.]. This association occurs on sandy levees, and is characterized by sand or sandy loam soils (coarser than interior areas), an absence of ferns, and an abundance of grasses, such as *Cinna arundinacea* (common woodreed), *Elymus* spp. (wheatgrass), and *Calamagrostis canadensis* (robust bluejoint). There is a remarkably low abundance of invasive species here compared to other portions of the occurrence and other sites. Nonetheless, invasives are present, and apparently best established at the southwest end of the island. Species include *Celastrus orbiculatus* (Asian bittersweet), *Berberis thunbergii* (Japanese barberry), including *Alliaria petiolata* (garlic mustard), *Lysimachia nummularia* (moneywort), and *Lonicera morrowii* (Morrow's honeysuckle). There is almost no *Toxicodendron radicans* (climbing poison ivy). 2006: Observed and photographed at Areas 1, 2, and 3. Major flooding in May left distinct bleaching lines high up on many of the silver maples.2003: SPNHF patch nearest the river (Area 1) is ***silver maple - false nettle - sensitive fern floodplain forest***, with a nearly pure canopy of silver maple and a sparse canopy of understory ferns. 2001: SPNHF patch (Area 1) observed and photographed. 1997: Four forest patches were observed. Tech Island (Area 2): *Acer saccharinum* (silver maple) dominated the canopy cover with some *Populus deltoides* (eastern cottonwood) within the releve. *Boehmeria cylindrica* (false nettle) and *Onoclea sensibilis* (sensitive fern) shared herb dominance with various graminoids. The entire island is a complex of large, old silver maple floodplain forest with a variety of canopy species, and various, patchy floodplain herbs and grasses. Concord Dump (Area 4): The *Acer saccharinum* (silver maple) dominant canopy overhung a fairly species poor herb layer with little to no subcanopy coverage. Sandy soils and flood debris were deposited throughout the floodplain, with grass and *B. cylindrica* (false nettel) patches scattered throughout. NHTI (Area 3): This site had a closed silver maple canopy with little to no subcanopy or shrub layer. *Boehmaria cylindrica* (false nettel), *Matteuccia struthiopteris* var. *pensylvanica* (ostrich fern), and *Onoclea sensibilis* (sensitive fern) dominate the understory, with lesser coverage of *Arisaema stewardsonii* [*triphyllum*] (Jack-in-the-pulpit), *Impatiens capensis* (spotted touch-me-not), *Cinna arundinacea* (common woodreed), and other herbs and graminoids. SPNHF (Area 1): *Acer saccharinum* (silver maple) floodplain forest patches of medium-low size and quality, due to the heavy trail use and extensive edges. *Carya ovata* (shagbark hickory), *Quercus rubra* (red oak), and *Fraxinus pennsylvanica* (green ash) share canopy space with silver maple, with *Toxicodendron radicans* (climbing poison ivy), *Celastrus orbiculatus* (Asian bittersweet), and *Berberis vulgaris* (European barberry) in the subcanopy/shrub layer, and *Onoclea sensibilis* (sensitive fern), *Matteuccia struthiopteris* [var. *pensylvanica*] (ostrich fern), *Boehmeria cylindrica* (false nettle), *Dactylis glomerata* (orchard grass), *Carex gynandra* (perfect-awned sedge), and *Eupatorium maculatum* (spotted Joe-Pye weed) in the understory.

General Area: 1997: Tech Island (Area 2): Good levee and slough channel development created a range of microtopographic variation. Soils ranged from coarse sand on levees to silty very fine sandy

	loams in floodplain terraces. Huge piles of flood debris, with dead trunks and railroad ties, sit in low areas, indicating periodic flood deposition. Concord Dump (Area 4): The upstream end of this forest is framed by an old landfill. Old road beds, as well as the slopes framing the floodplain had considerable old dumping. Access points have considerable garbage. Edges were characterized by grassy openings, *Toxicodendron radicans* (poison ivy), and a recently used homeless structure near the upstream end. This floodplain had 1-4' deep slough channels throughout with a moderate size, stagnant pool in the deepest channel. Silty and very fine sandy loams had mottling throughout the soil column, with varying root depths. NHTI (Area 3): This floodplain complex is framed by parking lots of the Technical Institute, and a trail invites hiking travel through the center of the floodplain. Disturbance seems to be encouraging the growth of vines and invasive species near the edge of the floodplain patch. A shallow emergent marsh with associated standing-water vernal pool at the downstream end of the patch adds to the diversity of this floodplain complex. Soils indicate very active deposition periodically (yearly?): silty, sandy soils, distinct layering of buried organic material, extensive mottling, no soil horizon development. SPNHF (Area 1): A steep forested bluff frames the land side of this floodplain/marsh complex, with extensive trails, old fields, and some timber plantation areas within and around the floodplain as well. ***Rich sugar maple - oak - hickory terrace forest*** occurs on this terrace.
General Comments:	
Management Comments:	1997: Easy access for hikers may increase trampling, off-trail dumping, etc. at this site.

Location

Survey Site Name: Merrimack River
Managed By: NHTI/Concord - Island Reserve

County: Merrimack
Town(s): Concord
Size: 136.6 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Five patches of forest along the Merrimack River in Concord. Area 1 (SPNHF): from Exit 16 on I-93, turn right (south) on Rte. 132. Take first right onto Eastman Street (as Rte. 132 turns left uphill). After ca. 0.3 mile make a sharp left turn onto Portsmouth Street. Continue ca. 0.3 mile to small dirt parking lot on the right. Area 2 (Tech Island): access by canoe. From Rte. 393 in Concord, take Exit 1 onto Fort Eddy Road. Head north to a boat ramp on the east side of the road. The south end of the island is opposite and slightly upstream of the ramp.Area 3 (Tech or NHTI): from Rte. 393 in Concord, take Exit 1 onto Fort Eddy Road. Head north, and after ca. 1 mile the forest is between this road and the river. Area 4 (Concord Dump, a.k.a. Fort Eddy Rd): from Exit 15 on Rte. 93N in Concord, go straight at the exit ramp stop sign onto Fort Eddy Rd. The forest is on the bank of the river to the east of the road.Area 5 (Sugar Ball): From East Side Drive just north of Rte. 393 intersection, descend east on driveway.

Dates documented

First reported: 1997-07-02 Last reported: 2009-09-14

New Hampshire Natural Heritage Bureau - Animal Record

American Eel (*Anguilla rostrata*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Apparently secure but with cause for concern
State:	Special Concern	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2000: Area 13215: Not enumerated.
General Area:
General Comments:
Management Comments:

Location

Survey Site Name: Merrimack River Drainage
Managed By:

County: Merrimack
Town(s): Bow
Size: 1.9 acres

Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2000: Turkey River

Dates documented

First reported: 2000

Last reported: 2000

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Bald Eagle (*Haliaeetus leucocephalus*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Special Concern	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2002-2012: Wintering eagles regularly observed at locations along the Merrimack River, day perching and night roosts:2013: 1 eagle observed on 1/4. 1 eagle observed on 1/12. 3 eagles observed at a single location 1/29. 2 eagles observed at a single location on 2/1. 2 eagles observed at a single location on 2/15. 1 eagle observed on 2/23. 1 eagle observed on 3/4.2012: Solitary eagles observed at 3 separate locations on 1/7. 1 eagle observed on 1/12. 1 eagle observed on 1/17. 1 eagle observed on 1/19. Solitary eagles observed at 3 separate locations on 1/23. 1 eagle observed on 1/25. 1 eagle observed on 2/2. 1 eagle observed on 2/9. 1 eagle observed on 2/14. 2 eagles observed at a single location, and solitary eagles observed at 5 separate locations on 2/25. 2 eagles observed at a single location on 2/28. Solitary eagles observed at 2 separate locations on 3/6. 1 eagle observed on 12/11. 2011: 1 eagle observed on 1/5. 1 eagle observed on 1/6. 1 eagle observed on 1/8. Solitary eagles observed at 2 separate locations on 1/9. 1 eagle observed on 1/11. Solitary eagles observed at 2 separate locations on 1/13. 1 eagle observed on 1/20. 2 eagles observed at a single location on 1/31. Solitary eagles observed at 2 separate locations on 2/3. Solitary eagles observed at 2 separate locations on 2/7. 1 eagle observed on 2/9. 2 eagles observed at a single location and solitary eagles observed at 2 separate locations on 2/15. Solitary eagles observed at 2 separate locations on 2/17. 1 eagle observed on 2/22. 2 eagles observed at 2 separate locations and a solitary eagle at a separate location on 2/26. 1 eagle observed on 2/28. 1 eagle observed on 3/2. Solitary eagles observed at 2 separate locations on 3/8. 2 eagles observed at a single location, and a solitary eagle observed at a separate location on 3/15. 1 eagle observed on 12/27. 1 eagle observed on 12/29.2010: 3 eagles observed at a single location, 2 observed at a single location, and a solitary eagle observed at a separate location on 1/9. 1 eagle observed on 12/3. 1 eagle observed on 12/17. 1 eagle observed on 12/22. 2 eagles observed at a single location on 12/28. 2 eagles observed at a single location on 12/30.2009: 2 eagles observed at a single location, and a solitary eagle observed at a separate location on 1/10. 3 eagles observed at a single location on 2/28.2008: 2 eagles observed at a single location, and solitary eagles observed at 3 separate locations on 1/12. 2 eagles observed at a single location and a solitary eagle observed at a separate location on 2/23.2007: Solitary eagles observed at 2 separate locations on 1/13. 1 eagle observed on 2/24.2006: 1 eagle observed on 2/25.2005: 2 eagles observed at a single location on 1/8. 2 eagles observed at a single location and a solitary eagle observed at a separate location on 2/24. 2 eagles observed at a single location on 2/26.2004: Solitary eagles observed at 5 separate locations on 1/10. 1 eagle observed on 1/27.2003: 1 eagle observed on 1/7. 1 eagle observed on 1/9. 1 eagle observed on 2/2. Solitary eagles observed at 2 separate locations on 2/5. 1 eagle observed on 3/4.2002: 1 eagle observed on 1/12. 1 eagle observed on 12/18.1993: Sightings near Hannah Dusting parking area, but no defined roost or perch site. Perching on east side of Sewall's Falls Dam area. Perching near Horseshoe Pond. Perching on both sides from Bridge Street to Manchester Street. Perching on east side of the river near Blue Seal Feeds. No perching in last few years near Garvins Falls Dam. Bow Power Plant: On River Road on west side of river, possible roosting just north of liquor store. Perching in Hooksett on both sides of river just north of Route 3 bridge.1991: The most active locations are Sewalls Falls, wetlands near I-393, Bow Power Plant and Hooksett boat ramp. Location of eagles depends on availability of open water and other factors.

General Area:
General Comments:

Management Comments:

Location

Survey Site Name: Merrimack River at Concord
Managed By: Merrimack River State Forest

County: Merrimack
Town(s): Concord
Size: 418.7 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Various locations along both banks of the Merrimack River, from Franklin south to Hooksett.

Dates documented

First reported: 198? Last reported: 2013-03-04

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Common Nighthawk (*Chordeiles minor*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Endangered	State:	Not ranked (need more information)

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2011: 97 North State Street: Female with 2 eggs observed on rooftop on 6/30. Nest lost to predation on 7/1.
2002: 1-2, possibly 3, adults observed flying and calling (7/16 Obs_id 142; 7/18 Obs_id 145; 7/21 Obs_id 129; 7/23 Obs_id 150; 7/26 Obs_id 153).
1991: 12 adult, sex unknowns (Obs_id 943).

General Area: 2011: 97 North State Street: Rooftop in urban setting.
2002: Terrestrial - urban / suburban.
1991: Terrestrial - urban / suburban (Obs_id 943).

General Comments: 2002: Birds flying over large area from 8:23-8:58 pm (7/16) and from 8:28-9:05 pm (7/18).
1991: Number above represents approximate high count for downtown Concord between 1981-2003. Numbers from 1993-2003 average only 2-3 birds. Nesting was documented in several years during the late 1980s/early 1990s (Obs_id 943).

Management Comments:

Location

Survey Site Name: Concord, Downtown
Managed By:

County: Merrimack
Town(s): Concord
Size: 18.3 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2011: 97 North State Street, Concord.
2002: Downtown Concord, in area bounded by Main, Pleasant, State, and Court Streets. Birds flying over Concord Public Library, State House, Bicentennial Square.
1991: Downtown Concord (Obs_id 943).

Dates documented

First reported: 1991-07-31 Last reported: 2011-06-30

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Northern Leopard Frog (*Lithobates pipiens*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Special Concern	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2016:1 adult observed.
2004: Areas 6668A & B: 20+ seen. Adults and young. Area 6634: 1 seen. Adult.
2003: Area 1037: 1 young seen.
General Area: 2016: Area 14281: Floodplain near river bank.
2004: Area 6668A,B: Floodplain forest.
2003: Area 1036: In yard.
General Comments:
Management Comments:

Location

Survey Site Name: Merrimack River, east of
Managed By: West Terrill Park

County: Merrimack
Town(s): Concord
Size: 94.3 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2004: Floodplain forest of Merrimack River, north of South End Bridge at south end of Old Turnpike Road, Concord. West of river (Area 6668A) and east of river (Area 6668B). Perennial stream channel behind corn fields on east side of Merrimack River and south of Bridge Street and the US Post Office, 43 11 57N, 71 31 12W (Area 6634).
2003: 7 Riverview Lane, in yard (Area 1037).

Dates documented

First reported: 2003-08-07 Last reported: 2016-06-24

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Northern Leopard Frog (*Lithobates pipiens*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Special Concern	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2004: 1 young frog observed (2004-0195). 10 seen. Adults and young. (Obs_id 2004.012). 5-7 seen. Adults and young. (Obs_id 2004.0166A,B,C). 1 seen. Adult. (Obs_id 2004.013). 2003: 1 adult seen (Obs_id 2003.0047). 2000: 1 adult seen (Obs_id 2000.0008).1996: Area 12188: 1 observed.

General Area: 2004: Field adjacent to oxbow wetland (Obs_id 2004-0195). Steep bank of boat ramp edge. Clumps of grass on damp ground. This area is a strip of trees between playing hills and the river, but was originally floodplain forest (Obs_id 2004.012). [Man-made pond.] (Obs_id 2004.013). 2003: Riverbank (Obs_id 2003.0047). 2000: Found in a window well at the SPNHF conservation center on 8/4 (Obs_id 2000.0008).1996: Area 12188: Horseshoe Pond.

General Comments: 2004: Smaller frogs very active. 2 adults were still (Obs_id 2004.012). 2000: Observer noted, "I haven't seen one in a long time. I thought you might be interested. Sorry about the quality of the photos, we only had a point and shoot camera available. They suffice for a positive ID though. Keep on herpin'" (Obs_id 2000.0008).

Management Comments:

Location

Survey Site Name: Merrimack River Floodplain
Managed By: Woodman

County: Merrimack
Town(s): Concord
Size: 47.3 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2004: NHTI, field adjacent to oxbow wetland (2004-0195). 2004: Floodplain forest on west side of Merrimack River in Concord. Boat launch under I-393 bridge (Obs_id 2004.0166A). Emergent marsh Inlet backwater of Merrimack River (Obs_id 2004.0166B). Grassy clearing along river behind mobile home park (Obs_id 2004.0166C). Across from the boat ramp at the NH Tech on Ft Eddy Road (Obs_id 2004.012). NH Fish & Game display pond [outside headquarters] (Obs_id 2004.013). 2003: Across from the boat ramp at the NH Tech on Ft Eddy Road (Obs_id 2003.0047, 2004.012). 2000: SPNHF Conservation Center (Obs_id 2000.0008).1996: Area 12188: South of Horseshoe Pond.

Dates documented

First reported: 1996-09-06 Last reported: 2004-08-24

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Northern Leopard Frog (*Lithobates pipiens*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Special Concern	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2004: 12 seen. Adults. (Obs_id 2004.0189).
General Area:
General Comments:
Management Comments:

Location

Survey Site Name: Merrimack River floodplain, Garvins Falls area
Managed By:

County: Merrimack
Town(s): Concord
Size: 7.7 acres
Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2004: [About 0.4 miles north of dam on peninsula on west side of Merrimack River.] (Obs_id 2004.0189).

Dates documented

First reported: 2004-09-23
Last reported: 2004-09-23

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Spotted Turtle (*Clemmys guttata*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Threatened	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2014: Area 14142: 1 adult male observed.
General Area: 2014: Area 14142: Found in warehouse. Very developed area and no obvious wetlands (other than Merrimack River) in vicinity.
General Comments:
Management Comments:

Location

Survey Site Name: Concord Sewage Treatment Plant
Managed By:

County: Merrimack
Town(s): Concord
Size: .4 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2014: Area 14142: Warehouse of Cohen Steel property on Hall Street, Concord.

Dates documented

First reported: 2014-07-28 Last reported: 2014-07-28

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle (*Glyptemys insculpta*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Rare or uncommon
State:	Special Concern	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2014: Area 14120: 1 adult male and 1 adule female observed. Area 14121M: 3 adult males observed on 4/20. 4 females observed on 5/3.
2013: Area 13461: 2 adult females observed. 7 adults observed, sex unknown.
2012: Area 13090: 1 adult female observed. Area 13100: 1 adult observed.
2011: Area 13134: 4 adults and 1 juvenile observed.
2009: Area 12307: 4 individuals observed.
2006: Area 11686: 1 adult seen.
1996: Area 6455: 1 female seen.

General Area: 2014: Area 14120: Floodplain forest; open areas with mud. Area 14121M: Oxbow marsh with buttonbush.
2013: Area 13461: Merrimack River.
2012: Area 13090: Merrimack River oxbow. Area 13100: Floodplain forest.
2009: Area 12307: Downed trees in river.
2006: Area 11686: Mostly woody, shrubby vegetation up the bank, but turtle was near an area where a wooden structure indicates a possible former dock, with a patch of grass standing out from an otherwise sparse herbaceous layer. Abundant sandy soil nearby, due to silting.
1996: Area 6455: Find sandy loam/silt of floodplain, supporting American elm, bittersweet, silver maple, etc. Turtle headed for the river from sandy lane between river-edge vegetation and cornfield.

General Comments:
Management Comments:

Location

Survey Site Name: Bradley's Island
Managed By: Merrimack River Outdoor Ed. & Consrv. Ctr.

County: Merrimack
Town(s): Concord
Size: 15.8 acres   Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2014: Area 14120: Floodplain behind NHTI athletic fields. Area 14121M: On SPNHF floodplain property in backwater marsh.
2013: Area 13461: SPNHF Conservation Center.
2012: Area 13100: Eastman Cove vernal area, Merrimack River.
2009: Area 12307: In Merrimack River just north of NHTI boat ramp.
2006: Area 11686: Outside bend of Merrimack River below Sugar Ball.
1996: Area 6455: Merrimack River. At edge of shrubs, 20' from W bank of river, behind cornfield just south of NHTI ball field.

Dates documented

First reported: 1996-08-29   Last reported: 2014-05-03

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle (*Glyptemys insculpta*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Rare or uncommon
State:	Special Concern	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2010: Area 12748: 2 juveniles observed.

General Area: 2010: Area 12748: Forested swamp adjacent to Bow Brook, a perennial stream. Plants include Impatiens, sedges, skunk cabbage, sensitive fern, poison ivy, arrowwood, honeysuckle, alternate leaved dogwood, and red maple.

General Comments: 2010: Area 12748: Observation comment: Turtle 1 was ~3.5 inches long. Turtle 2 was 2.8 inches long. 'Location of the turtles seems unlikely given the physical obstacles they must have overcome. The nearest known pop is in a tribuatary to the Turkey River, several miles upstream. These turtles either had to cross 3A from the Merrimack River (no known pop there) or travel from the Turkey River up 2 long culverts (or over land, crossing an off ramp from I-89). This does not seem like secure or promising habitat for wood turtles.'

Management Comments:

Location

Survey Site Name: Bow Junction
Managed By:

County: Merrimack
Town(s): Bow
Size: 1.9 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2010: Area 12748: Park behind the Pitco Fryolator building on the west side of Rte. 3A. Walk west to Bow Brook, paralleling the highway. Follow the brook south to the wetland area on the east side of the brook.

Dates documented

First reported: 2010-06-09 Last reported: 2010-06-09

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

Exhibit 2

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

In Reply Refer To: June 28, 2018
Consultation Code: 05E1NE00-2018-SLI-1481
Event Code: 05E1NE00-2018-E-05203
Project Name: Bow-Concord 13742

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

Project Summary

Consultation Code: 05E1NE00-2018-SLI-1481

Event Code: 05E1NE00-2018-E-05203

Project Name: Bow-Concord 13742

Project Type: TRANSPORTATION

Project Description: The project consists of a 4.5-mile section of the I-93 corridor from just south of its intersection with Interstate 89 (I-89) to just north of its intersection with Interstate 393 (I-393) at Exit 15. Exits 12, 13, 14 & 15 on I-93 are included in the project area, as well as Exit 1 on I-89 and Exit 1 on I-393.

I-93 through Bow and Concord is a four-lane divided urban principal arterial highway with limited access, meaning access is provided only at interchanges. South of the project limits, I-93 is a six-lane divided urban arterial highway. The basic purpose of the project is to improve transportation efficiency and reduce safety problems within this approximately 4.5-mile segment of highway.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/43.196774147366376N71.52718115584855W

Counties: Merrimack, NH

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Flowering Plants

NAME	STATUS
Small Whorled Pogonia *Isotria medeoloides* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1890	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Exhibit 3

Gene W. McCarthy

From: Paula Bellemore <pbellemore@lchip.org>
Sent: Thursday, September 20, 2018 4:11 PM
To: Jennifer L. Zorn
Subject: RE: NHDOT #13742: Interstate 93 Improvements Bow to Concord

Hi Jennifer,
LCHIP assisted with the preservation of the Kimball Jenkins Estate located on North Main St., which appears to be the historic resource indicated on the project map. Beyond it does not appear that LCHIP has assisted with the protection of any natural, cultural or historic resources in the project area described.

Paula

From: Jennifer L. Zorn <JZorn@mjinc.com>
Sent: Tuesday, September 04, 2018 12:24 PM
To: Paula Bellemore <pbellemore@lchip.org>
Cc: Martin, Rebecca <Rebecca.Martin@dot.nh.gov>
Subject: Fw: NHDOT #13742: Interstate 93 Improvements Bow to Concord

Hi Paula,

I'm so sorry to ask you for a favor. I have misplaced your reply on this matter back from 2017. Is is possible for you to confirm (via email is fine) that there are no LCHIP properties in the study area for the I-93 Improvement project. Much of the project is located in the right-of-way of the I-89 and I-93.

Your reply is needed for the NEPA Environmental Assessment.

If you have any questions, please let me know.

Thank you,

Jennifer

From: Jennifer L. Zorn
Sent: Monday, May 2, 2016 2:17 PM
To: lwcf@dred.nh.gov; pbellemore@lchip.org; steve.walker@nh.gov
Subject: NHDOT #13742: Interstate 93 Improvements Bow to Concord

Good Afternoon,

In the role as consultant, McFarland Johnson is preparing a NEPA Environmental Assessment for this NHDOT project, #13742. To complete the research phase of this work, the funding sources of public lands such as conservation lands, recreation lands, historic properties, and similar is necessary. Identification of funding sources for any 4(f), 6(f), LCHIP, CLS, LWCF properties is critical for the inventory, evaluating impacts and determining what, if any, consultation may be necessary.

Enclosed is a figure showing the 4.5 mile project corridor and study area (red line) that extends from Bow to Concord I-93. Properties of note include: Cilley State Forest, South End Marsh, and West Terrill Park.

If you need any further information from me to assist in this request, please let me know.

Thank you,
Jennifer

Jennifer L. Zorn, AICP • Project Manager
McFarland Johnson
53 Regional Drive • Concord, NH 03301
Office: 603-225-2978 ext. 141

Gene W. McCarthy

From: Walker, Steve <Steve.Walker@nh.gov>
Sent: Tuesday, May 3, 2016 7:53 AM
To: Jennifer L. Zorn
Subject: RE: NHDOT #13742: Interstate 93 Improvements Bow to Concord

Hi Jennifer. That might be the best project map I have received in 14 years. There are no LCIP properties in the project area. Thanks Steve

Steve Walker
Office of Energy and Planning
Stewardship Specialist
603-271-6834

From: Jennifer L. Zorn [mailto:JZorn@mjinc.com]
Sent: Monday, May 02, 2016 2:17 PM
To: DRED: Land & Water Conservation Fund; pbellemore@lchip.org; Walker, Steve
Subject: NHDOT #13742: Interstate 93 Improvements Bow to Concord

Good Afternoon,

In the role as consultant, McFarland Johnson is preparing a NEPA Environmental Assessment for this NHDOT project, #13742. To complete the research phase of this work, the funding sources of public lands such as conservation lands, recreation lands, historic properties, and similar is necessary. Identification of funding sources for any 4(f), 6(f), LCHIP, CLS, LWCF properties is critical for the inventory, evaluating impacts and determining what, if any, consultation may be necessary.

Enclosed is a figure showing the 4.5 mile project corridor and study area (red line) that extends from Bow to Concord I-93. Properties of note include: Cilley State Forest, South End Marsh, and West Terrill Park.

If you need any further information from me to assist in this request, please let me know.

Thank you,
Jennifer

Jennifer L. Zorn, AICP • Project Manager
McFarland Johnson
53 Regional Drive • Concord, NH 03301
Office: 603-225-2978 ext. 141

Exhibit 4

STATE OF NEW HAMPSHIRE
DEPARTMENT of NATURAL and CULTURAL RESOURCES
OFFICE OF THE COMMISSIONER
172 Pembroke Road Concord, New Hampshire 03301
Phone: 271-2411 Fax: 271-2629

RECEIVED
JUN 27 2018
NHDOT
Highway Design

June 22, 2018

Don Lyford, Project Manager
NH Dept. of Transportation
PO Box 483
Concord NH 03302-0483

RE: DOT Project #13742 Bow-Concord I-93 – Impacts to Cilley State Forest

Dear Mr. Lyford,

This is in response to the Department of Transportation's (DOT) request for consultation regarding potential impacts to Cilley State Forest from the proposed Interstate 93 expansion project through Bow and Concord.

The Department of Natural and Cultural Resources (DNCR) understands that DOT's preferred alternative proposes to impact approximately 0.7 acres along the edge of Cilley State Forest and that mitigation has been proposed to replace this acreage with other abutting lands that are of reasonably equivalent size and usefulness. The proposed impact and mitigation areas have been reviewed in the field by Division of Forests and Lands staff and DNCR concurs with the assessment of proposed impacts and the mitigation proposal as presented.

We appreciate DOT's efforts to minimize harm to the forest and its willingness to involve DNCR early in the project planning process. We look forward to continued consultation with DOT through final design as it relates to the Cilley State Forest property and associated mitigation.

Please contact Tracey Boisvert, Division of Forests and Lands, Land Management Bureau Administrator, with any questions or for additional project consultation. She may be reached via email at tracey.boisvert@dncr.nh.gov or by phone at 603-271-3457.

Sincerely,

Sarah L. Stewart
Commissioner

cc: Brad Simpkins, Director Division of Forests and Lands
Tracey Boisvert, Division of Forests and Lands

Exhibit 5

Christine J. Perron

From: Lamb, Amy <Amy.Lamb@dncr.nh.gov>
Sent: Wednesday, July 11, 2018 10:16 AM
To: Christine J. Perron
Cc: Jennifer L. Zorn; Bowman, Peter; Stanwood, Sabrina; Martin, Rebecca
Subject: RE: Bow-Concord 13742 - small whorled pogonia
Attachments: Bow-Concord_surveymap.JPG

Apologies, I forgot to include the attachment, and incorrectly referred to Exit 1 instead of Exit 2 (corrected below).

Amy Lamb
Ecological Information Specialist
(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301

From: Lamb, Amy
Sent: Wednesday, July 11, 2018 10:13 AM
To: 'Christine J. Perron'
Cc: Jennifer L. Zorn; Bowman, Peter; Stanwood, Sabrina; Martin, Rebecca
Subject: RE: Bow-Concord 13742 - small whorled pogonia

Hi Christine,

NHB staff member Pete Bowman and I surveyed the area of Cilley State Forest adjacent to I-89 for small whorled pogonia (*Isotria medeoloides*) on 6/13/2018.

We entered the State Forest from Iron Works Road in Concord, and followed existing trails to the southeastern edge of the corn fields, where we entered the woods. We then headed south until reaching I-89, and conducted a meandering search through the woods in proximity of the highway to the Exit 2 onramp, then headed north and west along the Turkey River and back through the State Forest to the corn fields. (Refer to attached map with GPS track.)

While walking along I-89, several ephemeral / seasonal drainages were crossed which contain wetlands vegetation including skunk cabbage (*Symplocarpus foetidus*), cinnamon fern (*Osmundastrum cinnamomeum*), sensitive fern (*Onoclea sensibilis*), and jewelweed (*Impatiens capensis*). The vegetation community was documented in the vicinity of the roadway expansion, at waypoint 61 shown on the attached map. The forest type was dry upland woods with red oak, white oak, white pine, and red maple in the overstory, and witch hazel (*Hamemelis virginiana*) frequent in the understory. Other species documented at this location include: bracken fern (*Pteridium aquilinum* ssp. *latiusculum*), wild sarsaparilla (*Aralia nudicaulis*), eastern spicy-wintergreen (*Gaultheria procumbens*), lowbush blueberry (*Vaccinium angustifolium*), sessile-leaved bellwort (*Uvularia sessilifolia*), and maple-leaved viburnum (*Viburnum acerifolium*).

Although the area in the vicinity of the waypoint/highway expansion consisted of mixed hardwood/pine forest and contained species commonly found in small whorled pogonia habitat (such as witch hazel), we did not observe seasonal drainages containing the necessary hydrology to support small whorled pogonia in this area. Throughout the full surveyed area, conditions were variably too dry, too wet, or contained too much understory vegetation to provide good small whorled pogonia habitat. We did not find any small whorled pogonia plants during our search, and we do not feel that any additional survey work is necessary in Cilley State Forest.

Thank you, and please let me know if you need additional information.
Amy

Amy Lamb
Ecological Information Specialist
(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301

From: Christine J. Perron [mailto:CPerron@mjinc.com]
Sent: Wednesday, April 25, 2018 12:26 PM
To: Lamb, Amy
Cc: Jennifer L. Zorn; Bowman, Peter; Stanwood, Sabrina; Martin, Rebecca
Subject: RE: Bow-Concord 13742 - small whorled pogonia

Hi Amy,

Rebecca coordinated with the USFWS to confirm that the Environmental Assessment can be completed this spring with a commitment to complete a survey for SWP in the vicinity of Cilley State Forest in June. Further consultation with FWS will occur if NHB's survey finds SWP in the project area.

Let us know if you need anything before the survey.

Thanks,
Christine

From: Lamb, Amy [mailto:Amy.Lamb@dncr.nh.gov]
Sent: Tuesday, April 17, 2018 3:07 PM
To: Christine J. Perron <CPerron@mjinc.com>
Cc: Jennifer L. Zorn <JZorn@mjinc.com>; Bowman, Peter <Peter.Bowman@dncr.nh.gov>; Stanwood, Sabrina <Sabrina.Stanwood@dncr.nh.gov>
Subject: RE: Bow-Concord 13742 - small whorled pogonia

Hi Christine,

Thank you for sending this over. Since the area with the greatest potential for small whorled pogonia habitat is in the vicinity of Cilley State Forest, we would be happy to search this area in mid-June of this year. Although you noted that the area has been visited previously and no SWP were found, and there is a fair amount of shrub cover in this area, we would like to do a quick field review to be certain since it is DNCR property. We can include the properties to the west as well if we have permission; the total area would be less than 10 acres and it would not be a problem for us to review it.

Let me know if this would work for DOT.

Best,
Amy

Amy Lamb
Ecological Information Specialist
(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301

From: Christine J. Perron [mailto:CPerron@mjinc.com]
Sent: Monday, April 16, 2018 1:41 PM
To: Lamb, Amy
Cc: Jennifer L. Zorn
Subject: Bow-Concord 13742 - small whorled pogonia

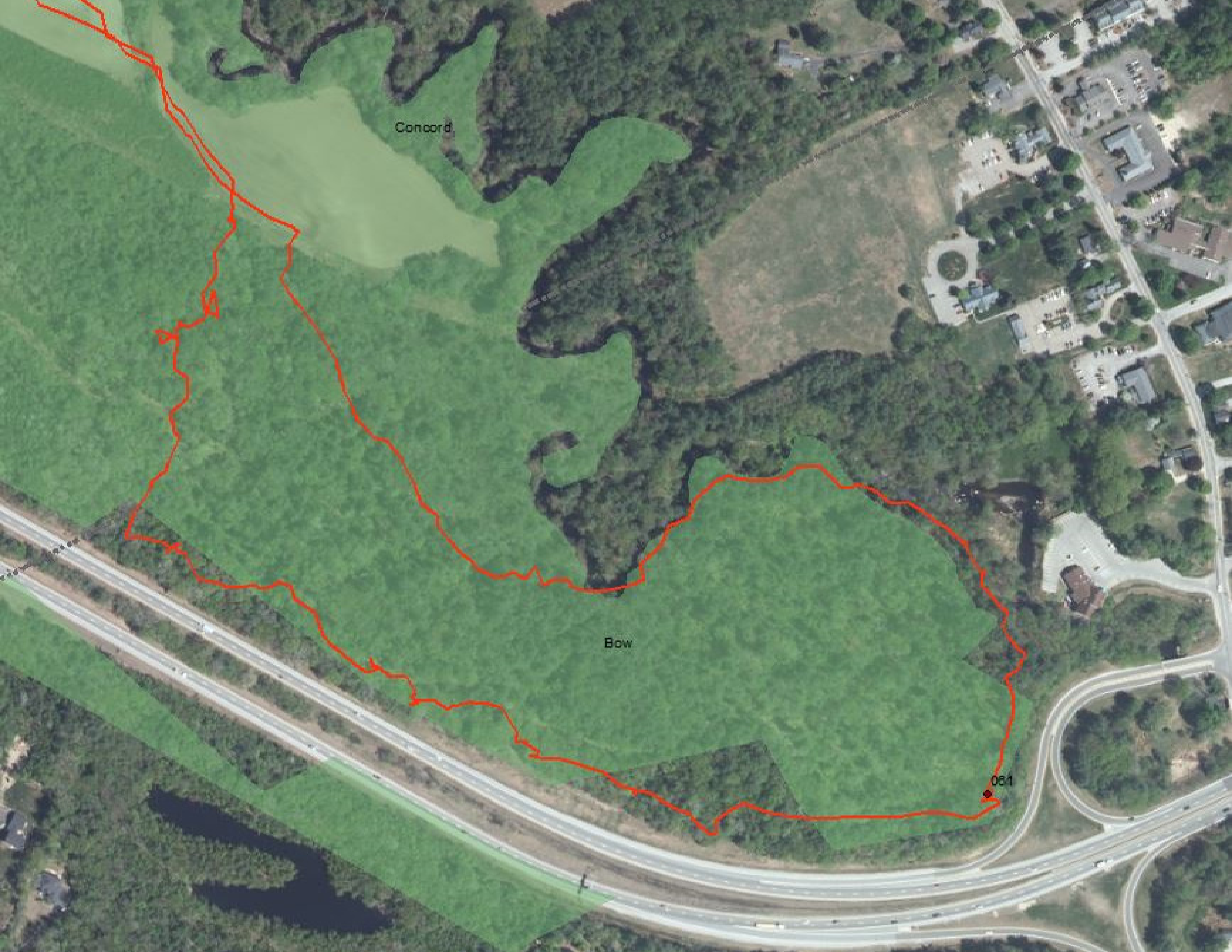
Hi Amy,

We have put together the attached information on small whorled pogonia in the Bow-Concord study area. Before we coordinate with USFWS, we wanted your input on any potential concerns or recommendations you may have.

Conceptual plans showing the preferred alternative for each project segment can be viewed at the website below under 'Public Information Meeting 2.'
http://www.i93bowconcord.com/Study-Documents.html

Thanks,
Christine

Christine Perron, CWS
Project Manager • Senior Environmental Analyst
McFarland Johnson
53 Regional Drive • Concord, NH 03301
OFFICE: 603-225-2978 ext. 128
www.mjinc.com


Concord
Bow
061

Gene W. McCarthy

From: Martin, Rebecca <Rebecca.Martin@dot.nh.gov>
Sent: Wednesday, October 10, 2018 11:38 AM
To: 'David Simmons'
Cc: 'Maria Tur'; 'Sikora, Jamie (FHWA)'
Subject: RE: [EXTERNAL] Bow-Concord 13742 - Small Whorled Pogonia
Attachments: RE: Bow-Concord 13742 - small whorled pogonia

Hello David,

This past summer Amy Lamb and her colleague, Pete Bowman, from the NH Natural Heritage Bureau surveyed the area of Cilley State Forest adjacent to I-89 for small whorled pogonia on 6/13/2018 (details attached). They reviewed the area that would be impacted by the Bow-Concord 13742 preferred alternative and found it to be a mixed hardwood/pine forest that contained species commonly found in small whorled pogonia habitat. However, they did not observe seasonal drainages containing the necessary hydrology to support small whorled pogonia in the area. Amy Lamb indicated that 'Throughout the full surveyed area, conditions were variably too dry, too wet, or contained too much understory vegetation to provide good small whorled pogonia habitat. We did not find any small whorled pogonia plants during our search, and we do not feel that any additional survey work is necessary in Cilley State Forest.'

Since the NHB database does not include any records of small whorled pogonia in or near the proposed project area, the Natural Heritage Bureau had indicated that the only potentially suitable habitat in the project area is in the vicinity of Cilley State Forest and the survey had a negative result, we feel that the no effect determination that we communicated about previously is appropriate. Please let me know if you have any questions or comments.

Thank you,

Rebecca Martin
Senior Environmental Manager
NH DOT Bureau of Environment
7 Hazen Drive
Concord, NH 03302
(603)271-6781
Rebecca.Martin@dot.nh.gov

From: David Simmons [mailto:David_Simmons@fws.gov]
Sent: Wednesday, April 25, 2018 12:10 PM
To: Martin, Rebecca
Cc: Maria Tur; Sikora, Jamie (FHWA)
Subject: RE: [EXTERNAL] Bow-Concord 13742 - Small Whorled Pogonia

Hi Rebecca,
Thank you for contacting me about this project. Your effects determination and survey proposal are reasonable given the proposed project footprint(s) and what we know about the species in the project area. Please keep me posted on the surveys; we can discuss potential consultation if surveys are positive and you/FHWA think the project may affect the species. Regards,
David

From: Martin, Rebecca [mailto:Rebecca.Martin@dot.nh.gov]
Sent: Wednesday, April 25, 2018 7:52 AM
To: 'David Simmons'

Cc: Maria Tur (maria_tur@fws.gov); Sikora, Jamie (FHWA)
Subject: [EXTERNAL] Bow-Concord 13742 - Small Whorled Pogonia
Good morning David,

Can you please refer me to the appropriate person to coordinate with regarding small whorled pogonia for DOT's Bow-Concord 13742 project? The Bow-Concord section of Interstate 93 (from the I-89/I-93 interchange to the I-93/I-393 interchange) serves as a critical link for statewide travel to the White Mountains and the Lakes Region, as well as an important local route within Concord. The Project's conceptual plans showing the preferred alternative for each project segment can be viewed at this website under 'Public Information Meeting 2.' http://www.i93bowconcord.com/Study-Documents.html

Our consultant is drafting an Environmental Assessment for the project. A public hearing for the project is scheduled for July of this year, so the EA will need to be completed soon to allow adequate time for review by FHWA and the public. I had previously coordinated with Susi von Oettingen regarding the Northern Long-eared Bat for the project. Our consultant has coordinated with the Natural Heritage Bureau (see email below). The NHB Ecological Information Specialist, Amy Lamb, has informed us that the NHB database does not include any records of small whorled pogonia in or near the proposed project area. In Amy's opinion, the potential suitable habitat in the project area is in the vicinity of Cilley State Forest. Amy suggests that NHB could survey this area this summer. We are hoping that USFWS will concur that a no effect finding is appropriate with a commitment to survey potential habitat later this summer and coordinate with USFWS. I look forward to discussing this project and the small whorled pogonia with someone in your office.

Thank you,
Rebecca Martin
Senior Environmental Manager
NH DOT Bureau of Environment
7 Hazen Drive
Concord, NH 03302
(603)271-6781
Rebecca.Martin@dot.nh.gov

From: Lamb, Amy [mailto:Amy.Lamb@dncr.nh.gov]
Sent: Tuesday, April 17, 2018 3:07 PM
To: Christine J. Perron <CPerron@mjinc.com>
Cc: Jennifer L. Zorn <JZorn@mjinc.com>; Bowman, Peter <Peter.Bowman@dncr.nh.gov>; Stanwood, Sabrina <Sabrina.Stanwood@dncr.nh.gov>
Subject: RE: Bow-Concord 13742 - small whorled pogonia
Hi Christine,

Thank you for sending this over. Since the area with the greatest potential for small whorled pogonia habitat is in the vicinity of Cilley State Forest, we would be happy to search this area in mid-June of this year. Although you noted that the area has been visited previously and no SWP were found, and there is a fair amount of shrub cover in this area, we would like to do a quick field review to be certain since it is DNCR property. We can include the properties to the west as well if we have permission; the total area would be less than 10 acres and it would not be a problem for us to review it. Let me know if this would work for DOT.

Best,
Amy
Amy Lamb
Ecological Information Specialist
(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301

From: Christine J. Perron [mailto:CPerron@mjinc.com]
Sent: Monday, April 16, 2018 1:41 PM
To: Lamb, Amy
Cc: Jennifer L. Zorn
Subject: Bow-Concord 13742 - small whorled pogonia
Hi Amy,
We have put together the attached information on small whorled pogonia in the Bow-Concord study area. Before we coordinate with USFWS, we wanted your input on any potential concerns or recommendations you may have.
Conceptual plans showing the preferred alternative for each project segment can be viewed at the website below under 'Public Information Meeting 2.'
http://www.i93bowconcord.com/Study-Documents.html
Thanks,
Christine

Christine Perron, CWS
Project Manager • Senior Environmental Analyst
McFarland Johnson
53 Regional Drive • Concord, NH 03301
OFFICE: 603-225-2978 ext. 128
www.mjinc.com

Exhibit 6

Christine J. Perron

From: Lamb, Amy <Amy.Lamb@dncr.nh.gov>
Sent: Monday, June 04, 2018 11:32 AM
To: Christine J. Perron
Subject: RE: NHB review: NHB18-1058

Thanks Christine! And a happy Monday to you.

Amy Lamb
Ecological Information Specialist
(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301

From: Christine J. Perron [mailto:CPerron@mjinc.com]
Sent: Monday, June 04, 2018 11:22 AM
To: Lamb, Amy
Subject: RE: NHB review: NHB18-1058

Hi Amy,

Yes, the tree clearing will be parallel to the roadway.
No, the bike path will not be impacted by the project. Grading will be near the path, but there will be no impact.

Happy Monday!
Christine

From: Lamb, Amy [mailto:Amy.Lamb@dncr.nh.gov]
Sent: Friday, June 01, 2018 2:27 PM
To: Christine J. Perron <CPerron@mjinc.com>
Subject: RE: NHB review: NHB18-1058

Hi Christine,

Thank you for the information. 1,500 square feet seems reasonable, especially given that it would be a narrow strip, presumably paralleling the roadway? Out of curiosity, is the bike path being relocated in this general area?

Thanks,
Amy

Amy Lamb
Ecological Information Specialist
(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301

From: Christine J. Perron [mailto:CPerron@mjinc.com]
Sent: Thursday, May 24, 2018 9:49 AM
To: Lamb, Amy
Subject: RE: NHB review: NHB18-1058

Hi Amy,

There are two areas of tree clearing on the east side of I-93 at the north end of the project. These areas are located to the north and south of an open area adjacent to the bike path and I-93. Google street view provides a good view of these areas:
https://goo.gl/maps/jpY241hvQBC2

South of the open area:
600 LF x 10' wide = 6,000 sq ft

North of the open area:
150 LF x 10' wide = 1,500 sq ft

The clearing in these locations is not located within delineated wetlands. These areas are based on preliminary design and could change somewhat once final design and permitting gets underway in 2020.

Let me know if you need anything else!
Christine

From: Lamb, Amy [mailto:Amy.Lamb@dncr.nh.gov]
Sent: Friday, May 18, 2018 12:39 PM
To: Christine J. Perron <CPerron@mjinc.com>
Subject: RE: NHB review: NHB18-1058

Hi Christine,

I am so sorry I missed your email. Do you have any information about the limited clearing that will occur here (approx. area/number of trees)?

Thank you,
Amy

Amy Lamb
Ecological Information Specialist
(603) 271-2834
amy.lamb@dncr.nh.gov

NH Natural Heritage Bureau
DNCR - Forests & Lands

172 Pembroke Rd
Concord, NH 03301

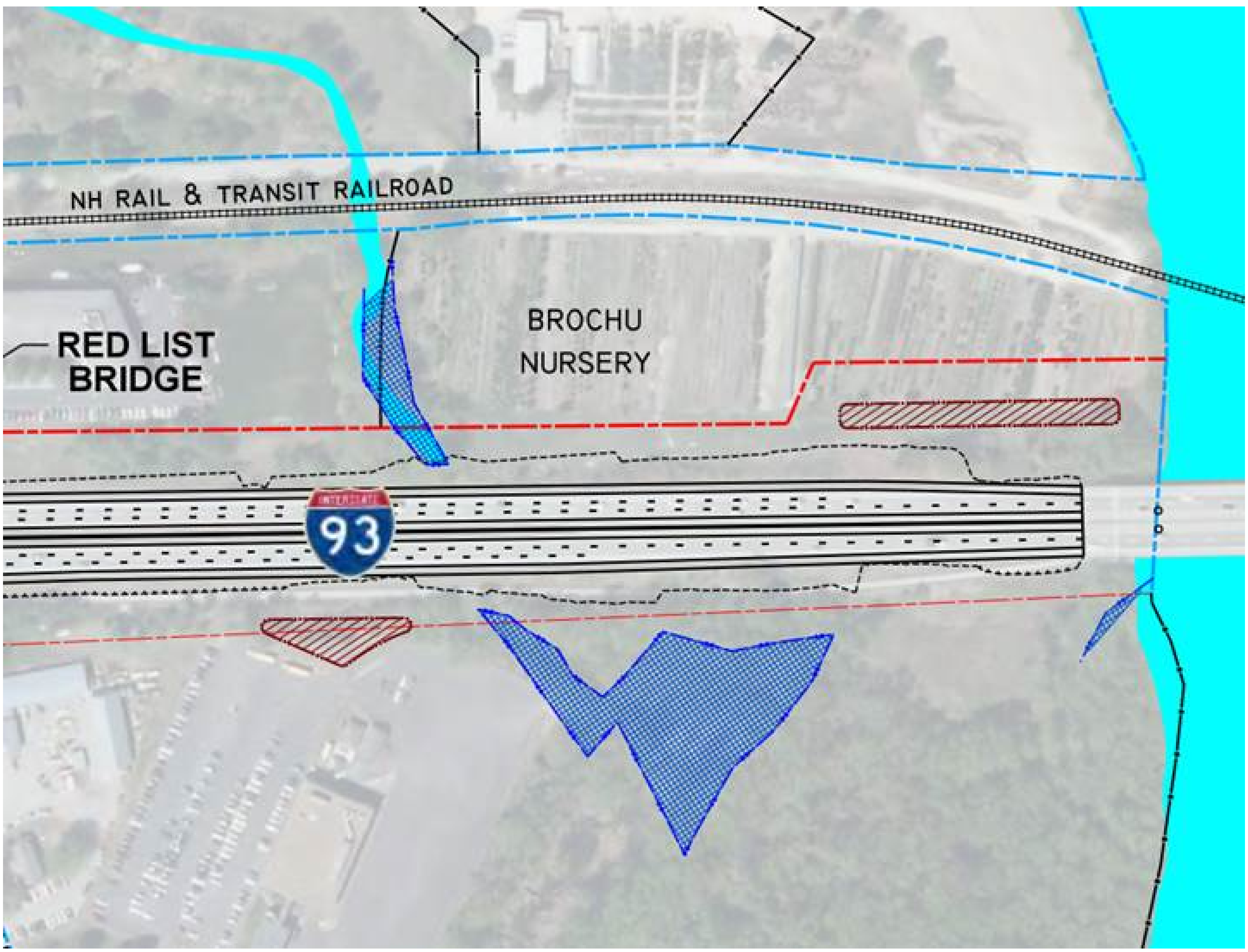
From: Christine J. Perron [mailto:CPerron@mjinc.com]
Sent: Monday, April 16, 2018 4:39 PM
To: Lamb, Amy
Subject: RE: NHB review: NHB18-1058

Thank you Amy.

Regarding the exemplary natural community, I'm pasting a snapshot of the concept plan for the northern end of the project (http://www.i93bowconcord.com/Documents/PIM%20February%202018/Exit%2014-15%20Concept%20F2.pdf):

The proposed slope line (black dashed line) will be located within existing ROW in this location. There may be a small amount of clearing at the new toe of slope, but the clearing will also remain within the ROW. The drainage design will not be completed until final design, at which time impacts will be refined and discussed prior to permitting. Would you like any additional information for the proposed work in this area?

Thanks,
Christine



From: Lamb, Amy [mailto:Amy.Lamb@dncr.nh.gov]
Sent: Monday, April 16, 2018 4:17 PM
To: Christine J. Perron <CPerron@mjinc.com>
Cc: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Subject: NHB review: NHB18-1058

Attached, please find the review we have completed. If your review memo includes potential impacts to plants or natural communities please contact me for further information. If your project had potential impacts to wildlife, please contact NH Fish and Game at the phone number listed on the review.

Best,
Amy

Amy Lamb
Ecological Information Specialist

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301
603-271-2834

Exhibit 7

Christine J. Perron

From: vonOettingen, Susi <susi_vonoettingen@fws.gov>
Sent: Wednesday, April 04, 2018 10:45 AM
To: Martin, Rebecca
Subject: Re: [EXTERNAL] RE: NH DOT Bow-Concord 13742 Acoustic Survey Report

Hi,

I think it is very realistic to use P/A surveys in lieu of bridge surveys for the time being. I have yet to see anything really conclusive re: NLEB use of bridges in New England. I think Alyssa may have some info on NLEB use, but I have no reports or documentation. We have bats - big and little browns, but I'm not sure about confirmed NLEB>

Susi

****
Susi von Oettingen
Endangered Species Biologist
New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301
(W) 603-227-6418
(Fax) 603-223-0104

www.fws.gov/newengland

On Wed, Apr 4, 2018 at 10:31 AM, Martin, Rebecca <Rebecca.Martin@dot.nh.gov> wrote:

> Hello Susi,
>
> As you might recall, the Bow-Concord acoustic survey last summer resulted in probable absence of NLEB in the project area. Also, the IPaC key for the NLEB and IBat Programmatic was recently updated. Our consultant was entering information about the project into the key and came to the question about bridge assessments (which have not been completed) at that step the key asks if a P/A survey was completed within 0.25 mi of the bridge. When our consultant selects yes for that question, it asks if the Field Office has verified that the P/A survey can be used for determining NLEB absence from bridges. I know we have discussed that NH bridges are not frequently used by bats. What are your thoughts on using the result of the P/A survey for determining NLEB absence from bridges?
>
> Thank you,
>
> Rebecca
>
> ---
>
> **From:** Martin, Rebecca
> **Sent:** Monday, December 11, 2017 1:56 PM

To: Susi vonOettingen (Susi_vonOettingen@fws.gov)
Subject: NH DOT Bow-Concord 13742 Acoustic Survey Report

Hello Susi,

Please find attached the acoustic survey report for the Bow-Concord 13742 project. Can you confirm receipt (large file)?

If you need any additional information, please let me know.

Happy Holidays!

Rebecca Martin

Senior Environmental Manager

NH DOT Bureau of Environment

7 Hazen Drive

Concord, NH 03302

(603)271-6781

Rebecca.Martin@dot.nh.gov

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

In Reply Refer To: October 10, 2018
Consultation Code: 05E1NE00-2018-I-1481
Event Code: 05E1NE00-2019-E-00159
Project Name: Bow-Concord 13742

Subject: Concurrence verification letter for the 'Bow-Concord 13742' project under the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

To whom it may concern:

The U.S. Fish and Wildlife Service (Service) has received your request dated to verify that the **Bow-Concord 13742** (Proposed Action) may rely on the concurrence provided in the February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (PBO) to satisfy requirements under Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended; 16 U.S.C 1531 *et seq.*).

Based on the information you provided (Project Description shown below), you have determined that the Proposed Action is within the scope and adheres to the criteria of the PBO, including the adoption of applicable avoidance and minimization measures, may affect, but is not likely to adversely affect (NLAA) the endangered Indiana bat (*Myotis sodalis*) and/or the threatened Northern long-eared bat (*Myotis septentrionalis*).

The Service has 14 calendar days to notify the lead Federal action agency or designated non-federal representative if we determine that the Proposed Action does not meet the criteria for a NLAA determination under the PBO. If we do not notify the lead Federal action agency or designated non-federal representative within that timeframe, you may proceed with the Proposed Action under the terms of the NLAA concurrence provided in the PBO. This verification period allows Service Field Offices to apply local knowledge to implementation of the PBO, as we may identify a small subset of actions having impacts that were unanticipated. In such instances, Service Field Offices may request additional information that is necessary to verify inclusion of the proposed action under the PBO.

For Proposed Actions that include bridge/structure removal, replacement, and/or maintenance activities: If your initial bridge/structure assessments failed to detect Indiana bats, but you later detect bats during construction, please submit the Post Assessment Discovery of Bats at Bridge/Structure Form (User Guide Appendix E) to this Service Office. In these instances, potential incidental take of Indiana bats may be exempted provided that the take is reported to the Service.

If the Proposed Action is modified, or new information reveals that it may affect the Indiana bat and/or Northern long-eared bat in a manner or to an extent not considered in the PBO, further review to conclude the requirements of ESA Section 7(a)(2) may be required. If the Proposed Action may affect any other federally-listed or proposed species, and/or any designated critical habitat, additional consultation is required. If the proposed action has the potential to take bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act may also be required. In either of these circumstances, please contact this Service Office.

The following species may occur in your project area and **are not** covered by this determination:

- Small Whorled Pogonia, *Isotria medeoloides* (Threatened)

Project Description

The following project name and description was collected in IPaC as part of the endangered species review process.

Name

Bow-Concord 13742

Description

The project consists of a 4.5-mile section of the I-93 corridor from just south of its intersection with Interstate 89 (I-89) to just north of its intersection with Interstate 393 (I-393) at Exit 15. Exits 12, 13, 14 & 15 on I-93 are included in the project area, as well as Exit 1 on I-89 and Exit 1 on I-393.

I-93 through Bow and Concord is a four-lane divided urban principal arterial highway with limited access, meaning access is provided only at interchanges. South of the project limits, I-93 is a six-lane divided urban arterial highway. The basic purpose of the project is to improve transportation efficiency and reduce safety problems within this approximately 4.5-mile segment of highway.

Determination Key Result

Based on your answers provided, this project(s) may affect, but is not likely to adversely affect the endangered Indiana bat and/or the threatened Northern long-eared bat. Therefore, consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required. However, also based on your answers provided, this project may rely on the concurrence provided in the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

Qualification Interview

1. Is the project within the range of the Indiana bat[1]?

   [1] See Indiana bat species profile

   Automatically answered
   No

2. Is the project within the range of the Northern long-eared bat[1]?

   [1] See Northern long-eared bat species profile

   Automatically answered
   Yes

3. Which Federal Agency is the lead for the action?
   A) Federal Highway Administration (FHWA)

4. Are *all* project activities limited to non-construction[1] activities only? (examples of non-construction activities include: bridge/abandoned structure assessments, surveys, planning and technical studies, property inspections, and property sales)

   [1] Construction refers to activities involving ground disturbance, percussive noise, and/or lighting.

   No

5. Does the project include *any* activities that are **greater than** 300 feet from existing road/ rail surfaces[1]?

   [1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

   No

6. Does the project include *any* activities **within** 0.5 miles of an Indiana bat and/or NLEB hibernaculum[1]?

   [1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

   No

7. Is the project located **within** a karst area?

   No

8. Is there *any* suitable[1] summer habitat for Indiana Bat or NLEB **within** the project action area[2]? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   [2] The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Section 402.02). Further clarification is provided by the national consultation FAQs.

   Yes

9. Will the project remove *any* suitable summer habitat[1] and/or remove/trim any existing trees **within** suitable summer habitat?

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   Yes

10. Will the project clear more than 20 acres of suitable habitat per 5-mile section of road/rail?

    No

11. Have presence/probable absence (P/A) summer surveys[1][2] been conducted[3][4] **within** the suitable habitat located within your project action area?

    [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

    [2] Presence/probable absence summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate distance from hibernacula) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

    [3] For projects within the range of either the Indiana bat or NLEB in which suitable habitat is present, and no bat surveys have been conducted, the transportation agency will assume presence of the appropriate species. This assumption of presence should be based upon the presence of suitable habitat and the capability of bats to occupy it because of their mobility.

    [4] Negative presence/probable absence survey results obtained using the summer survey guidance are valid for a minimum of two years from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise.

    Yes

    SUBMITTED DOCUMENTS

    - *Bow-Concord 13742 Acoustic Survey Report December 2017.pdf https://ecos.fws.gov/ipac/project/2TNC27MCOFGN7MTIML73OIWJHE/projectDocuments/11878187*

12. Did the presence/probable absence (P/A) summer surveys detect Indiana bats and/or NLEB[1]?

    [1] P/A summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate home range) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

    No

13. Were the P/A summer surveys conducted **within** the fall swarming/spring emergence range of a documented Indiana bat hibernaculum[1]?

    [1] Contact the local Service Field Office for appropriate distance from hibernacula.

    No

14. Does the project include activities **within documented NLEB habitat**[1][2]?

    [1] Documented roosting or foraging habitat – for the purposes of this consultation, we are considering documented habitat as that where Indiana bats and/or NLEB have actually been captured and tracked using (1) radio telemetry to roosts; (2) radio telemetry biangulation/triangulation to estimate foraging areas; or (3) foraging areas with repeated use documented using acoustics. Documented roosting habitat is also considered as suitable summer habitat within 0.25 miles of documented roosts.)

    [2] For the purposes of this key, we are considering documented corridors as that where Indiana bats and/or NLEB have actually been captured and tracked to using (1) radio telemetry; or (2) treed corridors located directly between documented roosting and foraging habitat.

    No

15. Will the removal or trimming of habitat or trees occur **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors?

    Yes

16. What time of year will the removal or trimming of habitat or trees **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors occur?

    C) During both the active and inactive seasons

17. Will *any* tree trimming or removal occur **within** 100 feet of existing road/rail surfaces?

    Yes

18. Will **more than** 10 trees be removed **between** 0-100 feet of the road/rail surface *during* the active season[1]?

    [1] Areas containing more than 10 trees will be assessed by the local Service Field Office on a case-by-case basis with the project proponent.

    Yes

19. Will the tree removal alter *any* **documented** Indiana bat or NLEB roosts and/or alter any surrounding summer habitat **within** 0.25 mile of a documented roost?

    No

20. Will *any* tree trimming or removal occur **between** 100-300 feet of existing road/rail surfaces?

    Yes

21. Are *all* trees that are being removed clearly demarcated?

    Yes

22. Will the removal of habitat or the removal/trimming of trees involve the use of **temporary** lighting?

    Yes

23. Will the removal of habitat or the removal/trimming of trees include installing new or replacing existing **permanent** lighting?

    Yes

24. Does the project include maintenance of the surrounding landscape at existing facilities (e.g., rest areas, stormwater detention basins)?

    No

25. Does the project include wetland or stream protection activities associated with compensatory wetland mitigation?

    No

26. Does the project include slash pile burning?

    No

27. Does the project include *any* bridge removal, replacement, and/or maintenance activities (e.g., any bridge repair, retrofit, maintenance, and/or rehabilitation work)?

    Yes

28. Is there *any* suitable habitat[1] for Indiana bat or NLEB **within** 1,000 feet of the bridge? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

    [1] See the Service's current summer survey guidance for our current definitions of suitable habitat.

    Yes

29. Has a bridge assessment[1] been conducted **within** the last 24 months[2] to determine if the bridge is being used by bats?

    [1] See User Guide Appendix D for bridge/structure assessment guidance

    [2] Assessments must be completed no more than 2 years prior to conducting any work below the deck surface on all bridges that meet the physical characteristics described in the Programmatic Consultation, regardless of whether assessments have been conducted in the past. Due to the transitory nature of bat use, a negative result in one year does not guarantee that bats will not use that bridge/structure in subsequent years.

    No

30. Is the bridge **within** a known maternity colony's home range[1]?

[1] Contact your local FWS office for more information if you are uncertain about where the nearest known maternity colony is located.

No

31. Have presence/probable absence (P/A) summer surveys[1][2] been conducted for this project with at least one survey point **within** suitable habitat and **within** 0.25 miles of the bridge[3][4]?

[1] See the Service's summer survey guidance for our current definitions of suitable habitat.

[2] Presence/probable absence summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate distance from hibernacula) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

[3] For projects within the range of either the Indiana bat or NLEB in which suitable habitat is present, and no bat surveys have been conducted, the transportation agency will assume presence of the appropriate species. This assumption of presence should be based upon the presence of suitable habitat and the capability of bats to occupy it because of their mobility.

[4] Negative presence/probable absence survey results obtained using the summer survey guidance are valid for a minimum of two years from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise.

Yes, P/A summer surveys were conducted within 0.25 miles of the bridge

SUBMITTED DOCUMENTS

- *Bow-Concord 13742 Acoustic Survey Report December 2017.pdf https://ecos.fws.gov/ipac/project/2TNC27MCOFGN7MTIML73OIWJHE/projectDocuments/11878187*

32. Did the presence/probable absence (P/A) summer surveys detect Indiana bats and/or NLEB[1]?

[1] P/A summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate home range) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

No, bats were not detected during the P/A surveys

33. Did the local Service Field Office verify[1] that this presence/probable absence (P/A) summer survey can be used for determining Indiana bat and/or NLEB absence from the bridge?

    [1] Coordination with local US Fish and Wildlife Service Field Office regarding the applicability of P/A surveys for this use is required.

    Yes, the local FWS office confirmed that this P/A survey can be used to assume bats are absent from the bridge

34. Will the bridge removal, replacement, and/or maintenance activities include installing new or replacing existing **permanent** lighting?

    Yes

35. Does the project include the removal, replacement, and/or maintenance of *any* structure other than a bridge? (e.g., rest areas, offices, sheds, outbuildings, barns, parking garages, etc.)

    Yes

36. Is there *any* suitable habitat[1] for Indiana bat or NLEB **within** 1,000 feet of the structure? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

    [1] See the Service's current summer survey guidance for our current definitions of suitable habitat.

    No

37. Will the project involve the use of *any* **temporary** lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees), or bridge/structure removal, replacement or maintenance activities?

    Yes

38. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **temporary** lighting (other than the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities) will be used?

    Yes

39. Will the project install *any* new or replace any existing **permanent** lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities?

    Yes

40. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **permanent** lighting (other than the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities) will be installed or replaced?

    Yes

41. Does the project include percussives or other activities (**not including tree removal/ trimming or bridge/structure work**) that will increase noise levels above existing traffic/ background levels?

    Yes

42. Will the activities that use percussives (**not including tree removal/trimming or bridge/ structure work**) and/or increase noise levels above existing traffic/background levels be conducted *during* the active season[1]?

    [1] Coordinate with the local Service Field Office for appropriate dates.

    Yes

43. Will *any* activities that use percussives (**not including tree removal/trimming or bridge/ structure work**) and/or increase noise levels above existing traffic/background levels be conducted *during* the inactive season[1]?

    [1] Coordinate with the local Service Field Office for appropriate dates.

    Yes

44. Are *all* project activities that are **not associated with** habitat removal, tree removal/ trimming, bridge or structure removal, replacement, and/or maintenance, lighting, or use of percussives, limited to actions that DO NOT cause any stressors to the bat species, including as described in the BA/BO (i.e. activities that do not involve ground disturbance, percussive noise, temporary or permanent lighting, tree removal/trimming, nor bridge/ structure activities)?

    Examples: lining roadways, unlighted signage , rail road crossing signals, signal lighting, and minor road repair such as asphalt fill of potholes, etc.

    No

45. Will the project raise the road profile **above the tree canopy**?

    No

46. Are the project activities that use percussives (not including tree removal/trimming or bridge/structure work) consistent with a Not Likely to Adversely Affect determination in this key?

    Automatically answered
    Yes, because the activities are within 300 feet of the existing road/rail surface, greater than 0.5 miles from a hibernacula, and are not within documented habitat

47. Are the project activities that use percussives (not including tree removal/trimming or bridge/structure work) and/or increase noise levels above existing traffic/background levels consistent with a No Effect determination in this key?

    Automatically answered
    Yes, because the activities are within 300 feet of the existing road/rail surface, greater than 0.5 miles from a hibernacula, and conducted during the inactive season

48. Is the location of this project consistent with a Not Likely to Adversely Affect determination in this key?

    Automatically answered
    Yes, because no bats were detected during presence/probable absence surveys conducted during the summer survey season and outside of the fall swarming/spring emergence periods. Additionally, all activities were at least 0.5 miles from any hibernaculum.

49. Is the bridge removal, replacement, or maintenance activities portion of this project consistent with a No Effect determination in this key?

    Automatically answered
    Yes, because the bridge has been assessed using the criteria documented in the BA and no signs of bats were detected

50. Is the structure removal, replacement, or maintenance activities portion of this project consistent with a No Effect determination in this key?

    Automatically answered
    Yes, because the structure is more than 1,000 feet from the nearest suitable habitat and is therefore considered unsuitable for use by bats

51. **General AMM 1**
    Will the project ensure *all* operators, employees, and contractors working in areas of known or presumed bat habitat are aware of *all* FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable Avoidance and Minimization Measures?

    Yes

52. **Lighting AMM 2**
Does the lead agency use the BUG (Backlight, Uplight, and Glare) system developed by the Illuminating Engineering Society[1][2] to rate the amount of light emitted in unwanted directions?

[1] Refer to Fundamentals of Lighting - BUG Ratings

[2] Refer to The BUG System—A New Way To Control Stray Light

No

53. **Lighting AMM 2**
Will *all* **permanent** lighting used during removal of suitable habitat and/or the removal/ trimming of trees within suitable habitat use downward-facing, full cut-off[1] lens lights (with same intensity or less for replacement lighting)?

[1] Refer to Luminaire classification for controlling stray light

Yes

54. **Lighting AMM 2**
Will *all* **permanent** lighting used during removal of suitable habitat and/or the removal/ trimming of trees within suitable habitat be directed away from *all* areas with suitable habitat?

Yes

55. **Lighting AMM 1**
Will *all* **temporary** lighting (besides that indicated for tree clearing or bridge/structure removal, replacement or maintenance activities) be directed away from suitable habitat during the active season?

Yes

56. **Lighting AMM 2**
Does the lead agency use the BUG (Backlight, Uplight, and Glare) system developed by the Illuminating Engineering Society[1][2] to rate the amount of light emitted in unwanted directions?

[1] Refer to Fundamentals of Lighting - BUG Ratings

[2] Refer to The BUG System—A New Way To Control Stray Light

No

57. **Lighting AMM 2**
Will *all* **permanent** lighting (other than any lighting already indicated for tree clearing or bridge/structure removal, replacement or maintenance activities) use downward-facing, full cut-off[1] lens lights (with same intensity or less for replacement lighting)?

[1] Refer to Luminaire classification for controlling stray light

Yes

58. **Lighting AMM 2**
Will the **permanent** lighting (other than any lighting already indicated for tree clearing or bridge/structure removal, replacement or maintenance activities) be directed away from *all* areas with suitable habitat?

Yes

Project Questionnaire

1. Have you made a No Effect determination for *all* other species indicated on the FWS IPaC generated species list?
Yes

2. Have you made a May Affect determination for *any* other species on the FWS IPaC generated species list?
No

3. How many acres[1] of trees are proposed for removal between 0-100 feet of the existing road/rail surface?

[1] If described as number of trees, multiply by 0.09 to convert to acreage and enter that number.

30.0

4. Please describe the proposed bridge work:
The project proposes to replace, rehabilitate, or widen 11 existing bridges. Additionally, 7 new bridges are proposed.

5. Please state the timing of all proposed bridge work:
Construction of this project has not yet been scheduled. At this time, it is assumed that bridge work could occur during the active season.

6. Please describe the proposed structure work:
It is anticipated that the project would require the removal of up to 5 buildings.

7. Please state the timing of all proposed structure work:
   Construction of this project has not yet been scheduled. At this time, it is assumed that building removal could occur during the active season.

Avoidance And Minimization Measures (AMMs)

These measures **were accepted** as part of this determination key result:

GENERAL AMM 1

Ensure all operators, employees, and contractors working in areas of known or presumed bat habitat are aware of all FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable AMMs.

LIGHTING AMM 2

When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting); or for those transportation agencies using the BUG system developed by the Illuminating Engineering Society, be as close to 0 for all three ratings with a priority of "uplight" of 0 and "backlight" as low as practicable.

Determination Key Description: FHWA, FRA, FTA Programmatic Consultation For Transportation Projects Affecting NLEB Or Indiana Bat

This key was last updated in IPaC on March 16, 2018. Keys are subject to periodic revision.

This decision key is intended for projects/activities funded or authorized by the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and/or Federal Transit Administration (FTA), which require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 of the Endangered Species Act (ESA) for the endangered **Indiana bat** (*Myotis sodalis*) and the threatened **Northern long-eared bat** (NLEB) (*Myotis septentrionalis*).

This decision key should only be used to verify project applicability with the Service's February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects. The programmatic biological opinion covers limited transportation activities that may affect either bat species, and addresses situations that are both likely and not likely to adversely affect either bat species. This decision key will assist in identifying the effect of a specific project/activity and applicability of the programmatic consultation. The programmatic biological opinion is not intended to cover all types of transportation actions. Activities outside the scope of the programmatic biological opinion, or that may affect ESA-listed species other than the Indiana bat or NLEB, or any designated critical habitat, may require additional ESA Section 7 consultation.

Exhibit 8

New Hampshire DOT Department of Transportation

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

Victoria F. Sheehan
Commissioner

William Cass, P.E.
Assistant Commissioner

BOW-CONCORD
T-A000(018)
13742
RPR 5623

Adverse Effect Memo

Pursuant to meetings and discussions on July 11, 2002, September 3, 2004, October 1, 2009, February 10, 2011, September 13, 2012, April 3, 2014, March 12, 2018, and June 14, 2018 and for the purpose of compliance with regulations of the National Historic Preservation Act, as amended, and the Advisory Council on Historic Preservation's *Procedures for the Protection of Historic Properties* (36 CFR 800), the NH Division of the Federal Highway Administration and the NH Division of Historical Resources have coordinated the identification and evaluation of historic and archeological properties with plans to widen a 4.5-mile section of Interstate 93 from south of its intersection with Interstate 89 (I-89) in Bow to just north of its intersection with Interstate 393 (I-393) at Exit 15 in Concord, New Hampshire. Exits 12, 13, 14 & 15 on I-93 are included in the project area, as well as Exit 1 on I-89 and Exit 1 on I-393.

Project Description:
The project consists of widening I-93 to 3 lanes in each direction with 12' shoulders. A fourth auxiliary lane will be provided between closely spaced interchanges and deficient interchanges will be addressed. The project area was divided into four segments for the alternatives analysis:

I-89 Area – This segment encompasses the I-93/I-89 interchange and Exit 1 on I-89. The close proximity of the two interchanges results in a short weaving sections between the two interchanges. The preferred alternative in this area includes braided ramps between the two interchanges, a Collector-Distributor Road for southbound I-89 traffic that would accommodate traffic utilizing Exit 1 and travelling southbound on I-93, and a new directional ramp for northbound I-93 to northbound I-89 traffic.

Exit 12 Area – This segment begins just north of the I-89 interchange to the bridge carrying I-93 over Hall Street. Three of the Exit 12 off ramps have deficient deceleration distances. The preferred alternative in this area includes replacing the bridges over Hall Street and the Pan Am railroad. The off ramps at Exit 12 will be reconfigured to address the deficient deceleration. To help with traffic on NH Route 3A, two roundabouts are proposed at the highway entrances/exits.

Exit 13 Area – This segment encompasses just north of where Hall Street crosses under the highway, the Exit 13 interchange to where the Merrimack River curves toward and runs parallel to the highway. There are queuing issues at the Exit 13 northbound off-ramp and the preferred alternative will widen the off-ramp and provide a signal at the intersection with Manchester Street.

Exit 14/15 Area – This segment encompasses just south of the Exit 14 ramps north to the Delta Drive Bridge over I-93, it extends west along I-393 to Commercial Street and east along I-393 to just before the Merrimack River. There are weaving issues between Exits 14 and 15 and within Exit 15. There are four red listed bridges in this study area; Delta Drive over I-93, I-393 over I-93, I-393 over Constitution Avenue, and I-393 over Fort Eddy Road/College Drive. A noise wall is proposed adjacent to the NH Technical Institute's campus, along I-93 from I-393 to the Delta Drive overpass.

Analysis:
Based on a review pursuant to 36 CFR 800.4 of the architectural and/or historical significance of resources in the project area, we agree that the following resources are eligible for listing on the National Register of Historic Places:

- 2 Valley Road, Bow, Upton House and Store – BOW0015
- 8 Logging Hill Road, Bow – BOW0023
- 521 South Street/1 Valley Road, Bow – BOW0014
- 22 Bridge Street, Concord, Ralph Pill Building/Concord Shoe Company – CON0516
- 24 Bridge Street, Concord, Concord Electric Light Station – CON0522
- 50 Storrs Street, Concord – CON0517
- 207 North Main Street, Concord – CON0512
- 244-246 North Main Street, Concord – CON0514
- 248-250 North Main Street, Concord – CON0515
- Boston, Concord & Montreal Railroad Corridor Historic District
- NH Highway Garage Complex on Stickney Avenue, Concord
- New Hampshire Technical Institute (NHTI), Concord

Detailed descriptions of the resources are on file at the New Hampshire Division of Historical Resources in Concord, New Hampshire.

A Phase IA Archaeological Sensitivity Assessment, completed by Independent Archaeological Consulting, LLC in April 2016, identified areas of moderate to high potential for undisturbed archaeological resources. In total, there are 27 potential resources within the project area, 19 in Bow and 8 in Concord. These potential resources include Native American sites ranging from Pre-Contact large base camps, small residential sites, to fishing processing sites. Potential Post-Contact Euroamerican resources range from 19th century saw and grist mills along the Turkey River, blacksmith shops, school houses, brickyards, residences to farmsteads.

During final design, Phase IB Intensive Archaeological Investigations at 16 of the 27 archaeologically sensitive locales will be conducted to establish the presence or absence of archaeological resources in the area of potential effect. The 11 locales not being investigated are outside of the project impact areas. Following the results of the Phase IB, all necessary phases of archaeology will be completed.

Public Consultation:
Coordination and meetings with stakeholders have been ongoing since 2016. Two Consulting Parties were identified, Faye Johnson, member of the Bow Heritage Commission, and Roy Schweiker, Concord resident. Public informational meetings were held on May 31, 2017, June 1, 2017, February 14 and 15, 2018 and June 7, 2018.

Determination of Effect:
Applying the criteria of effect at 36 CFR 800.5, we have determined that the project will have an adverse effect on 2 Valley Road and 521 South Street/1 Valley Road, in Bow. The roadway is shifting in that location and the property at 521 South Street/1 Valley Road will be fully acquired by the State and removed. There will be a retaining wall less than 20 feet from 2 Valley Road, greatly impacting its setting.

There will be no adverse effect to the following properties: 22 Bridge Street; 24 Bridge Street; Boston, Concord & Montreal Railroad; NH Highway Garage Complex; and NHTI, all in Concord. Impacts to these properties consist of the following:

22 Bridge Street: Loudon Road would be approximately 7' to 8' closer to the property but would remain within the existing Loudon Road and Bridge Street right-of-ways. Driveway modifications would extend onto the property. These modifications will not impact the character defining features of the buildings.

24 Bridge Street: Loudon Road would be approximately 7' to 8' closer to the property but would remain within the existing Loudon Road and Bridge Street right-of-ways. Driveway modifications would extend onto the property. These modifications will not impact the character defining features of the buildings.

Boston, Concord & Montreal Railroad: Impacts to the rail line and associated structures were avoided. A permanent easement will be needed for slope grading and/or utilities. This easement would be a strip easement located along 1,500 feet or less of the railroad property. The easement and any slope grading will not impact the character defining features of the railroad. Aside from the rail there are no rail features in the area of the easement.

NH Highway Garage Complex: Impacts to the buildings on this property were avoided. Acquisition of approximately 250 square feet will be necessary for slope grading and sidewalk relocation. The acquisition is necessary for the relocation of an existingsidewalk, and will not impact the design, workmanship, location, materials, feeling or association of the resource. The setting will be very minimally altered, but will not impact any character defining features of the Garage complex.

NHTI: Partial acquisition or permanent easements will be required for slope grading and a stormwater treatment area, totaling approximately 1.8 acres. All impacts will be located along the perimeter of the property and no buildings will be impacted. The proposed stormwater treatment area would be more than 1,000' from the campus buildings.

Based upon the noise studies completed to date, the State intends to install a sound wall adjacent to the NHTI campus as a noise abatement measure. It is unknown at the time of this memo if the NHTI directors will welcome the wall. The final decision on the installation and design of the sound wall will be made upon completion of the project final design and public involvement process. If the sound wall is installed it will significantly decrease the noise that is currently experienced on portions of the campus, near I-93, from 68.4 dB(A) to 62.6 dB(A) with a 16' sound wall or 59.9 dB(A) with a 25' sound wall. While it may also impact the view from the installation of a sound wall, it has been determined that the view to the highway is not a character defining feature of the campus, and therefore a sound wall would not adversely affect the eligibility of NHTI. If NHTI opposes the sound wall for aesthetic reasons, the department may be able to work with NHTI on the design of the wall. Should NHTI elect not to have a sound wall constructed, there would be no impact to the campus other than the impacts described above. Although the noise levels would increase, as the I-93 ramps would be closer to the property, current noise analysis shows that the noise from the highway is already at a mitigatable level, per Federal noise regulations. Therefore, not installing a sound wall would slightly increase the already loud highway noise, from 68.4 dB(A) to 69.9 dB(A).

The following properties will not be affected by the undertaking: 8 Logging Hill Road in Bow, 50 Storrs Street, 207 North Main Street, 244-246 North Main Street, and 248-250 North Main Street in Concord. These properties fall outside of any direct or indirect impacts.

The result of identification and evaluation for the proposed Bow-Concord Interstate 93 Improvement Project is a finding of *Adverse Effect*.

Mitigation Measures:
Appropriate mitigation for the impacts to the two Bow properties will be recorded in a Memorandum of Agreement. The mitigation stipulation will be decided in consultation with FHWA, NHDOT, SHPO and the Consulting Parties.

Section 4(f) *(to be completed by FHWA)*	*There Will Be:*	☐ **No 4(f);**	☐ **Programmatic 4(f);**	☒ **Full 4 (f); or**
	☐ **A finding of *de minimis* 4(f) impact as stated:** In addition, with NHDHR concurrence of no adverse effect for the above undertaking, and in accordance with 23 CFR 774.3, FHWA intends to, and by signature below, does make a finding of *de minimis* impact. NHDHR's signature represents concurrence with both the no adverse effect determination and the *de minimis* findings. Parties to the Section 106 process have been consulted and their concerns have been taken into account. Therefore, the requirements of Section 4(f) have been satisfied.			

In accordance with the Advisory Council's regulations, consultation will continue, as appropriate, as this project proceeds.

Leigh Levine 10/11/2018 Jill Edelmann 10/9/2018

For: Patrick Bauer, Administrator — Date
Federal Highway Administrator

Jill Edelmann — Date
Cultural Resources Manager

Concurred with by the NH State Historic Preservation Officer:

Elizabeth H. Muzzey — Date
State Historic Preservation Officer
NH Division of Historical Resources

c.c. Jamie Sikora, FHWA
Christine St. Louis, NHDHR
Rebecca Martin , NHDOT
Don Lyford, NHDOT
Gene McCarthy, MJ
Christine Perron, MJ

s:\environment\projects\bow\13742\cultural\13742adverseeffectfhwa.docx

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

System: M - Marine

Subsystem: 1 - Subtidal; 2 - Intertidal

	1 - Subtidal				2 - Intertidal			
Class	RB – Rock Bottom	UB – Unconsolidated Bottom	AB – Aquatic Bed	RF – Reef	AB – Aquatic Bed	RF – Reef	RS – Rocky Shore	US – Unconsolidated Shore
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud	1 Algal 3 Rooted Vascular	1 Coral 3 Worm	1 Algal 3 Rooted Vascular	1 Coral 3 Worm	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic

System: E - Estuarine

Subsystem: 1 - Subtidal; 2 - Intertidal

	1 - Subtidal				2 - Intertidal							
Class	RB – Rock Bottom	UB – Unconsolidated Bottom	AB – Aquatic Bed	RF – Reef	AB – Aquatic Bed	RF – Reef	SB – Streambed	RS – Rocky Shore	US – Unconsolidated Shore	EM – Emergent	SS – Scrub-Shrub	FO – Forested
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vascular 4 Floating Vascular	2 Mollusk 3 Worm	1 Algal 3 Rooted Vascular 4 Floating Vascular	2 Mollusk 3 Worm	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Non-persistent 5 *Phragmites australis*	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

System: R - Riverine

Subsystem: 1 - Tidal; 2 – Lower Perennial; 3 – Upper Perennial; 4* - Intermittent; 5* – Unknown Perennial

Class	RB** – Rock Bottom	UB – Unconsolidated Bottom	SB** – Streambed	AB – Aquatic Bed	RS – Rocky Shore	US – Unconsolidated Shore	EM – Emergent
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent

* **Intermittent** is limited to the **Streambed** Class;
Unknown Perennial is limited to **Unconsolidated Bottom** Class code **R5UB** only

** **Rock Bottom** is not permitted for the **Lower Perennial** Subsystem;
Streambed is limited to **Tidal** and **Intermittent** Subsystems

Classification of Wetlands and Deepwater Habitats of the United States, Cowardin *et al*. 1979

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

System: L - Lacustrine

- **Subsystem:** 1 - Limnetic
  - **Class:** RB – Rock Bottom
    - **Subclass:** 1 Bedrock; 2 Rubble
  - **Class:** UB – Unconsolidated Bottom
    - **Subclass:** 1 Cobble-Gravel; 2 Sand; 3 Mud; 4 Organic
  - **Class:** AB – Aquatic Bed
    - **Subclass:** 1 Algal; 2 Aquatic Moss; 3 Rooted Vascular; 4 Floating Vascular
- **Subsystem:** 2 - Littoral
  - **Class:** RB – Rock Bottom
    - **Subclass:** 1 Bedrock; 2 Rubble
  - **Class:** UB – Unconsolidated Bottom
    - **Subclass:** 1 Cobble-Gravel; 2 Sand; 3 Mud; 4 Organic
  - **Class:** AB – Aquatic Bed
    - **Subclass:** 1 Algal; 2 Aquatic Moss; 3 Rooted Vascular; 4 Floating Vascular
  - **Class:** RS – Rocky Shore
    - **Subclass:** 1 Bedrock; 2 Rubble
  - **Class:** US – Unconsolidated Shore
    - **Subclass:** 1 Cobble-Gravel; 2 Sand; 3 Mud; 4 Organic; 5 Vegetated
  - **Class:** EM – Emergent
    - **Subclass:** 2 Nonpersistent

System: P - Palustrine

- **Class:** RB – Rock Bottom
  - **Subclass:** 1 Bedrock; 2 Rubble
- **Class:** UB – Unconsolidated Bottom
  - **Subclass:** 1 Cobble-Gravel; 2 Sand; 3 Mud; 4 Organic
- **Class:** AB – Aquatic Bed
  - **Subclass:** 1 Algal; 2 Aquatic Moss; 3 Rooted Vascular; 4 Floating Vascular
- **Class:** US – Unconsolidated Shore
  - **Subclass:** 1 Cobble-Gravel; 2 Sand; 3 Mud; 4 Organic; 5 Vegetated
- **Class:** ML – Moss-Lichen
  - **Subclass:** 1 Moss; 2 Lichen
- **Class:** EM – Emergent
  - **Subclass:** 1 Persistent; 2 Nonpersistent; 5 *Phragmites australis*
- **Class:** SS – Scrub-Shrub
  - **Subclass:** 1 Broad-Leaved Deciduous; 2 Needle-Leaved Deciduous; 3 Broad-Leaved Evergreen; 4 Needle-Leaved Evergreen; 5 Dead; 6 Deciduous; 7 Evergreen
- **Class:** FO – Forested
  - **Subclass:** 1 Broad-Leaved Deciduous; 2 Needle-Leaved Deciduous; 3 Broad-Leaved Evergreen; 4 Needle-Leaved Evergreen; 5 Dead; 6 Deciduous; 7 Evergreen

MODIFIERS

In order to more adequately describe the wetland and deepwater habitats, one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

Water Regime			Special Modifiers	Water Chemistry			Soil
Nontidal	**Saltwater Tidal**	**Freshwater Tidal**		**Coastal Halinity**	**Inland Salinity**	**pH Modifiers for all Fresh Water**	
A Temporarily Flooded	L Subtidal	S Temporarily Flooded-Tidal	b Beaver	1 Hyperhaline	7 Hypersaline	a Acid	g Organic
B Saturated	M Irregularly Exposed	R Seasonally Flooded-Tidal	d Partly Drained/Ditched	2 Euhaline	8 Eusaline	t Circumneutral	n Mineral
C Seasonally Flooded	N Regularly Flooded	T Semipermanently Flooded-Tidal	f Farmed	3 Mixohaline (Brackish)	9 Mixosaline	i Alkaline	
E Seasonally Flooded/ Saturated	P Irregularly Flooded	V Permanently Flooded-Tidal	h Diked/Impounded	4 Polyhaline	0 Fresh		
F Semipermanently Flooded			r Artificial	5 Mesohaline			
G Intermittently Exposed			s Spoil	6 Oligohaline			
H Permanently Flooded			x Excavated	0 Fresh			
J Intermittently Flooded							
K Artificially Flooded							

1 6' BITUMINOUS SIDEWALK
WITH GRANITE CURB

2 RAISED SPLITTER ISLAND

3 NEW TRAFFIC SIGNAL

4 NEW STREET TREES

5 NEW DECIDUOUS AND EVERGREEN PLANTING

6 BIKE LANE

7 NEW CROSS WALK

8 NEW RETAINING WALL

9 NEW MEADOW PLANTING

- - - APPROXIMATE EXTENT OF NEW PLANTING

PERSPECTIVE VIEW SHED

BOW CONCORD VISUAL IMPACT ASSESSMENT: I-89 CONCEPT K -PROPOSED PLAN
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson CRJA landscape architects

BOW CONCORD VISUAL IMPACT ASSESSMENT: I-89 CONCEPT K - EXISTING
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

BOW CONCORD VISUAL IMPACT ASSESSMENT: I-89 CONCEPT K - PROPOSED
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
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landscape architects

① 6' BITUMINOUS SIDEWALK
WITH GRANITE CURB

② RAISED SPLITTER ISLAND

③ NEW TRAFFIC SIGNALS

④ NEW STREET TREES

⑤ NEW DECIDUOUS AND EVERGREEN TREE PLANTING

⑥ BIKE LANE

⑦ NEW CROSS WALK

1 6' BITUMINOUS SIDEWALK
WITH GRANITE CURB

2 RAISED SPLITTER ISLAND

3 PLANTED CENTRAL ISLAND

4 COBBLESTONE TRUCK APRON

5 NEW STREET TREES

6 BIKE LANE

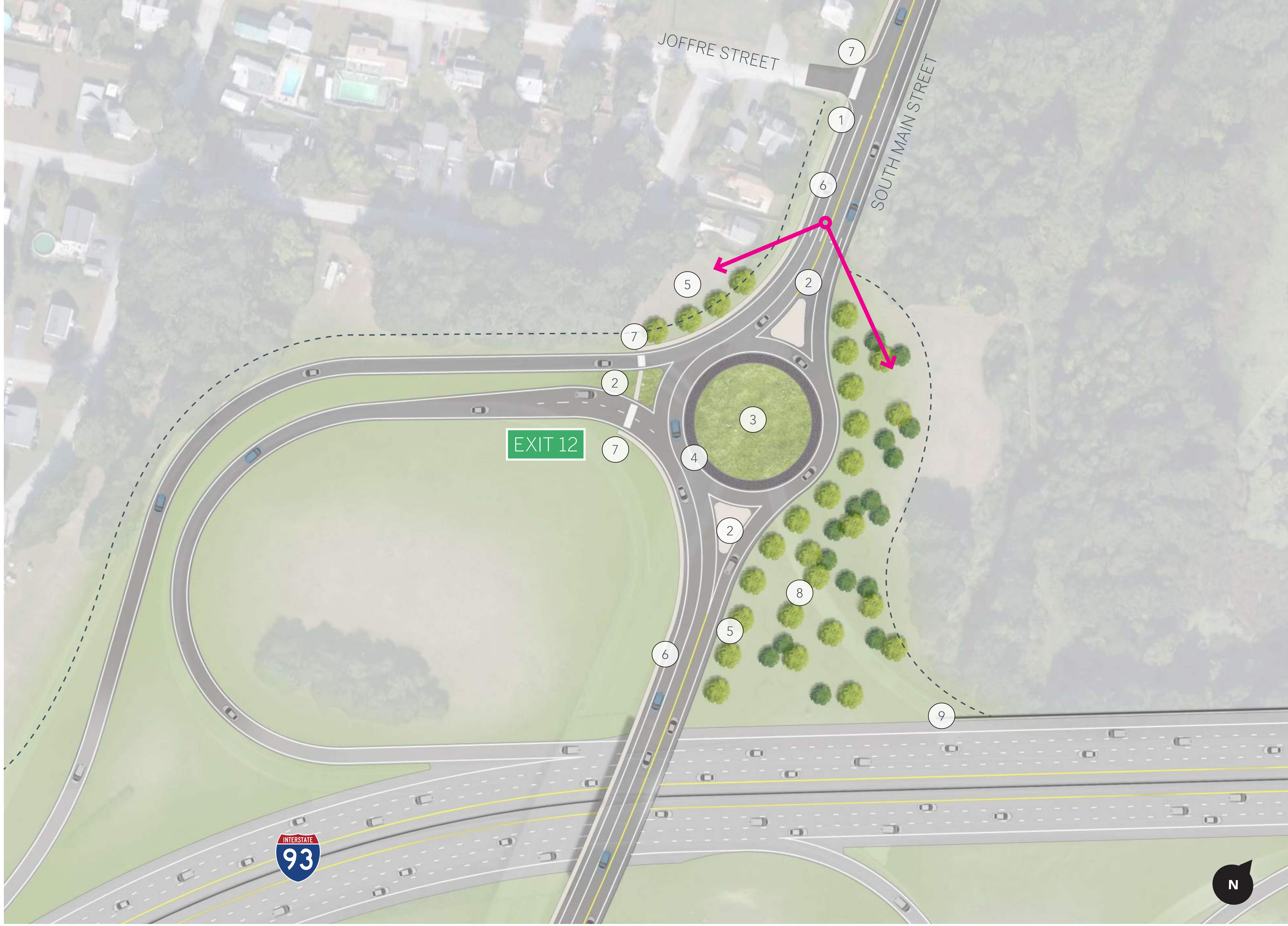
7 NEW CROSSWALK

8 NEW EVERGREEN AND DECIDUOUS TREE PLANTING

9 RETAINING WALL

--- APPROXIMATE EXTENT OF NEW PLANTING

PERSPECTIVE VIEW SHED



BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 12 CONCEPT F - EXISTING
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 12 CONCEPT F: PROPOSED
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

1 6' BITUMINOUS SIDEWALK WITH GRANITE CURB

2 RAISED SPLITTER ISLAND

3 PLANTED CENTRAL ISLAND

4 COBBLESTONE TRUCK APRON

5 NEW STREET TREES

6 BIKE LANE

1. CONCRETE TRAFFIC BARRIER
2. ADDITIONAL HIGHWAY LANE
   NORTH BOUND
3. ADDITIONAL HIGHWAY LANE
   SOUTH BOUND
4. 6' BITUMINOUS SIDEWALK
   WITH GRANITE CURB
5. RETAINING WALL
6. NEW MEADOW PLANTING
7. NEW DECIDUOUS AND
   EVERGREEN TREE PLANTING
8. NEW CROSSWALK
9. NEW TRAFFIC SIGNAL

--- APPROXIMATE EXTENT OF NEW PLANTING

PERSPECTIVE VIEW SHED

BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 13 CONCEPT B - EXISTING
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 13 CONCEPT B - PROPOSED
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

① CONCRETE TRAFFIC BARRIER

② ADDITIONAL HIGHWAY LANE
NORTHBOUND

③ ADDITIONAL HIGHWAY LANE
SOUTHBOUND

BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 13 CONCEPT B - PROPOSED
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

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1. 6' BITUMINOUS SIDEWALK
   WITH GRANITE CURB
2. RAISED SPLITTER ISLAND
3. RELOCATED STREET LIGHTS
4. NEW CROSS WALK
5. NEW STREET TREES
6. NEW DECIDUOUS AND EVERGREEN TREE PLANTING
7. NATIVE MEADOW PLANTING
8. BIKE LANE
9. STORM WATER POND
10. RETAINING WALL

- - - APPROXIMATE EXTENT OF NEW PLANTING

PERSPECTIVE VIEW SHED

BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 14-15 CONCEPT F2 - Proposed Plan
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 14-15 CONCEPT F2: PROPOSED
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

1. 6' BITUMINOUS SIDEWALK WITH GRANITE CURB
2. RAISED SPLITTER ISLAND
3. RELOCATED STREET LIGHTS
4. NEW CROSSWALK
5. NEW STREET TREES
6. NEW DECIDUOUS AND EVERGREEN TREE PLANTING
7. NATIVE MEADOW PLANTING
8. BIKE LANE

BOW CONCORD VISUAL IMPACT ASSESSMENT: EXIT 14 CONCEPT F2- PROPOSED
Concord, New Hampshire

VISUALIZATIONS
February 14, 2018

McFarland Johnson
CRJA landscape architects

Appendix E
DISTRIBUTION LIST

Federal Agencies	
Michaela E. Noble Director, Office of Environmental Policy and Compliance U.S. Department of the Interior 1849 C Street, NW Washington, DC 20240	
Kelly Knight Director, NEPA Compliance Division Environmental Protection Agency Mail Code 2251-A 1200 Pennsylvania Avenue, N.W. Washington, DC 20460	
Alexandra Dapolito Dunn USEPA New England, Region 1 Mail Code ORA01-4 5 Post Office Square – Suite 100 Boston, MA 02109-3912	
John M. Fowler, Executive Director Advisory Council on Historic Preservation 401 F Street NW, Suite 308 Washington DC 20001-2637	
Paul F. Ford Acting Regional Administrator – Region I Federal Emergency Management Agency 99 High St. Boston, MA 02110	
Col. William M Conde District Engineer Commander U.S. Army Corps of Engineers New England District 696 Virginia Road Concord, MA 01742-2751	
Federal Railroad Administration 1200 New Jersey Avenue, SE Washington, DC 20590	

Dr. Louis W. Uccellini NOAA Assistant Administrator for Weather Services and Director, National Weather Service 1325 East-West Highway Silver Spring, MD 20910-3283	
Chris Oliver Assistant Administrator, National Marine Fisheries Service 1315 East-West Highway Silver Spring, MD 20910-3283	
Michael Pentony Regional Administrator, GARFO NOAA Fisheries Service 55 Great Republic Drive Gloucester, MA 01930	
Wendie Weber Regional Director, U.S. Fish and Wildlife Service Northeast Region 300 Westgate Center Dr. Hadley, MA 01035	
Tod Chapman Field Supervisor, U.S. Fish and Wildlife Service New England Field Office 70 Commercial Street, Suite 300 Concord, NH 03301	
Keith Robinson New England WSC Director U.S. Geological Survey 331 Commerce Way Pembroke, NH 03275-3718	
Rick Ellsmore State Conservationist USDA Natural Resources Conservation Service 273 Locust St., Suite 2D Dover, NH 03820	
Stacy L. Luke District Manager Merrick County Conservation District 10 Ferry Street, Suite 211, Box 312 Concord, NH 03301	

State Agencies	
Collis Adams Wetlands Bureau Administrator NHDES Land Resources Management 29 Hazen Drive; PO Box 95 Concord, NH 03302-0095	
Laura S. Black Special Projects & Compliance Specialist NH Division of Historical Resources State Historic Preservation Office 19 Pillsbury Street - 2nd floor Concord, NH 03301-3570	
Sabrina Stanwood Bureau Administrator NH Natural Heritage Bureau DRED - Forests & Lands 172 Pembroke Rd Concord, NH 03301	
Phil Bryce Director, Division of Parks and Recreation 172 Pembroke Road P.O. Box 1856 Concord, NH 03302-1856	
Jared Chicoine Director, NH Office of Strategic Initiatives Governor Hugh J. Gallen State Office Park Johnson Hall, 3rd Floor 107 Pleasant Street Concord, NH 03301	
Robert R. Scott, Commissioner NH Department of Environmental Services PO Box 95 Concord, NH 03302-0095	
Clark B. Freise, Assistant Commissioner NH Department of Environmental Services PO Box 95 Concord, NH 03302-0095	
Timothy W. Drew, Administrator NHDES Public Information & Permitting Unit PO Box 95 Concord, NH 03302-0095	

Environmental Protection Bureau Office of the Attorney General 33 Capitol Street Concord, NH 03301	
David E. Neils Chief Water Poll Biologist, Water Pollution Division Department of Environmental Services PO Box 95 Concord, NH 03302-0095	
Michael J. Wimsatt, P.G., Director NHDES Waste Management Division 29 Hazen Drive; PO Box 95 Concord, NH 03302-0095	
Eugene J. Forbes, P.E., Director NHDES Water Division PO Box 95 Concord, NH 03302-0095	
Brad Simpkins, Director/State Forester Division of Forests and Lands 172 Pembroke Road Concord, NH 03302-1856	
Craig A. Wright, Director NHDES Air Resources Division PO Box 95 Concord, NH 03302-0095	
Jeffrey Rose Commissioner New Hampshire Department of Natural and Cultural Resources 172 Pembroke Road Concord, NH 03301	
Glenn Normandeau, Executive Director New Hampshire Fish and Game Department 11 Hazen Drive Concord, NH 03301	
Transportation & Construction Bureau Office of the Attorney General 33 Capitol Street Concord, NH 03301	
Governor Chris Sununu Office of the Governor State House 107 North Main Street Concord, NH 03301	

New Hampshire Executive Council 107 North Main Street State House, Room 207 Concord, NH 03301	
The Honorable Andru Volinsky NH Executive Council, District Two 107 North Main Street State House, Room 207 Concord, NH 03301	
The Honorable Russell E. Prescott NH Executive Council, District Three 107 North Main Street State House, Room 207 Concord, NH 03301	
The Honorable Christopher C. Pappas NH Executive Council, District Four 107 North Main Street State House, Room 207 Concord, NH 03301	
The Honorable David K. Wheeler NH Executive Council, District Five 107 North Main Street State House, Room 207 Concord, NH 03301	
U.S. Senator Jeanne Shaheen 2 Wall Street, Suite 220 Manchester, NH 03101	
U.S. Senator Margaret Hassan 1589 Elm Street Third Floor Manchester, NH 0310	
U.S. Congresswoman Ann McLane Kuster 18 North Main Street, Fourth Floor Concord, NH 03301	
U.S Congresswoman Carol Shea-Porter 660 Central Ave Unit 101 Dover, NH 03820	
Perry Plummer Director, NH Department of Safety Homeland Security and Emergency Management 33 Hazen Drive Concord, NH 03305	

State Representatives – Concord

District 10

Ward 5
David Luneau 211 Putney Hill Road, Hopkinton, NH, 03229-2510

Mel Myler PO Box 82, Contoocook, NH, 03229-0082

Mary Jane Wallner 24 Samuel Drive, Concord, NH 03301-3051

District 11

Ward 1
Stephen J. Shurtleff 11 Vinton Drive, Penacook, NH 03303-1583

District 12

Ward 2
Paul J. Henle 11-2 Cabernet Drive, Concord, NH, 03303-1071

District 13

Ward 3
Beth Richards 3 Willard Street, Concord, NH, 03303-3509

District 14

Ward 4
James R. MacKay 139 North State Street, Concord, NH, 03301-6431

District 15

Ward 6
Linda B. Kenison 10 Marshall Street, Concord, NH, 03301-2420

District 16

Ward 7
Timothy A. Soucy 11 Princeton Street, Concord, NH, 03301-2333

District 17

Ward 8
Dick W. Patten 30 Pinewood Trail, Concord, NH 03301-5247

District 18

Ward 9
Kristina Schultz 806 Alton Woods Drive, Concord, NH 03301-7857

District 19

Ward 10
Christy D. Bartlett 77 Sanborn Road, Concord, NH 03301-1819

District 27

Ward 1-7

Mary Stuart Gile 35 Penacook Street, Concord, NH, 03301-4518

District 28

Ward 8
Katherine D. Rogers 804 Alton Woods Drive, Concord, NH 03301-7857

Ward 9
Katherine D. Rogers 804 Alton Woods Drive, Concord, NH 03301-7857

Ward 10
Katherine D. Rogers 804 Alton Woods Drive, Concord, NH 03301-7857

State Representatives – Bow

District 23

J.R. Hoell 32 Ordway Road, Dunbarton, NH 03046-4320

Bill Kuch 348 Page Road, Bow, NH 03304-4513

Mary Beth Walz 25 One Stack Drive, Bow, NH 03304-4708

State Senators

District: 15 (Concord)

Dan Feltes 33 North State Street Legislative Office Building, Room 5, Concord, NH 03301

District: 16 (Bow)

Kevin Cavanaugh 33 North State Street Legislative Office Building, Room 5, Concord, NH 03301

Others (Including Local and Regional Organizations)

Michael Tardiff
Executive Director
Central New Hampshire Regional Planning Commission
28 Commercial Street, Suite 3
Concord, NH 03301

Central NH Regional Planning Commission 28 Commercial Street, Ste. 3 Concord, NH 03301	CNHRPC Executive Committee Members Tyson Miller, Chair (Canterbury) Harold Wright, Vice Chair (Bradford) Keith Johnson, Treasurer (Deering) Steve Buckley (Bow) Ken Milender (Warner) Ken Swayze (Dunbarton) Matthew Hicks (Concord)
Town of Bow-Town Manager David L. Stack, Town Manager Bow Municipal Building 10 Grandview Road Bow, NH 03304	
Town of Bow-Planning Department Matt Taylor Director of Community Development 10 Grandview Road Bow, NH 03304	
Town of Bow-Conservation Commission Sandra Crystall, Chair Town of Bow 10 Grandview Rd Bow, NH 03304	
City of Concord-City Manager Thomas J. Aspell Jr. City Manager 41 Green St. Concord, NH 03301	
City of Concord-Engineering Department David Cedarholm, City Engineer City Hall 41 Green Street 3rd Floor Concord, NH 03301	
City of Concord-Planning Department Heather Shank, City Planner 41 Green Street 3rd Floor Concord, NH 03301	
City of Concord-Conservation Commission Kristine Tardiff 41 Green Street Concord, NH 03301	

Agencies, organizations and individuals that attended the 2017 and 2018 Public Informational Meetings	
Attendees at the 2017 and 2018 Public Informational Meetings that provided an email addresses were notified by email	
Agencies, organizations and individuals that submitted written comments prior to the public comment period opening	
All commenters that submitted comments through the project website were notified by email	

KTN ✓
CJP ✓

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
INTER-OFFICE COMMUNICATION

DATE: April 29, 2014

FROM: JA Jay Ankenbrock, Chief of Labor Compliance, Executive Office

TO: Michael J. Dugas, P.E., Chief of Preliminary Design

RE: Environmental Justice Population Analysis, Project: **Bow-Concord 13742**

The attached analysis and recommendations are provided pursuant to Title VI of the Civil Rights Act of 1964 and Executive Orders 12898 & 13166. The intent of these statutes is to ensure fair and full participation and the equal receipt of benefits under Federally-assisted programs. Your efforts to accommodate and encourage participation by traditionally underserved groups, where significant, will ensure program access and minimize the potential for disproportionate project impacts on protected groups.

The table entitled "EJ Population Analysis" shows the presence of protected groups that might be impacted by the project. Personnel responsible for project planning/design and the coordination of public meetings/hearings should use this analysis to guide their outreach efforts under Title VI and in support of developing a context sensitive solution. Based on the availability of information and where appropriate, we have included specific outreach recommendations to facilitate public comment from underrepresented groups.

Please note that US Census American FactFinder data is used to provide to an EJ Population analysis for the project. If you have questions regarding this analysis, please contact me @ 271-2467.

Encls: EJ Population Analysis

Cc: Peter Crouch, Traffic Systems Engineer, Bureau of Traffic
Kevin Nyhan, Administrator, Bureau of Environment
Don Lyford, Bureau of Highway Design
Carol Spoerl, Bureau of Right-of-Way

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MAY 0 1 2014
NH DEPARTMENT OF
TRANSPORTATION

EJ Population Analysis for Project: Bow-Concord 13742

STUDY AREA	AVG% Elderly Population	AVG % Minority Population	AVG % Low-income Population	AVG% LEP
Impacted Area – Merrimack County US Census Tract #310.01 Blocks 1 & 3, Census Tract #310.02 Block 2, Census Tract #321 Block 3, Census Tract # 322 Block 2, Census Tract #323 Block 1 and Census Tract #324 Block 1.	15.64%	5.59%	8.60%	0.78%
Surrounding Area – Merrimack County, Census Tract #324 Blocks 2 & 3, Census Tract #322 Block 1, Census Tract #321 Block 2, Census Tract #310.02 Block 2 and Census Tract #30.01 Block 1.	13.79%	7.81%	7.71%	0.96%

REMARKS:

* The population percentage identified is meaningfully greater than the surrounding area and constitutes an EJ population. Characteristics of this particular study area indicate that targeted outreach efforts to solicit public participation should be taken.

LEP Definition: Where there is a population of people who speak English as a second language less than well (as indicated by the U.S. Census data). When a particular LEP language group constitutes 5% of the impacted population, the Department is required to translate public information meeting notices and take appropriate measures to ensure language access. If this requirement exists, the Project Manager should contact the Title VI Coordinator for further assistance.

Impacted Area: The impacted area was defined by the project limits and the area in the immediate vicinity that most closely corresponds to the boundaries of Census Tracts and Block Groups

Surrounding Area: All Census Tracts and Block Groups outside of, and immediately adjacent to, the impacted area

Special Considerations: Special consideration should be given to any project features that affect pedestrian accessibility. This project constitutes an alteration in accordance with Title II of the Americans with Disabilities Act. As such, minimum ADAAG accessibility requirements apply, unless deemed technically infeasible. For more information, I have provided a link to the Draft Public Rights-of-Way Guidelines (PROWAG). Although these guidelines will not be enforceable until they have been adopted by the US DOJ and US DOT, the FHWA considers them to be the most current recommended best practices in pedestrian facility design: http://www.access-board.gov/rowdraft.htm#Text.

Outreach Recommendations: In consideration of the populations above, we are providing contact information for all known agencies and subsidized housing units serving the above groups within the project area. These contacts should be included in your notification list for public information meetings and hearings related to this project.

Resident/Agency Address	Org/Housing Type	Contact Name/Number
Concord Gardens 15 Concord Gardens Concord, NH 03301	Low-Income	781-544-7766
Fayette Street Projects 22 Fayette St Concord, NH 03301	Disabled/Low-Income	603-225-0977
Fellowship Apartments 12 Allison St Concord, NH 03301	Disabled/Low-Income	603-225-0977
Fellowship House 11 Chesley St Concord, NH 03301	Disabled/Low-Income	603-225-0977
Firehouse Block 46 Warren St Concord, NH 03301	Seniors/Low-income	617-266-0044
Florence V Hodges Apts 205 Loudon Rd Concord, NH 03301	Low-Income	603-224-9221
Granite Ledges of Concord 151 Langley Parkway Concord, NH 03301	Seniors	603-224-0777

Havenwood-Heritage Heights 33 Christian Ave Concord, NH 03301	Seniors	800-457-6833
Royal Gardens 1 Royal Gardens Concord, NH 03301	Low-Income	
Transitional Housing Services 99 Pleasant St Concord, NH 03301	State Agency	603-271-5261
Washington Court 70 Washington St Concord, NH 03301	Disabled/Low-Income	603-225-0977
Concord Public Library 45 Green St Concord, NH 03301		Patricia Immen 603-225-8670
Concord Parks & Rec 14 Canterbury Rd Concord, NH 03301		David Gill 603-225-8690
Concord City Hall 41 Green St Concord, NH 03301		Suzanne Stevens 603-225-8570
Concord Community TV 170 Warren St Concord, NH 03301		Doris Ballard 603-226-8872
Greater Concord Chamber of Commerce 49 South Main St Suite 104 Concord, NH 03301		Timothy Sink 603-224-2508
BMCAP 26 Commercial St Suite 105 Concord, NH 03301	Senior Center	Polly Mills Fife 603-228-6956
Town of Bow 10 Grandview Road Bow, NH 03304		603-228-1187

Baker Free Library
509 South St
Bow, NH 03304

603-224-7113

Bow Parks/Rec & Community Center
10 Grandview Rd
Bow, NH 03304

Malinda Blakey
603-228-2222

NOTICE OF AVAILABILITY

ENVIRONMENTAL ASSESSMENT / DRAFT SECTION 4(f) EVALUATION
INTERSTATE-93 IMPROVEMENT PROJECT
BOW AND CONCORD, NEW HAMPSHIRE

Summary:

The NHDOT is issuing this notice to advise the public that an Environmental Assessment (EA) / Draft Section 4(f) Evaluation, dated October 29, 2018, has been prepared for the proposed Interstate 93 Improvement Project located in the Town of Bow and the City of Concord, New Hampshire [FWHA #T-A000(18), NHDOT #13742]. The EA was prepared in accordance with the National Environmental Policy Act and the NHDOT's guidelines for environmental documents. The public comment period begins October 29, 2018.

The proposed project involves a 4.5-mile segment of Interstate 93 between Bow and Concord, New Hampshire. The purpose of the project is to address the existing deficiencies and future transportation needs for all users while balancing the needs of the surrounding communities.

The EA can be accessed and downloaded from the project website, www.I93BowConcord.com or can be viewed as a hardcopy document at FHWA and NHDOT (see contact information below) as well as at the Town of Bow and City of Concord public libraries.

Public Hearing and Comments:

There will be a public hearing to present the findings and accept comments on November14, 2018 at the NHDOT, John O. Morton Building, (Room 114) located at 7 Hazen Drive, Concord, NH 03301 at 7:00pm. Room 114 will be open to the public at 6:00pm for the public to review the plans. Written comments will be accepted through December 14, 2018. Comments may be submitted in writing or by email to Mr. Donald Lyford or Mr. Jamison Sikora (see contact information below) or through the project website "Contacts" page, http://www.i93bowconcord.com/Project-Contacts.html.

For Further Information Contact:

Mr. Donald Lyford, NH Department of Transportation, John O. Morton Building, 7 Hazen Drive, Concord, NH 03301 at (603) 271-2165 or Donald.Lyford@dot.nh.gov.
Mr. Jamison Sikora, NH Federal Highway Administration, 53 Pleasant Street, Suite 2200, Concord, NH 03301 at (603) 410-4870 or Jamie.Sikora@dot.gov.

Supplementary Information:

The EA evaluated numerous alternatives. A preferred alternative has been selected because it addresses safety, capacity and operational issues throughout the 4.5 corridor including seven interchanges and portions of local roads. The preferred alternative includes the following elements: Widening the mainline I-93 to six lanes (three lanes northbound / three lanes southbound) with auxiliary lanes and shoulders; addressing six Red List bridges; improvements to two system interchanges that connect two interstate highways (I-93 to I-89 connection and I-93 to I-393 connection at Exit 15); and improvements to five local interchanges (Exit 1 along I-89 and Exits 12, 13 and 14 along I-93 and Exit 1 along I-393).

Impacts to the natural, cultural, and socio-economic environment are analyzed and presented in the EA. The EA also includes a Draft Section 4(f) Evaluation regarding impacts to historic structures and recreational resources.