Brook at Fordway Ext. Bridge). Although continuous water quality data have been collected at Station 10A-BVR since July 2006, consistent with the TMDL implementation plan, continuous water quality data have not been collected at Station 09-BVR since June 2009. Station 09-BVR is located downstream of each of the Build Alternatives and would be an ideal monitoring location to assess TMDL compliance. However, a new proposed Station 08Z-BVR located just upstream of Station 09-BVR on Beaver Brook (in a comparable but logistically better deployment location compared to 09-BVR) is proposed.

NHDOT has committed to providing funds for NHDES to modify and expand the in-stream chloride monitoring program in the Upper Beaver Brook watershed as proposed in an NHDES memo dated November 30, 2018, titled “Revised I93 TMDL Implementation Monitoring Plan.” The expanded in-stream chloride monitoring program is proposed to include 5 years of continuous specific conductance monitoring with dataloggers and chloride sampling at Station 10A-BVR and a new proposed Station 08Z-BVR located just downstream of Station 09-BVR on Beaver Brook (in a comparable but logistically better deployment location compared to 09-BVR). NHDOT will support this expanded monitoring effort during construction and for a period of 5 years post-construction to establish current water quality conditions and document any Project effects on water quality during construction and operation of the Project.

If water quality standards exceedances are indicated by the NHDES chloride monitoring program, NHDOT and the Towns will work with NHDES and EPA on appropriate next steps, including corrective actions. Notification of EPA, additional BMPs or changes to existing BMPs, as well as additional monitoring may be appropriate depending on the nature of the water quality standards exceedance. It is expected that any corrective actions to address water quality standards exceedances (due to any source) that deviate from the Chloride Reduction Implementation Plan for Beaver Brook, Derry, Londonderry, Auburn, Chester, NH (NHDES, 2011) would necessarily require NHDES to modify and update the implementation plan because this document is the primary means of supporting achievement of the Beaver Brook chloride TMDL.

4.12 Wetlands and Vernal Pools

4.12.1 Affected Environment

Regulatory Overview

Federal Regulations

Wetlands are defined under Section 404 of the CWA as “…areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Wetlands include swamps, bogs, and marshes and do not necessarily feature standing water. Wetlands and surface waters (streams, rivers, ponds, and lakes) are regulated under federal and state law and local zoning and regulations. Under federal law, discharges of dredged or fill material into “waters of the United States,” including wetlands, requires a permit under Section 404 of the CWA. In addition, work in “navigable” waters also requires a permit under Section 10 of the Rivers and Harbors Act. In both cases, the issuing authority is USACE. In addition to permitting requirements, federal actions must adhere to

Executive Order 11990 (dated May 24, 1977), which requires, among other things, that, in complying with NEPA, federal agencies shall avoid undertaking or providing assistance for new construction in wetlands unless the agency finds that there is no practicable alternative and the proposed action includes all practicable means to reduce harm to wetlands.

State Regulations

New Hampshire's wetland definition is substantively the same as the federal definition. State law (RSA 482-A) and Administrative Rules (Wt 100-900) require a permit to be issued by the NHDES Wetlands Bureau prior to conducting regulated activities in wetlands. Derry and Londonderry each have a municipal Conservation Commission that reviews permit applications and makes recommendations to the NHDES Wetlands Bureau.

Municipal Regulations

Each community also has a locally regulated wetland protection district in their zoning ordinance.

<u>Londonderry Wetland Regulation</u>

Londonderry's zoning ordinance (Town of Londonderry, 2016) has a conservation overlay district that includes the following within the study area:

- specifically named wetlands and land area within 100 feet of the edge of these wetlands;
- specific perennial streams and adjoining land within 100 feet of the centerline of these streams; and
- all other wetlands and land within 50 feet of the edge of these wetlands with an exemption of wetlands less than 0.5-acre in size.

Figure 4.12-1, FEIS Volume II, depicts wetlands within the study area. Named wetlands are listed in Londonderry's zoning ordinance and shown on Figure 4.12-2 FEIS Volume II. Named wetlands within the study area are described briefly as follows:

- **Duck Pond** is a 40-acre mostly open-water wetland that lies within an orchard west of I-93. There is commercial development on NH 102 directly adjacent to Duck Pond to the south. Soils are mapped as Greenwood and Ossipee soils, ponded.
- **Mammoth 1** is a 35-acre wetland complex on the west side of the study area. This wetland is predominantly beaver impounded with standing dead trees. Soils are mapped as Chocorua mucky peat.
- **Mammoth 2** is a 50-acre wetland complex that is partially within a powerline ROW where vegetation is maintained. Other portions of the wetland are forested and scrub-shrub. Mammoth 2 drains north into Mammoth 1. Soils are mapped as Chocorua mucky peat.
- **Peat Bog** is a 128-acre scrub-shrub and forested wetland east of I-93. Hydrology in portions of the wetland has been altered by a railroad bed that bisects it, with the eastern portion dominated by shrub vegetation and the western portion by

deciduous and evergreen trees. Soils are mapped as Greenwood mucky peat, a very poorly drained soil. Parts of this wetland are a true low-nutrient bog, and other parts dominated by cattails and other emergent vegetation. Beaver Brook passes through the southern portion of the wetland, but the northern portion of the wetland has no apparent inlet.

- **Scobie Pond** is a 50-acre wetland complex with an open water portion in the south and an acidic scrub-shrub/forested portion in the north that likely features a floating peat mat. Soils are mapped as Ossipee mucky peat in the vegetated portion of the wetland, a very poorly drained soil, and as water in the open water portion. Scobie Pond has no apparent inlet and drains southward into Beaver Brook.
- **Stonehenge** is a 40-acre historically ditched emergent, scrub-shrub and forested wetland complex that lies west of I-93. Ditching in the emergent portion of the wetland was likely performed for mosquito control. The ditches feed into a stream that in turn drains into Beaver Brook. Soils in this wetland are mapped as Scarboro muck and Greenwood and Ossipee, ponded.
- **Wheeler Pond** is a 9-acre mostly open water pond fringed by emergent wetland vegetation. Commercial development abuts the pond on the south and east sides. Wheeler Pond is fed by an unnamed tributary stream from the north and drains eastward under NH 102 eventually into Beaver Brook. Soils are mapped as water.

Derry Wetland Regulation

Derry's zoning ordinance (Town of Derry, 2016a) has a wetlands conservation overlay district that regulates the use of land subject to extended periods with a high water table, standing water, or flooding. This overlay district is defined by:

- all areas of very poorly drained soils;
- areas of poorly drained soil that are 2,000 square feet or more in size and that exhibit a predominance of 50 percent or more of wetland vegetation;
- areas of wetlands of any size if contiguous to surface waters such as lakes, ponds, and streams; and
- areas designated as bogs regardless of size.

Proposed projects that are reviewed by the Derry Planning Board may be required to undergo an environmental assessment to evaluate impacts to wetland resources. In addition to the wetland overlay district, Derry's zoning provides for extra protection designated prime wetlands. NH Administrative Rules Wt-700 et seq. provide a means for municipalities to grant an additional level of protection under state permitting to those wetlands determined to be exceptional by the municipality. Prime wetlands are designated by the municipality according to the requirements of RSA 482-A:15 and Chapter Wt-700 and include those wetland areas that are of "significant value and worthy of extra protection because of their uniqueness, fragility, and/or unspoiled character" (Wt-701.01). NHDES Administrative Rules Wt-700 includes procedures that must be followed before a permit may be issued for impacts to designated prime wetlands. Derry's designated prime wetlands are depicted on Figure 4.12-2. Derry's zoning has additional restrictions including a 150-foot regulated buffer around designated prime wetlands.

The designated prime wetlands located within the study area in Derry are briefly described below and depicted on Figure 4.12-2, FEIS Volume II.

- **Prime Wetland A-01**: This 5-acre wetland is located north of Hoods Pond and west of Franklin Street and includes areas characterized as emergent wetland and other areas of forested/scrub-shrub wetland. Shields Brook flows south through this wetland and then into Hoods Pond. Dominant vegetation includes cattail (*Typha* spp.), sedges (*Carex* spp.), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), jack-in-the-pulpit (*Arisaema triphyllum*), alder (*Alnus* spp.), willow (*Salix* spp.), and pond lilies (*Nuphar* spp.). Wildlife observations made within this wetland include songbirds and dragonflies (*Odonata*). The soil within this wetland is mapped as Greenwood mucky peat, which is a very poorly drained soil.
- **Prime Wetland A-06**: This 36-acre wetland is located west of NH 28 Bypass and east of Scobie Pond Road. The wetland is bounded by NH 28 Bypass to the east, Scobie Pond Road to the west, and Old Manchester Road to the north, and an Eversource powerline bisects the southern portion of the wetland. It includes areas characterized as forested, scrub-shrub, and emergent wetland. Shields Brook flows from Lower Shields Pond to the southwest through this wetland. Common vegetation within the wetland includes peat moss (*Sphagnum* spp.), willow, sensitive fern, monkey flower (*Mimulus* spp.), and blueberry (*Vaccinium* spp.). Wildlife species observed in this wetland include red-winged blackbirds (*Agelaius phoeniceus)* and sandpipers (*Actitis macularia)*. The soil within this wetland is mapped as Chocorua mucky peat, which is a very poorly drained soil.
- **Prime Wetland A-09**: This 61-acre wetland is located east of NH 28 Bypass and south of English Range Road near the northern limits of the study area. This wetland surrounds Lower Shields Pond and a portion of Shields Brook. It includes areas characterized as forested wetland and areas of scrub-shrub wetland. Vegetation present within this wetland includes jack-in-the-pulpit, jewelweed (*Impatiens capensis*), pond lily, wood lily (*Lilium philadelphicum*), and partridgeberry (*Mitchella repens*). Common wildlife species observed within this wetland include muskrats (*Ondatra zibethicus*), various songbirds, and northern harrier (*Circus cyaneus*). The soil within this wetland is mapped as Greenwood mucky peat, which is a very poorly drained soil.
- **Prime Wetland B-12**: North of Tsienneto Road and west of NH 102 and English Range Road is a 10-acre prime wetland. It includes areas characterized as forested wetland and areas of emergent/scrub-shrub wetland. An unnamed tributary stream flows south through this wetland and into Beaver Lake via a culvert under NH 102. Dominant vegetation includes red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), silky dogwood (*Cornus amomum*), speckled alder (*Alnus incana*), arrowwood (*Viburnum dentatum*), meadowsweet (*Spiraea alba* var. *latifolia*), purple loosestrife (*Lythrum salicaria*), Canada goldenrod (*Solidago canadensis*), jewelweed, meadow rue (*Thalictrum* spp.), poison ivy (*Toxicodendron radicans*), sedges, sensitive fern, cinnamon fern, interrupted fern (*Osmunda claytoniana*), common arrowhead (*Sagittaria* spp.), and peat moss. Wildlife species observed within this wetland include painted turtle (*Chrysemys picta picta*) and green frog

(*Rana clamitans*). The soils within this wetland are mapped as Greenwood and Ossipee soils, which are very poorly drained soils.

- **Prime Wetland F-13**: This 122-acre wetland is located north of Pierce Avenue, adjacent to Hoodkroft Country Club, and is associated with portions of West Running Brook and Beaver Brook. It includes areas characterized as scrub-shrub wetland and scrub-shrub/emergent wetland. Dominant vegetation includes cattail, red maple, buttonbush, alder, willow, arrowhead, bulrush, duckweed, and northern swamp dogwood (*Cornus racemosa*). Wildlife species observed in this wetland include mallard, great blue heron, songbirds, white-tailed deer, and muskrat. Soils within this wetland are mapped primarily as Greenwood and Ossipee soils. This soil unit consists of very poorly drained soils.

Wetland Mapping

Wetlands for the Project have been mapped in different ways between 2005 and 2019. The approximate boundaries of wetlands within the study area were initially photo-interpreted by comparing hydric soil map units (Table 4.12-1, FEIS Volume II) from the USDA *Soil Survey of Rockingham County, New Hampshire Part 1* (Kelsea and Gove, 1994), with the National Wetland Inventory (NWI) maps produced by USFWS. Aerial photographs were reviewed to further refine wetland boundaries, and limited field reconnaissance was used to resolve discrepancies between these various sources. In 2005 and 2006, wetlands interpreted from the aerial review were verified in the field during the vernal pool surveys conducted in the same years. The wetland verification was done along 200-foot-wide corridors associated with Alternatives A through D. Wetlands in the undeveloped parcels to the east of I-93 (Woodmont Commons East, also previously known as the “Hyrax Parcels”) were delineated and GPS surveyed in 2011 (Normandeau Associates, Inc., 2011). In 2016 additional field review was undertaken to verify aerial interpretations for Alternatives B, C, D, and F, and to modify wetland boundaries as needed. Wetlands within 200 feet of the preferred alternative were field delineated in September–December 2016 and wetland boundaries were located with a Trimble hand-held GPS unit with sub-meter accuracy under ideal conditions. In addition, boundaries of wetlands outside the Build Alternative footprints within the study area were re-examined using 2017 aerial photography and, in some cases, the boundaries were redefined. In 2019, additional wetlands were delineated and GPS-located around the proposed stormwater BMPs.

Existing wetlands in the study area, which corresponds to the study area for surface waters and water quality, are depicted on Figure 4.12-1.

Prime wetland locations were provided by the Town of Derry through its GIS Coordinator, and the Derry Conservation Commission provided supporting documentation.

Table 4.12-1. Poorly Drained and Very Poorly Drained Soils within the Study Area

Symbol	Soil Name	Drainage Class
97	Greenwood and Ossipee soils, ponded	Very poorly drained
115	Scarboro muck	Very poorly drained
125	Scarboro muck, very stony	Very poorly drained

Symbol	Soil Name	Drainage Class
295	Greenwood mucky peat	Very poorly drained
305	Lim-Pootatuck complex	Lim—poorly drained; Pootatuck—moderately well drained
314A	Pipestone sand, 0 to 5 percent slopes	Poorly drained
395	Chocorua mucky peat	Very poorly drained
495	Ossipee mucky peat	Very poorly drained
546A	Walpole very fine sandy loam, 0 to 5 percent slopes	Poorly drained
547A	Walpole very fine sandy loam, 0 to 3 percent slopes, very stony	Poorly drained
547B	Walpole very fine sandy loam, 3 to 8 percent slopes, very stony	Poorly drained
656A	Ridgebury very fine sandy loam, 0 to 5 percent slopes	Poorly drained
657A	Ridgebury very fine sandy loam, 0 to 3 percent slopes, very stony	Poorly drained
657B	Ridgebury very fine sandy loam, 3 to 8 percent slopes, very stony	Poorly drained

Source: NRCS (2017)

Hydric Soils

NRCS maps soils according to characteristics of drainage, particle size, soil horizons, organic content, and other features. Soils are named by towns where the soil series was first recognized. NRCS soil mapping rates the soil's ability to drain water into seven values from excessively drained to very poorly drained. Wetlands most commonly occur in poorly drained and very poorly drained soils, described by NRCS as:

- "**Poorly drained**: Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of internal free water is shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth. Free water at shallow depth is usually present. This water table is commonly the result of low or very low saturated hydraulic conductivity of nearly continuous rainfall, or of a combination of these.
- **Very poorly drained**: Water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season. The occurrence of internal free water is very shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded. If rainfall is high or nearly continuous, slope gradients may be greater" (NRCS, 2013).

Wetland Cowardin Classification

Wetlands within the study area were classified according to the system developed by Cowardin et al. (1979) and implemented by USFWS for the NWI. This system recognizes groups of wetland types based upon the presence of shared hydrologic, geomorphic, chemical, and/or biological factors. A hierarchical approach is used that recognizes the following five basic levels of classifying wetlands: system, subsystem, class, subclass, and dominance type. At the system level, there are five different wetland types, including marine (e.g., open ocean areas overlying the continental shelf and high energy coast line), estuarine (e.g., deep water tidal habitats and adjacent tidal wetlands), riverine (e.g., flowing freshwater within a channel), lacustrine (e.g., deep water areas and wetlands associated with a freshwater lake), and palustrine (e.g., non-tidal wetlands dominated by trees, shrubs and emergent vegetation). At the class level, the classification system recognizes similarities in substrate (e.g., rocky shore, rocky bottom, unconsolidated bottom) and dominant vegetation type (e.g., emergent, shrub, forested).

Approximately 14 percent of the study area is composed of wetlands (Figure 4.12-1). These include a variety of different wetland types, as classified by Cowardin et al. (1979), and most are associated with the major lakes, ponds, brooks, and streams in the study area. Surface waters, including rivers, lakes, and ponds, are not discussed in this document. Palustrine wetland types within the study area are generalized into forested, scrub-shrub, and emergent and are described as follows.

Forested wetlands (Cowardin Code PFO) within the study area are typically dominated by species such as red maple, green ash, American elm (*Ulmus americana*), yellow birch (*Betula alleghaniensis*), eastern hemlock (*Tsuga canadensis*), and eastern white pine (*Pinus strobus*). These wetlands typically have an understory composed of common shrub species such as silky dogwood, red osier dogwood (*Cornus sericea*), highbush blueberry, speckled alder, meadowsweet, and tree seedlings, as well as herbaceous ground cover. Common herbaceous species present included sensitive fern, cinnamon fern, royal fern (*Osmunda regalis*), purple loosestrife, jewelweed, rough-stemmed goldenrod (*Solidago rugosa*), bluejoint, and wool-grass (*Scirpus cyperinus*).

Scrub-shrub wetlands (Cowardin Code PSS) are dominated by species such as speckled alder; long-beaked willow (*Salix bebbiana*); winterberry (*Ilex verticillata*); silky dogwood; common elder (*Sambucus canadensis*); witch hazel (*Hamamelis virginiana*); and saplings of red maple, gray birch (*Betula populifolia*), and other tree species.

Emergent wetlands (Cowardin Code PEM) are shallow and deep marshes associated with streams and seasonally flooded areas that are too wet for scrub-shrub or forested vegetation. In some cases, emergent wetlands may result from management of vegetation in powerline ROW or hay fields (known as "wet meadows"). Dominant species in these types of wetlands include common cattail, purple loosestrife, bluejoint, sedges, and wool-grass. Vegetation in wet meadows includes red osier dogwood, long-beaked willow, meadowsweet, jewelweed, goldenrods, bluejoint, and reed canarygrass (*Phalaris arundinacea*).

Palustrine Open Water Wetlands (Cowardin Code PUB) are ponds and other open water wetlands. Palustrine open water wetlands are distinguished from lacustrine wetlands in that they are smaller than 20 acres, less than 2 meters deep, and lack wave-formed or bedrock shorelines.

Wetlands occur in a variety of landscape settings within the study area. One wetland-landscape association that is present throughout the study area consists of wetlands associated with small streams. These stream-associated wetlands include forested, scrub-shrub, and emergent communities that typically occur over very poorly drained Greenwood mucky peat, Ossipee mucky peat, Chocorua mucky peat, and Greenwood and Ossipee soils. The wetland system associated with Beaver and West Running Brook along the east central portion of the study area is a good example of this wetland-landscape association.

Wetland Functions and Values

Wetlands in the study area provide a variety of functions and values that benefit the natural environment and society. *The Highway Methodology Workbook Supplement* (USACE, 1999) recognizes up to 13 different functions and values, including:

- groundwater recharge/discharge;
- floodflow alteration;
- fish and shellfish habitat;
- sediment/toxicant retention;
- nutrient removal /retention/transformation;
- production export;
- sediment/shoreline stabilization;
- wildlife habitat;
- recreation;
- education/scientific value;
- uniqueness/heritage;
- visual quality/aesthetics; and
- endangered species.

Many of the larger tracts of undeveloped land within the study area are composed at least in part of wetland communities. In the direct vicinity of the alternatives, a large wetland complex (Stonehenge) is bisected by I-93 at the interchange point for Alternatives C and D. A generalized discussion of wetland functions provided by wetlands in the study area follows. Anticipated effects to specific wetland functions from the Project are discussed in Section 4.12.2.

The undeveloped land along streams in the study area is mostly wetlands, including several prime wetlands in Derry and named wetlands in Londonderry. These streams, and the undeveloped lands associated with them, likely serve as important travel corridors for wildlife. In addition, wetlands are important habitats for waterfowl and wading birds, and are also at least periodically important to other wildlife populations. For example, vernal pools are critical breeding habitats for species such as wood frogs (*Rana sylvatica*), spotted salamanders (*Ambystoma maculatum*), and blue-spotted salamanders (*Ambystoma laterale*). Vernal pools can also be important habitat for rare species of wildlife such as Blanding's turtles (*Emydoidea blandingii*), spotted turtles (*Clemmys guttata*), and marbled salamanders (*Ambystoma opacum)*.

Previous studies documented the presence of three vernal pools adjacent to I-93, and there are numerous other potential vernal pools scattered throughout the study area (Figure 4.12-1, 4.12-3, 4.12-4, 4.12-7, 4.12-8, 4.12-9, 4.12-10, and 4.12-11). Other wetlands are seasonally important to migratory species such as the American woodcock (*Scolopax minor*).

Wetlands can provide recreational opportunities such as hunting, fishing, canoeing, and hiking (see also section 4.19). Large open water bodies such as Beaver Lake and Scobie Pond provide a variety of recreational opportunities. Beaver Lake has a public boat launch and a public beach (Galiens Beach) along its western shoreline near the eastern end of all the Build Alternatives.

Wetlands can provide valuable water treatment functions by removing excess nutrients and retaining sediments and toxicants. Those wetlands with high stem densities, dense emergent vegetation, and slow moving and sinuous watercourses are generally the most effective at performing these functions, which are particularly valuable in a landscape that includes residential and commercial development where there is opportunity for wetlands to receive urban runoff. These functions can also be important in less developed landscapes where specific activities, such as recreational all-terrain vehicle use, can result in soil erosion.

Wetlands that overlie aquifers are important for the protection of groundwater from potential contaminations during recharge. Portions of all of the alternatives, which include numerous streams and stream-associated wetlands, are underlain by a low-yielding aquifer (0 to 1,000 square feet/day). Just south of Alternative F, a high yielding aquifer (1,001 to 4,000 square feet/day) extends south from a point near the confluence of Beaver Brook and Shields Brook. Other wetlands that occur near public wells, but that are not directly associated with an aquifer, are also important in protecting water quality.

Floodflow alteration (i.e., storage and desynchronization) is another valuable wetland function. Typically, wetlands within broad, flat floodplains are particularly good examples. Within the study area, floodplains are generally confined to narrow corridors along the various streams, but broader floodplains do occur along Beaver Brook just south of the intersection of the NH 28 Bypass (South Main Street) and NH 102 in Derry, and in association with a broad marsh located north of NH 28, and east of Exit 5 in Londonderry. The presence of these wetlands reduces potential flood damage to downstream residential and commercial areas and reduces erosion.

Wetlands are sometimes associated with rare or uncommon plants and are occasionally associated with other unique features such as archaeological sites. These embedded features can afford educational and scientific research opportunities or otherwise make the wetland unique. For example, peatlands such as bogs and fens are uncommon natural communities in this part of NH, and they can support a variety of rare plant species. Peat Bog in Londonderry is an example of a low nutrient bog.

Vernal Pools

Vernal pools are temporary or permanent shallow pools that provide essential breeding habitat for certain amphibian and invertebrate species. Vernal pools are defined in NH State Administrative Rules (Env-Wt 101.108) as follows:

"**Vernal pool**" means a surface water or wetland, including an area intentionally created for purposes of compensatory mitigation, which provides breeding habitat for amphibians and invertebrates that have adapted to the unique environments provided by such pools and which:

(a) Is not the result of ongoing anthropogenic activities that are not intended to provide compensatory mitigation, including but not limited to:

(1) Gravel pit operations in a pit that has been mined at least every other year; and

(2) Logging and agricultural operations conducted in accordance with all applicable New Hampshire statutes and rules; and

(b) Typically has the following characteristics:

(1) Cycles annually from flooded to dry conditions, although the hydroperiod, size, and shape of the pool might vary from year to year;

(2) Forms in a shallow depression or basin;

(3) Has no permanently flowing outlet;

(4) Holds water for at least 2 continuous months following spring ice-out;

(5) Lacks a viable fish population; and

(6) Supports one or more primary vernal pool indicators, or 3 or more secondary vernal pool indicators.

"**Primary vernal pool indicators**" means the presence or physical evidence of breeding by marbled salamander, wood frog, spotted salamander, jefferson-blue spotted salamander complex, or fairy shrimp.

"Secondary vernal pool indicators" means physical evidence used by wildlife biologists or certified wetlands scientists familiar with vernal pool habitats as evidence of presence of a vernal pool, if primary vernal pool indicators are absent and other vernal pool characteristics suggest vernal pool habitat. Secondary vernal pool indicators include, but are not limited to, caddisfly larvae and cases (*Limnephilidae, Phryganeidae, or Polycentropodidae*), clam shrimp and their shells (*Laevicaudata*, *Spinicaudata*), fingernail clams and their shells (*Sphaeriidae*), aquatic beetle larvae (*Dytiscidae, Gyrinidae, Haliplidae, and Hydrophilidae*), dragonfly larvae and exuviae (*Aeshnidae*, *Libellulidae*), spire shaped snails and their shells (*Physidae*, *Lymnaeidae*), flat-spire snails and their shells (*Planorbidae*), damselfly larvae and exuviae (*Coenagrionidae, Lestidae*), and true fly larvae and pupae (*Culicidae, Chaoboridae, and Chironomidae*).

Potential vernal pools located within 100 feet of the alternatives and within the Woodmont Commons East parcels (collectively the "vernal pool study area") were first identified and mapped using aerial photo interpretation. Potential pools were then surveyed in the field in spring 2006 to determine presence/absence and extent of breeding activity by vernal pool amphibian species. An additional vernal pool survey was undertaken in spring 2009 using the primary and secondary indicators established in the NHDES Wetland Rules and Special Wetland definition in the PGP. Vernal pool habitats were also identified in the I-93 corridor as part of the I-93 widening project. In 2011, vernal pools were delineated within the Woodmont Commons East parcels as part of a larger wetland delineation effort. A third vernal pool study was undertaken within the Woodmont Commons East parcels in spring 2014 and 2015. Altogether, the I-93 widening data, 2006 and 2009 vernal pool surveys, and 2014–2015 vernal pool surveys resulted in the identification of 46 vernal pools in the vernal pool study area (Appendix H). Two vernal pools that had been previously identified in earlier surveys were determined not to be vernal pools in the 2014–2015 vernal pool survey because they lacked the required indicators.

Vernal pools were evaluated for productivity by documenting the presence of vernal pool species, as follows:

- high productivity = 20 or more wood frog (WF), spotted salamander (SS) or blue spotted/Jefferson salamander (BS) egg masses; or fairy shrimp present)
- medium productivity = 10 to 19 WF, SS, or BS egg masses
- low productivity = fewer than 10 WF, BS, or SS egg masses

USACE, New England District, published wetland mitigation guidance in 2016 (USACE, 2016) that incorporates recommendations for vernal pool mitigation. The guidance recommends that vernal pools be evaluated using the USACE-New England District draft vernal pool characterization form (USACE, 2016, page 129), which uses several metrics including the quality of the surrounding landscape, cover type in the vernal pool, and hydroperiod of the vernal pool to rate each as low, medium, or high quality. Vernal pools were evaluated using the USACE vernal pool characterization form to guide recommendations for mitigation for impacts to vernal pools. Productivity and USACE quality are noted in the vernal pool summary in Appendix H.

4.12.2 Environmental Consequences

Wetland functions are affected by both direct impacts (dredging and filling) and indirect impacts, such as alterations in hydrology, introduction of pollutants from road runoff, loss of vegetative cover caused by adjacent tree cutting, impacts on wildlife habitat species that use both wetland and upland, or by creating barriers between wetlands that make up a habitat mosaic. Construction of any alternative may incur temporary impacts to adjacent wetlands. Also, design details such as stormwater treatment and sound barriers may involve additional wetland impacts at the periphery of the treatment areas (stormwater treatment would not be designed in known wetland areas). Direct wetland impacts described below for each alternative were calculated as the area where the Project footprint directly overlays adjacent wetlands. Indirect impacts on wetlands have only been calculated for the preferred alternative and must be mitigated. Secondary impacts associated with induced development are discussed in Chapter 5, *Indirect Effects and Cumulative Impacts*.

Wetland Impact Types

The majority of wetland impacts for all alternatives would occur in forested wetlands (Table 4.12-2). Scrub-shrub and scrub-shrub/emergent wetland impacts would generally occur within previously disturbed wetlands and wetlands in powerlines where vegetation is maintained on a regular basis. Likewise, emergent wetland impacts would generally occur to wetlands situated within maintained powerlines and in areas adjacent to existing roads.

Table 4.12-2. Summary of Direct Wetland Impacts (Acres) by Wetland Type

Wetland Type[a]	Direct Impact by Alternative[b] (Acres)			
	A[c]	B	C	D
Forested	3.24	6.74	6.78	3.09
Scrub-Shrub	0.02	1.02	0.51	0.35
Scrub-Shrub/ Emergent	0.07	0.91	0.90	0.05
Emergent	0.20	0.23	0.26	0.13

Wetland Type[a]	Direct Impact by Alternative[b] (Acres)			
	A[c]	B	C	D
Vernal Pools[d]	1.31	1.09	0.27	0.29
TOTAL	4.85	10.00	8.73	3.89

[a] Wetland cover types determined using NWI mapping, aerial photograph interpretation (high resolution September 2017), and ground-truthing. Wetland cover types are based on classification system of Cowardin et al., 1979. See Section 4.12.1 for descriptions of wetland cover types.

[b] No direct impacts to wetlands are proposed for Alternative F. Four stream crossings would be expanded as discussed in Section 4.11.

[c] Impact quantities for Alternative A (the preferred alternative) reflect a more advanced design than the values for the other alternatives for consistency with state and federal wetland permit applications.

[d] Cowardin types are not provided here for vernal pools, but vernal pools within the study area are generally characterized as pockets of open water within forested wetland.

No Build Alternative

Because the No Build Alternative would not involve new construction, there would be no new impacts on wetlands caused by this Alternative.

Build Alternatives

The wetland and vernal pool impacts associated with each Build Alternative are discussed below and depicted on Figures 4.12-1 and Figures 4.12-3 through 4.12-13. Tables 4.12-3 and 4.12-4 also provide summaries of impact information for wetlands and vernal pools. Appendix I provides detailed information by Alternative for functions and values affected in each wetland. The wetland and vernal pool impact values for the preferred alternative, identified as the preferred alternative, have been refined based on a more detailed design.

Table 4.12-3. Direct Impact Totals by Highway Segment and Wetland Classification

Impact Location and Wetland Classification[a]	Direct Impact by Alternative[b] (Acres)			
	A	B	C	D
Access Ramp Total	**2.97**	**2.18**	**2.42**	**2.42**
Forested	2.38	1.71	2.22	2.22
Emergent				
Vernal Pools[c]	0.59	0.47	0.20	0.20
New Alignment East of NH 28 Total		**5.03**	**5.01**	
Forested		3.81	3.79	
Scrub-Shrub		0.17	0.17	
Scrub-Shrub/Emergent		0.84	0.84	
Emergent		0.21	0.21	
New Alignment West of NH 28 Total	**1.39**	**2.71**	**1.21**	**1.21**
Forested	0.56	1.22	0.77	0.77
Scrub-Shrub	0.02	0.86	0.35	0.35

Impact Location and Wetland Classification[a]	Direct Impact by Alternative[b] (Acres)			
	A	B	C	D
Emergent	0.12	0.02	0.02	0.02
Vernal Pools	0.69	0.62	0.08	0.08
Road Widening Total	**0.26**	**0.07**	**0.09**	**0.29**
Forested	0.18	0.01	0.00	0.10
Scrub-Shrub/Emergent	0.07	0.07	0.06	0.15
Emergent	0.01	0.00	0.03	0.03
Vernal Pools	0.00			0.01
Stormwater Facilities Total[d]	**0.23**	**n/a**	**n/a**	**n/a**
Forested	**0.06**	**n/a**	**n/a**	**n/a**
Scrub-Shrub	**0.01**	**n/a**	**n/a**	**n/a**
Emergent	**0.08**	**n/a**	**n/a**	**n/a**
Vernal Pools	**0.03**	**n/a**	**n/a**	**n/a**
Overall Total	**4.85**	**10.00**	**8.73**	**3.92**

[a] Wetland cover types determined using NWI mapping, aerial photograph interpretation (high resolution September 2017), and ground-truthing. Wetland cover types are based on classification system of Cowardin et al., 1979. See Section 4.12.1 for descriptions of wetland cover types.

[b] No direct impacts to wetlands are proposed for Alternative F. Four stream crossings would be expanded as discussed in Section 4.11.

[c] Cowardin types are not provided for vernal pools, but vernal pools are generally characterized as pockets of open water within forested wetland.

[d] Stormwater facilities were only designed for Alternative A (the preferred alternative). Stormwater facilities for the other alternatives would also likely impact wetlands.

As might be expected, alternatives with more new roadway alignment would incur greater direct wetland impacts, with Alternative B and C each resulting in approximately 5 acres of impacts located east of NH 28 along the powerline corridor and within adjacent forested wetlands. Alternative F would involve no direct wetland impacts. Construction of the access ramps would involve equivalent impacts for each Alternative, with each involving between 2.18 acres to 2.97 acres of impact to predominantly forested wetland. Impacts resulting from and permitted under the ongoing I-93 widening project are not included in this calculation. Road widening would result in a relatively small portion of the total wetland impact for each Alternative.

Indirect “edge effect” impacts to wetlands within 25 to 150 feet (depending on wetland type) of development was calculated only for the preferred alternative for mitigation purposes in accordance with the USACE 2016 Mitigation Guidance, as described in Section 4.12.3.

Vernal Pool Impacts

Alternatives A, B, C, and D all involve impacts to vernal pools. Table 4.12-4 shows the area of direct impact to the vernal pools in the study area from each alternative. In some cases, the impacts would be to the entire pool or would leave a small remnant unlikely to provide productive habitat for vernal pool species. In other cases, a small, direct impact may allow the pool to continue functioning. Where partial direct impacts and/or road construction in the surrounding uplands that vernal pool species rely on result in a reduction of vernal pool value, these impacts must also be accounted for, and mitigation will be required (see Section 4.12.3). Direct impacts were measured for all alternatives, but only the preferred alternative was further evaluated for vernal pool value impacts and mitigation requirements. Impacts associated with future development are discussed in Chapter 5, *Indirect Effects and Cumulative Impacts*. Direct impacts to vernal pools and their buffers from road construction are discussed in this section.

Table 4.12-4. Vernal Pool Direct Impacts (square feet)

VP ID	Productivity[a]	USACE Rating[b]	A	B	C	D
VP 2	m	m	7,236	7236		
VP 3	m	m	9,173	6413		
VP 4	h	m	9,250	8279		
VP 6	m	m	15,546	13,834		
VP 8	l	h	11,100			
VP 11	l	m				
VP 12	l	m		2,340		490
VP 13	h	m		5,445		
VP 15	l	l			1,611	1,611
VP 17	h	h			7,053	7,053
VP 19	l	l			3,292	3,292
VP 42	m	h	4,748	4,479		
VP 46	m	h	180	940		
TOTAL (sf)			57,233	47,466	11,956	12,446

[a] Qualitative Values: h = high productivity (20 or more WF, SS or BS egg masses; or fairy shrimp present); m=medium productivity (10 to 19 WF, SS, or BS egg masses); and l = low productivity (<10 WF, BS, or SS egg masses).

[b] USACE New England District DRAFT Vernal Pool Characterization Form (USACE, 2016)

Vernal Pool Buffer Impacts

Because vernal pool species are dependent on upland habitat for portions of their life cycle, impacts to the surrounding upland habitat were evaluated for each Alternative. USACE recognizes a 100-foot vernal pool envelope (VPE) and critical terrestrial habitat (CTH) from 100 feet to 750 feet from the edge of the vernal pool (USACE, 2015). USACE recommends avoiding any disturbance within the VPE and limiting disturbance within the CTH to 25 percent. To evaluate impacts to vernal pool upland habitat for each Alternative, the percentages of each cover type within the VPE and CTH for each vernal pool within the study area were calculated using GIS data provided by the Towns that identified forested edge and pavement. The forested areas within each zone for each vernal pool were modified to account for shrub habitat within powerlines and to remove inaccessible habitat to create existing conditions of the vernal pool life zones. It was assumed that new roadway alignment and I-93 access ramps would create a barrier that would render upland habitat inaccessible. I-93, NH Route 28, and Tsienneto Road were assumed to be existing barriers to amphibian access. Roads within residential subdivisions were not assumed to pose a barrier to available forested upland habitat. Individual amphibians may successfully cross the busier roadways, and there is amphibian mortality within residential subdivisions on roads, but these assumptions were made to provide a consistent evaluation method for all alternatives. Indirect vernal pool impacts also affect wildlife that are not obligate vernal pool breeders but rely on vernal pools as an important source of food, water, and cover. Impacts to upland buffer habitat also affect habitat connectivity and wildlife movements around the landscape.

Table 4.12-5 presents the percentage of VPE and CTH for each vernal pool that is available under existing and proposed conditions.

Table 4.12-5. Percentage of Vernal Pool Surrounding Upland Habitat Available under Each Alternative

Vernal Pool ID	Existing Conditions		Alt A		Alt B		Alt C		Alt D	
	VPE	CTH	VPE	CTH	VPE	CTH	VPE	CTH	VPE	CTH
VP 02	69%	**50%**	55%	**47%**	55%	**47%**	69%	**50%**	69%	**50%**
VP 03	62%	**52%**	45%	**48%**	45%	**48%**	62%	**52%**	62%	**52%**
VP 04	59%	**49%**	30%	**31%**	30%	**32%**	59%	**49%**	59%	**49%**
VP 05	98%	**66%**	98%	**38%**	98%	**40%**	98%	**66%**	98%	**66%**
VP 06	99%	97%	65%	87%	45%	**46%**	99%	97%	99%	97%
VP 07	97%	96%	89%	**55%**	97%	**61%**	97%	96%	97%	96%
VP 08	81%	**68%**	62%	**60%**	81%	**51%**	81%	**68%**	81%	**68%**
VP 09	84%	**61%**	66%	**39%**	84%	**60%**	84%	**61%**	84%	**61%**
VP 11	47%	**39%**	39%	**38%**	47%	**39%**	47%	**39%**	39%	**38%**
VP 12	64%	**73%**	64%	**62%**	6%	**33%**	64%	**73%**	64%	**73%**
VP 13	98%	92%	98%	**55%**	23%	**43%**	98%	92%	98%	92%
VP 15	59%	**48%**	59%	**48%**	59%	**48%**	16%	**1%**	16%	**1%**
VP 16	88%	**35%**	88%	**35%**	88%	**35%**	72%	**30%**	72%	**30%**
VP 17	99%	**57%**	99%	**57%**	99%	**57%**	48%	**26%**	48%	**26%**
VP 18	100%	**71%**	100%	**71%**	100%	**71%**	98%	**46%**	98%	**46%**
VP 19	91%	80%	91%	80%	91%	80%	40%	**27%**	40%	**27%**
VP 20	100%	84%	100%	84%	100%	84%	74%	**50%**	74%	**50%**
VP 21	94%	**66%**	94%	**64%**	94%	**66%**	86%	**28%**	86%	**28%**
VP 22	96%	86%	96%	86%	96%	86%	96%	86%	96%	86%
VP 23	86%	87%	86%	86%	86%	87%	86%	87%	86%	87%
VP 24	100%	78%	100%	76%	100%	76%	100%	76%	100%	76%

Vernal Pool ID	Existing Conditions		Alt A		Alt B		Alt C		Alt D	
	VPE	CTH	VPE	CTH	VPE	CTH	VPE	CTH	VPE	CTH
VP 25	88%	89%	88%	89%	88%	89%	88%	89%	88%	89%
VP 26	96%	88%	96%	88%	96%	88%	96%	88%	96%	88%
VP 26b	90%	86%	90%	86%	90%	86%	90%	86%	90%	86%
VP 27	82%	**52%**	82%	**48%**	82%	**48%**	82%	**49%**	82%	**49%**
VP 28	63%	**43%**	63%	**38%**	63%	**38%**	63%	**39%**	63%	**39%**
VP 29	59%	**43%**	59%	**36%**	59%	**36%**	59%	**37%**	59%	**37%**
VP 30	71%	81%	71%	81%	71%	**62%**	71%	81%	71%	81%
VP 31	90%	84%	90%	84%	90%	83%	90%	84%	90%	84%
VP 32	83%	81%	83%	81%	83%	80%	83%	81%	83%	81%
VP 33	68%	82%	68%	82%	68%	75%	68%	82%	68%	82%
VP 34	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
VP 35	91%	78%	91%	78%	91%	78%	91%	78%	91%	78%
VP 36	88%	**74%**	88%	**74%**	88%	**74%**	88%	**74%**	88%	**74%**
VP 37	91%	82%	91%	82%	91%	82%	91%	82%	91%	82%
VP 38	90%	84%	90%	84%	90%	84%	90%	84%	90%	84%
VP 39	80%	76%	80%	76%	80%	76%	80%	76%	80%	76%
VP 40	98%	84%	98%	84%	98%	84%	98%	84%	98%	84%
VP 41A	95%	92%	95%	92%	95%	92%	95%	92%	95%	92%
VP 42	100%	**67%**	41%	**22%**	46%	**24%**	100%	**67%**	100%	**67%**
VP 44	100%	**73%**	100%	**47%**	100%	**45%**	100%	**73%**	100%	**73%**
VP 45	98%	96%	79%	**54%**	60%	**51%**	98%	96%	98%	96%
VP 46	100%	97%	78%	**54%**	59%	**51%**	100%	97%	100%	97%
VP 47	85%	97%	85%	**65%**	85%	**61%**	85%	97%	85%	97%
VP 48	90%	97%	90%	**71%**	90%	**67%**	90%	97%	90%	97%
VP 49	98%	88%	98%	78%	98%	75%	98%	88%	98%	88%
VP 50	100%	86%	100%	86%	100%	86%	100%	86%	100%	86%
VP 51	58%	77%	58%	77%	58%	**63%**	58%	77%	58%	77%
VP 54	92%	80%	92%	**71%**	92%	80%	92%	80%	92%	80%
VP 56	96%	**75%**	96%	**72%**	96%	**72%**	96%	**75%**	96%	**75%**
VP 57	99%	81%	99%	78%	99%	78%	99%	81%	99%	81%
VP 58	98%	76%	98%	**74%**	98%	**74%**	98%	76%	98%	76%
VP 59	97%	93%	97%	92%	97%	92%	97%	93%	97%	93%

Vernal Pool ID	Existing Conditions		Alt A		Alt B		Alt C		Alt D	
	VPE	CTH	VPE	CTH	VPE	CTH	VPE	CTH	VPE	CTH
VP 60	96%	82%	96%	79%	96%	79%	96%	82%	96%	82%
VP 61	95%	77%	95%	**73%**	95%	**73%**	95%	77%	95%	77%
VP 63	96%	95%	96%	**67%**	96%	**72%**	96%	95%	96%	95%
VP 64	92%	**67%**	92%	**47%**	92%	**67%**	92%	**67%**	92%	**67%**

Note: Vernal pools proposed to be directly impacted are shaded gray. Values in bold font represent critical terrestrial habitat disturbance greater than 25%. The small reductions associated with stormwater facilities for Alternative A (the preferred alternative) were not evaluated for this table.

Table 4.12-6 presents a tally of impacts to VPEs, by Alternative. No vernal pool envelopes are intact under the existing condition, as presented in Table 4.12-5. Because the USACE guidance uses 75 percent as a threshold for providing sustainable CTH, tallies of impacted CTHs and tallies of CTHs for which the usable habitat would be decreased to below 75 percent are provided. For comparison, the small additional encroachments to VPEs and CTHs associated with the preferred alternative stormwater facilities are not included in Tables 4.12-5 and 4.12-6.

Table 4.12-6. Vernal Pool Surrounding Upland Habitat Impact Summary

Impact Type	Alt A	Alt B	Alt C	Alt D
Count of Impacts to VPEs	5	7	4	7
Count of Impacts to CTHs	25	26	8	11
Count of Impacts to CTH that decrease available habitat to below 75%	4	5	0	0

Note: Vernal pools directly impacted are not included in these tallies.

Wetland Impacts by Alternative

Alternative A

The preferred alternative would result in an estimated 4.85 acres of direct vegetated wetland impact, including direct impacts to seven documented vernal pools. Wetland impact areas for the preferred alternative are depicted in Appendix I, *Wetlands and Vernal Pools Functions and Values and Wetland Photographs*. Photo locations are depicted in Figures 4.12-7 through 4.12-11. Wetland 14 is west of I-93 and falls within the footprint of the interchange for the preferred alternative. This primarily forested wetland includes an intermittent stream with a 269-acre watershed that parallels the highway and flows east under the highway near the Ash Street overpass. Portions of the stream and wetland would be impacted by the I-93 widening project. The wetland is approximately 17 acres and has the capacity to provide the following functions and values: groundwater interchange, floodflow alteration, fish/shellfish habitat, sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, wildlife habitat, and visual quality/aesthetics. Of these functions and values, floodflow alteration, sediment/toxicant retention, and wildlife habitat are considered principal. Approximately 1.78 acres of impact would occur to this forested wetland as a result of the new interchange construction. This is the largest single wetland impact that would occur under the preferred alternative. Approximately 0.56 acre of the stream would be relocated and constructed in a manner that restores stream function.

East of I-93, where the access ramps would be constructed and in the footprint of the western portion of the alignment, are several vernal pools and associated forested wetlands that would be impacted by the preferred alternative. A total of seven vernal pools would be directly impacted by new alignment in this section, and five of these would likely cease to function as vernal pools. The VPE of an additional 5 VPs would also be affected, with a total of 8.19 acres. The CTEs of 25 vernal pools would be affected (many of which overlap). The total impact area to CTEs for the preferred alternative is 32.25 acres. VPE and CTE impacts are considered indirect vernal pool impacts and were further evaluated for mitigation purposes (see Section 4.12.3).

Wetland impacts along the existing alignment would result from roadway widening. No direct vernal pool impacts would occur along the existing alignment, but prime wetland (B-12) north of Tsienneto Road would be impacted in conjunction with the widening of the road and replacement of the existing stream crossing. There is also a small impact to the Prime Wetland A-01 for the outlet of a stormwater drainage system.

In accordance with New Hampshire Wetland Regulations Env-Wt 703, the potential impacts of the Project on prime wetlands are described below.

(1) There will be no significant net loss of values set forth in RSA 482-A:1:

> RSA 482-A:1 identifies wetlands as valued sources of nutrients for finfish, crustacea, shellfish, and wildlife of significant value; habitats and reproduction areas for plants, fish, and wildlife of importance; sources of commerce, recreation, and aesthetic enjoyment of the public; important for maintenance of adequate groundwater levels; and absorption of flood waters and silt. Derry designated this wetland as Prime Wetland B-12 in 1986, noting that this emergent wetland’s high percentage of vascular plants filters and regulates the quantity and quality of water flowing to Beaver Lake; is undisturbed and natural, with nature trails; and is connected to other wetlands and waterbodies by streams. Derry further notes that a beaver dam helps to maintain a large area of open water that attracts wildlife. An improved road crossing of the outlet in a steeply sided, forested area downstream of the marsh that is designed to meet stream rule standards without draining the marsh will have a negligible effect on wetland habitat values, filtering capabilities, and public access or enjoyment. It will reduce road and property flooding. The Prime Wetland Report indicates that B-12 is 10.1 acres, while the NWI map indicates it is 15.7 acres. Both likely underestimate jurisdictional wetland area. The impact to the wetland is 3,265 square feet, which is approximately 0.5% of the NWI-mapped wetland area.
>
> Prime Wetland A-01 is a 5-acre emergent and scrub-shrub wetland surrounded by single and multi-family residences, just south of the channelized portion of Shields Brook. The 98 square feet of impact is not significant in size, and the stormwater that will be discharged will have been treated in accordance with water quality standards.

(2) The Project is consistent with the purpose specified in RSA 482-A:1:

The purpose of the wetland protection law as stated in RSA 482-A:1 is to protect the public good and welfare. Tsienneto Road crosses the outlet stream of the Prime Wetland, and flooding has been a problem due to the undersized culverts. These undersized culverts serve as a dam, impounding flow that forms a small pond adjacent to the road. Approximately 50 feet upstream of the road is a stone wall that crosses the wetland and impedes flow. Approximately 300 feet upstream of the road is the beaver dam, mentioned in the 1986 Prime Wetland Report, which impounds surface water in the large marsh, to the benefit of wetland wildlife as noted in the report. This crossing will maintain the public values of the marsh because a weir will be constructed to avoid draining the marsh. The crossing will also protect public welfare by reducing flooding impacts and more safely accommodating traffic.

The treatment of stormwater is also in the public interest and must be discharged back to surface water, as will occur at Wetland A-01.

(3) The Project could not be relocated to avoid impacts on prime wetlands without either reducing the public value of the Project, or negatively affecting the public health or safety:

The B-12 crossing has been designed to minimize wetland impacts while still reducing flooding, improving stream flow, and improving traffic flow. Because the road crossing is already present (and predates the designation of the wetland as prime), the location is unavoidable.

There are limited opportunities but significant need for stormwater treatment in this highly developed Project area, and every effort was made to find suitable, low impact solutions that minimize environmental impacts and maximize water quality goals.

(4) The Project's impacts on prime wetlands are the minimum practical without either reducing the public value of the Project, or negatively affecting the public health or safety:

The crossing location of Prime Wetland B-12 is unavoidable, and upgrades are necessary to accommodate a slightly wider road and to meet stream crossing rules. At this time, the impact area is consistent with a conceptual level design. However, impacts at this location will be reduced as much as possible during final design, if it can be accomplished without compromising the value of the Project or public safety and health. A second, small impact (57 square feet) to this prime wetland has been eliminated.

The 98-square-foot impact to A-01 is the minimum necessary for this stormwater infrastructure.

(5) The Project incorporates appropriate and practicable compensatory mitigation for each of the wetland functions and values of RSA 482-A:1, and each of the functions and values ranked by the municipality that are impacted by the Project. The mitigation proposed shall be appropriate in terms of matching the proposed benefit given the relative harm of the Project. The mitigation shall be practicable given the technology available at the time of this application.

The impacts to the functions and values of Prime Wetland B-12 are expected to be negligible, due to the location of the impacts at the outlet channel more than 300 feet downstream of the marsh proper. However, the direct impact quantities as well as indirect “edge effect” impacts, as required by the USACE 2016 Mitigation Guidance document, are included in the Aquatic Resource Mitigation (ARM) fund calculation. Impacts to the functions and values of Prime

Wetland A-01 for a stormwater outlet are also minimal. All prime wetland impacts will be mitigated by the Project in accordance with NHDES regulations.

There are also approximately 16 acres of wetlands within 25 to 150 feet (depending on wetland type) of the roadway that would be indirectly impacted by the Exit 4A Project. These impacts are not a total loss of wetland area, but rather a reduction of wetland functions and values, and under federal guidance, are proportionately mitigated (see Table 4.12-8).

Alternative B

Alternative B would have the most wetland impacts of all the alternatives, because it involves the most new alignment in undeveloped land. Alternative B has slightly fewer impacts than Alternative A from the interchange construction at 2.18 acres, and a small amount of impact from road widening and improvements. East of the I-93 interchange, eight vernal pools at the western end of the new alignment would be impacted, along with associated forested wetlands. The CTEs of 26 vernal pools would be impacted by this alternative.

West of Ashleigh Drive, a total of 5.03 acres of forested, scrub-shrub, and emergent wetland would be impacted on undeveloped land and powerline alignment. A total of 1.28 acres of a forested and scrub-shrub wetland complex (Wetland 42) that lies between and behind commercial buildings on NH 28 would be impacted.

Other large impacts under Alternative B would include 2.08 acres of forested wetland south of the powerlines (Wetland 48), 1.14 acres of scrub-shrub wetland under the powerline intersection and adjacent forested wetland (Wetlands 54 and 60) and impacts on several other large wetland areas from new alignment (Wetland 52, 0.46 acre, and Wetland 47, 0.42 acre). Indirect “edge effect” wetland impacts from the direct wetland impacts of this alternative would also occur, but were not calculated.

Alternative C

Alternative C would use the northern interchange, where construction of the access ramps would create 2.42 acres of wetland impact, including impacts to two vernal pools in the access ramp footprint. A third vernal pool at the western end of the alignment would also be impacted. The CTEs of eight other vernal pools would also be affected. Because Alternative C would also involve new alignment east of NH 28, the impacts in this area on undeveloped land and powerlines would be comparable to Alternative B at 5.01 acres. Indirect “edge effect” wetland impacts from the direct wetland impacts of this alternative would also occur, but were not calculated.

Alternative D

Alternative D would use the northern interchange where impacts would be comparable to Alternative C with 2.42 acres for interchange construction, and 1.21 acres of impact for new alignment west of NH 28. Because the rest of the Alternative follows existing roadway, the remaining impacts from widening and improvements would be relatively minor, with 0.29 acre of impact. There would be direct impacts to four vernal pools and impacts to the CTEs of eleven vernal pools. Indirect “edge effect” wetland impacts from the direct wetland impacts of this alternative would also occur, but were not calculated.

4.12.3 Mitigation

Mitigation is required for direct impacts to wetlands, streams, and vernal pools and indirect impacts to wetlands and vernal pools. Mitigation for wetland impacts has not yet been finalized, but it would likely involve an in-lieu-fee payment to the ARM fund at NHDES and potentially preservation of land for conservation and/or culvert upgrades through the Stream Passage Improvement Program (SPIP). The following section describes these mitigation options.

The in-lieu fee amount and conserved land, if any, would be determined in accordance with NH RSA 482-A:28 and NHDES Wetland Rules and with federal Section 404 guidelines in 40 CFR (b)(1)J, and with the USACE's 2016 *New England District Compensatory Mitigation Guidance*. The ARM fund payment was estimated based on the impacts associated with the advanced conceptual plans for the preferred alternative following the guidance documents and input from NHDES, USACE, and EPA (Table 14.12-7). For direct impacts to wetlands and streams, area of wetland impact (Table 4.12-2) was added to the ARM fund calculator, which calculates the cost to create a wetland of similar type within the impacted municipality at the required mitigation ratios.

The USACE 2016 Mitigation Guidance also provides ratios for temporary fill, permanent conversion (forested to emergent), and secondary impact edge effects. The guidelines recommend that a portion of the standard amount of mitigation that would be required if a wetland were directly impacted should be added to the total if the wetland is within the "Impact Zone" of the Project. The size of the impact zone varies by wetland type, and impact zones are broken into two types, depending on proximity to the Project, with a closer "High Level Impact Zone" requiring more mitigation than the rest of the impact zone (Table 4.12-8). There are about 16 acres of wetlands within the impact zones of the Exit 4A Project, a percentage of which must be mitigated. Indirect wetland impact areas overlapping indirect vernal pool impact areas were not double counted, but the higher vernal pool mitigation requirements were used.

Table 4.12-7. Proposed In-Lieu Fee Summary for the Preferred Alternative

Resource	Impact Quantity	In Lieu Fee Estimate	Assumptions
All Wetlands	211,377 square feet (4.85 acres)	$1,065,666.32	Includes direct impacts to all wetlands and vernal pools in accordance with 2016 USACE Mitigation Guidance.
Secondary Impacts "Edge Effects"	105,415.2 square feet (2.42 acres)	$531,455.30	Mitigation for secondary "Edge Effects" are calculated as recommended in the 2016 USACE Mitigation Guidance.
Vernal Pools Loss	221,000 square feet (5.07 acres)	$1,114,181.09	Mitigation for functional loss of 4 medium and 1 high value vernal pool based on ratios recommended in 2016 USACE Mitigation Guidance
Vernal Pools - Secondary	104,000 square feet (2.39 acres)	$524,320.51	For 4 vernal pools, partially or indirectly impacted, that are modeled to drop in value
Streams[a]	1,725 linear feet	$427,248.00	Calculated for impacts to channels of all streams and banks of perennial streams

Resource	Impact Quantity	In Lieu Fee Estimate	Assumptions
TOTAL		**$3,662,871.22**	

[a] Stream S1 would be considered self-mitigating because there are sufficient data for providing streambed simulation to replicate the stream.

Table 4.12-8. USACE Recommended Mitigation for Secondary Impact Edge Effects

Wetland Type	Impact Zone[a]	Acreage in Impact Zone (30% Design)	% of Standard Amount	Acreage to be mitigated
Palustrine Emergent	25	0.24	25%	0.06
	75	0.60	10%	0.06
Scrub Shrub	50	1.09	25%	0.27
	100	2.64	10%	0.26
Forested	50	4.14	25%	1.04
	150	7.31	10%	0.73
			Total	2.42[b]

[a] USACE identifies “High level impact zones” and “remainder of impact zone” for emergent, scrub shrub, and forested wetlands. The amount of mitigation required is a percentage of what would be required for direct impacts.

[b] Secondary impact edge effects have been refined since the June 20, 2018, natural resource agency meeting, again after the March 15, 2019, meeting with state and federal wetland regulators, and after design of the stormwater BMPs.

The 2016 Mitigation Guidance provides specific recommendations for direct and indirect impacts to vernal pools. The area of direct vernal pool impact is included in the wetland ARM fund calculator. An additional in-lieu-fee payment is required for vernal pools that receive direct fill by the Project and are judged unlikely to function as vernal pools due to that fill, even if some wetland remains. Vernal pool quality is evaluated using USACE’s “Vernal Pool Characterization” form that provides a scoring system for low-, medium-, and high-quality vernal pools based on the characteristics of the vernal pool itself and of the surrounding landscape.

For the preferred alternative, there are four medium quality and one high quality vernal pools that would be substantially impacted and probably cease to function as vernal pools (VPs 2, 4, 6, 8, and 42). The 2016 USACE Mitigation Guidance recommends a vernal pool functional loss mitigation ratio of 1:1 (low quality): 1:3 (medium quality): 1:5 (high quality), and these ratios are applied as a 13,000 square foot factor per pool for in-lieu fee calculations. This factor is based on an equivalent cost of preserving one vernal pool. Following this guidance, factors of 13,000 square feet would be applied to the ARM fund calculator for each low value vernal pool, 39,000 square feet for each medium value pool, and 65,000 square feet for each high value pool. Using this guidance, the total factor applied for mitigation of lost vernal pool function for four medium and one high value pool would be 221,000 square feet. This is the area entered into the ARM fund calculator for vernal pool loss.

The 2016 USACE Mitigation Guidance also provides recommendations for additional in-lieu fee payments for vernal pools that would be partially impacted or that would have impacts to their CTH that reduce their vernal pool value but do not cause a complete loss of function. Value loss is determined by scoring the landscape portion of the USACE "Vernal Pool Characterization" form for wetlands with encroachments in their CTH (Table 4.12-5) and identifying any pools whose current values drop from high to medium, high to low, or medium to low under the built condition. Based on GIS analysis, modeling, and USACE review, four vernal pools would be affected sufficiently to drop in value due to project impacts but would likely continue to function as vernal pools (VPs 3, 9, 46 and 64). The vernal pool value loss is the difference between the before and after value factors. For example, if a high value VP (value of 65,000) drops to a medium value VP (value of 39,000), the loss value of 26,000 is entered in the ARM fund calculator (65,000 – 39,000 = 26,000). Low value vernal pools do not need to be evaluated. Using this guidance, the total area to be mitigated for indirect impacts to the four vernal pools that have been evaluated to have dropped one value level would be 4 X 26,000 or 104,000 square feet (2.39 acres). In February of 2019, EPA and USACE (the Agencies) issued a proposed rule redefining "Waters of the U.S." under the CWA. Under this rule, nonadjoining wetlands that do not have a continuous surface connection to a jurisdictional water, including some vernal pools, would no longer fall under federal jurisdiction, and secondary or indirect impacts would no longer require mitigation. However, all indirect vernal pool impact and mitigation calculations in this document are based on the 2016 guidance (the current guidance at the time the SDEIS and this FEIS were prepared). The mitigation details could change during permitting depending on future regulatory and guidance changes.

The ARM fund payment that would result from the construction of the preferred alternative was calculated based on the conceptual level design plans to be $3,662,871.22 (Table 4.12-7). Other potential avenues for wetland mitigation include land preservation and the SPIP. NHDOT is currently investigating the mitigation suitability of a parcel of land in Derry adjacent to a Town Forest, which has the support of the Derry Conservation Commission. The SPIP is a partnership with NHDOT and NHDES that would use mitigation funds to address culverts within the Project watershed that have inadequate aquatic organism passage or structural condition. NHDOT is evaluating several stream crossings for applicability under this program. Preservation of a suitable property or participation in the SPIP would be expected to lower the ARM fund payment accordingly.

4.13 Groundwater

4.13.1 Affected Environment

The study area for aquifers is shown in Figure 4.13-1 and is the same as the study area for surface waters and water quality. The study area for groundwater wells is based on a 1,300-foot buffer, which corresponds to a minimum radius for WHPAs. A WHPA as defined in RSA 485-C:2 is the "surface and subsurface area surrounding a water well or wellfield, supplying a public water system (PWS), through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The WHPA for individual wells varies in radius from 1,300 feet to 4,000 feet, depending on the status of the WHPA delineation (preliminary versus refined) and the maximum daily amount of water withdrawn from the well. WHPAs are delineated preliminarily by a radius centered on a wellhead location (preliminarily a 1,300-foot radius for wells producing less than 7,200 gallons per day (gpd) up to a 4,000-foot radius for wells