Northern Pass Transmission Project

Vegetation and Ecological Communities

Prepared For:
Northern Pass Transmission, LLC
and
Public Service Company of New Hampshire
d/b/a Eversource Energy

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1 Introduction

The Northern Pass Transmission Project (Northern Pass, or the Project) is a proposed 192-mile transmission line project that will carry 1,000 MW of renewable hydroelectric power from Canada to New Hampshire and greater New England. The Project will construct 158 miles of direct-current (DC) transmission line in New Hampshire from the Canadian border to a converter terminal to be built in Franklin, NH. Approximately 60 miles of this will be underground in existing road ROW, and the rest will be overhead line. There it will be converted to alternating current (AC) and sent via a 34-mile AC overhead transmission line to a substation in Deerfield (Figure A-1) where it will connect to the New England power grid, which serves all customers in the region. Approximately 82 miles of existing overhead transmission and distribution lines of various voltages that share the existing ROW will be relocated within the existing ROW to make room for the new line. Upgrades to existing AC facilities ("AC System Support facilities") are required at Deerfield Substation in Deerfield and Scobie Pond Substation in Londonderry, where expansions of the existing facilities are planned as well as small modifications for the two existing 345-kV transmission lines between Deerfield and Scobie Pond substations. Upgrades to these lines do not require the construction of new transmission line, but will involve some minor temporary land disturbance.

Northern Pass follows an existing Eversource Energy (Eversource) transmission line right-of-way (ROW) or public road ROW for over 80% of its length. Approximately 32 miles of the project in northern New Hampshire would require the clearing of new ROW. Starting from the north, Northern Pass will enter New Hampshire from Canada at Halls Stream. The overhead line transitions to a short underground cable segment under the Connecticut River and Route 3 ROW, resurfacing less than a mile away in Clarksville, where the overhead transmission line continues to Route 145.

At this point the overhead line will transition to underground cable for approximately 7.6 miles following the ROW of Old County Road, North Hill Road, and Bear Rock Road to the junction of Bear Rock Road and Heath Road in Stewartstown. Here the line will resurface to an overhead transmission line and follow a proposed ROW through Stewartstown, Dixville, Millsfield, and Dummer until joining the existing overhead transmission line ROW in Dummer near Route 16. The route then follows existing ROW to Route 302 in Bethlehem, passing over the Upper Ammonoosuc River in Stark, Otter Brook and the Israel River in Lancaster, John's River in Dalton, and the Ammonoosuc River in Bethlehem.

At Route 302, the line is proposed to go underground following the road ROW of Routes 302, 18, 112, 116 and 3 for approximately 52 miles through the towns of Bethlehem, Sugar Hill, Franconia, Easton, Woodstock, Thornton, Campton, Plymouth and Bridgewater, where the existing transmission line ROW crosses Route 3. Along the way, the line will be directionally drilled under the Gale River in Franconia, Moosilauke Brook in Woodstock and the Baker River in Plymouth.

At Route 3 in Bridgewater, the line transitions back to overhead line, and follows existing transmission ROW though the towns of Bridgewater, Ashland, Bristol, New Hampton, Hill, Franklin, Northfield, Canterbury, the City of Concord, Pembroke and Allenstown to the terminus in Deerfield (Figure A-1). Within this portion of the ROW, the line will pass over the Squam River in Ashland, Pemigewasset River (in several towns), the Merrimack River at the Franklin/Northfield Town line, Turtle Pond in Concord, The Soucook River at the Concord/Pembroke line, the Suncook River at the Pembroke/Allenstown line, and the Lamprey River in Deerfield.

This report provides a summary of vegetation and ecological communities identified by Normandeau Associates, Inc., during the natural resource field review for Northern Pass.

2 Vegetation and Ecological Communities Definitions and Methodology

The U.S. Forest Service (USFS) has defined geographic areas with generally similar characteristics into ecological units (referred to as ecoregions) within the United States. Ecoregions include areas with similar environmental resources. Ecoregion boundaries are determined by examining patterns of vegetation, wildlife, geology, soils, water quality, climate, and human land use as well as other important components of an ecosystem. Ecoregions are further divided into a hierarchical framework (Table B-1). USFS ecoregion subsections along the transmission corridor represent a unique combination of climate conditions, bedrock and topography, soils, and vegetation (Figure A-2, Table B-2). Natural communities are grouped according to size distribution within a particular ecoregion: "matrix" forest communities dominate the uplands of a region, covering tens of thousands of acres; "patch" communities are smaller, occupying areas from <1 to hundreds of acres or, less commonly, thousands of acres.

It should be noted that the existing Eversource ROW between Dummer and Londonderry consists primarily of shrubland, grassland, and early successional forest regeneration due to ongoing vegetation maintenance operations. Northern Pass crosses a diverse section of New Hampshire's biophysical features and related natural vegetation. Forests in the north and the mountains typically experience 90 to 120 frost-free days while those near the south can have 150 or more frost-free days (Table B-2). This illustrates the substantial latitude- and elevation-driven shift in climate and vegetation conditions throughout the Project. Topography, surface materials and landforms, soils, and other features also change along the transmission corridor.

Information used to complete this analysis includes U.S. Geological Survey (USGS) topographic data, bedrock maps (Figure A-3), wildlife habitat maps from the New Hampshire Wildlife Action Plan (WAP 2010; Figure A-4 through Figure A-10), and NH Natural Heritage Bureau (NHNHB) natural community and natural community system classifications (Sperduto and Kimball 2011; Sperduto and Nichols 2011; Sperduto 2005). The NHNHB community classification system evaluates the rarity of a natural community, a species, or both within the state and across its range. The degree of rarity is identified by a ranking system. Definitions of natural community state rarity ranks (S-ranks) are found in Appendix C.

Natural communities (those communities that have not been altered by vegetation management) within the Project area are those that are too wet or too rocky to support significant tree growth. These include shrub thicket, meadow marsh, emergent marsh, aquatic bed, open peatland, and cliff natural community types. The great majority of the vegetation within the existing Eversource ROW represents early successional anthropogenic vegetation types comprised of mostly native shrub, herbaceous, and tree (sapling) species. These anthropogenic communities are often novel combinations of species that are partially analogous to natural communities that otherwise would occur. Some are unique to ROW environments or other similar openings maintained by regular cutting or mowing. Others with naturally low levels of tree cover more closely approximate a corresponding natural community type.

The maintenance and recreational vehicle uses represent disturbance regimes that diminish the density of trees and shrubs and produce open conditions where certain native and non-native herbaceous species excel. These species ("disturbance colonizers") rely on or respond to the disturbance regime. Many of the rare plants found within the ROW fall into this category. These plants typically do not occur in shrubbier portions of the ROW where they cannot compete successfully with shrubs and trees, but they also do not occur where disturbance levels are too great, such as directly in wheel tracks. Prior to European settlement, most of these species occurred in native habitats maintained by periodic, recurring natural disturbances such as wind throw, river flooding, or wild fire.

The absence of significant tree cover can result in additional water in the soil due to diminished evapotranspiration by trees. This can substantially influence the species assemblage present. On hydric soils, water retention tends to reinforce the predominance of wetland shrubs and herbaceous plants. On non-hydric soils, excess soil water drains more readily, and, in combination with increased solar radiation in the ROW environment, can result in seasonally dry or dry-mesic conditions. These tendencies do not apply to all sites within the ROW due to variation in soils, drainage, and other factors, but they do correspond to observations at many sites.

Differences in biophysical conditions and vegetation within each section of the Project area are the focus of this report. Each section of this report describes the vegetation at two scales: 1) vegetation in the project vicinity and 2) vegetation within the Project area. The Project area includes the existing road and transmission ROW, the proposed ROW, and site development footprints. Descriptions draw on field observations from surveys for rare species and exemplary natural communities on targeted sections within the Project area and the field surveys undertaken to delineate wetlands along the length of Project area. Vegetation and ecological communities are described below, presented beginning at the U.S./Canada Border and traveling south consistent with the sections identified in Figure A-1 for the length of the Northern Pass corridor.

3 Survey Results

3.1 U.S./Canada Border to Existing Transmission Line ROW in Dummer (Section N1)

3.1.1 Vegetation in the Project Vicinity

The proposed transmission line ROW in this area occurs within an area that is currently mostly forested. This project section extends from Halls Stream at the U.S./Canada Border to the eastern edge of the existing Eversource transmission line ROW in Dummer (Figure A-1). Elevations range from approximately 1,100 feet above mean sea level (msl) in the vicinity of Halls Stream and by the Connecticut River in Pittsburg and Clarksville to 2,985 feet above msl where the proposed Project crosses the summit of Sugar Hill in Stewartstown. This northernmost section of the Project area falls within the Connecticut Lakes and Mahoosic-Rangely Lakes ecoregion subsections (Figure A-2). The terrain is generally mountainous with large river valleys. Many rivers and streams are found in this portion of the Project, including high-gradient channel systems associated with mountainous areas, and moderate- and low-gradient channel systems associated with lower hills and broad valleys. Glacial till is abundant in surface deposits while calcium-rich bedrock (mafic and carbonate-bearing bedrock types) underlies much of the Project area in this section, especially from Dixville to the U.S. border (Figure A-3). Upon weathering, these rocks (or glacial till derived from them) can yield higher than average soil calcium levels and soil fertility, referred to as "rich" sites. A variety of other site conditions also affect soil fertility, resulting in uneven distribution of rich site conditions.

This sparsely developed and sparely populated cold climate region of the state has natural communities similar to those found in the boreal forest region of Canada. The dominant community types in this area are northern hardwood-conifer forests and lowland spruce-fir forests (Table 1, Figure A-4). High elevation spruce-fir forest is found on upper mountain slopes and ridgetops in the vicinity of the Project in Dixville and in Stewartstown near Sugar Hill. Seepage forests occur on lower mountain slopes. Northern white cedar-balsam fir swamps and rich mesic forests are relatively common in this region and reflect the influence of calcium-bearing bedrock and its influence on soil conditions and plant nutrition. Rare plant species in this area are mostly associated with rich woods, swamps, and fens, including northern white cedar swamps. Forest communities in the vicinity of this section have been strongly impacted by historic and on-going timber harvesting, which has affected forest structure, age and size classes of trees, and species composition.

Table 1. Dominant and Characteristic Plant Communities, U.S./Canada Border to Existing Transmission Line ROW in Dummer

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Dominant/Matrix	
Laurentian Mixed Forests Northern hardwood-conifer forest system (S5) Sugar maple-beech-yellow birch forest (S5) Northern hardwood-spruce-fir forest (S4) Semi-rich mesic sugar maple forest (S3S4)	Northern Hardwood-Conifer Forest
Acadian Spruce-Fir Forests Lowland spruce-fir forest/swamp system (S3) Lowland spruce-fir forest (S3)	Lowland Spruce-Fir Forest
Characteristic Patch	
Laurentian Mixed Forests Rich mesic forest system (S2S3) Rich mesic forest (S3)	Northern Hardwood-Conifer Forest No corresponding WAP habitat type
Acadian Spruce-Fir Forests High elevation spruce-fir forest system (S4) High elevation spruce-fir forest (S4)	High Elevation Spruce Fir
Peatlands Medium level fen system (S3S4) Rich sloping fen system Alder wooded fen (S3S4)	Peatlands
Swamps Near-boreal minerotrophic swamp system (S2S3) Northern white cedar-balsam fir swamp (S2) Forest seep/seepage forest system Northern hardwood seepage forest (S3) Subacid forest seep (S3S4) *Circumneutral hardwood forest seep* (S3) Northern hardwood-black ash-conifer swamp (S3)	No direct corresponding WAP habitat type (embedded within various forest habitats, and Peatlands)
Marshes Emergent marsh-shrub swamp system (S5) Mixed tall graminoid-scrub-shrub marsh (S4S5) Tall graminoid meadow marsh (S4) Emergent marsh (S5) Aquatic bed (S4S5) Sand plain basin marsh system	Marsh and Shrub Wetlands
River Channels and Floodplains High-, moderate-, and low-gradient river channel systems (S3, S3S4, and S3S4, respectively) Boulder-cobble river channel (S3)	No corresponding WAP habitat (partially included in Floodplain Forest habitat)

*see Appendix C for rank codes and descriptions

3.1.2 Vegetation within the Project Area

Much of the proposed Project area between the U.S. border and Dummer occurs within a remote forested area that is actively logged. In addition to logging roads, a network of all-terrain vehicle and snowmobile trails traverses this area. Approximately 8 miles of the proposed Project occurs along existing public roads in Clarksville and Stewartstown, where the transmission line is proposed to be installed underground. The transmission line will also be installed underground beneath the Connecticut River in Clarksville/Pittsburg.

Many pole-sized trees (5- to 11-inch diameter at breast height [dbh]), small sawtimber trees (12- to 18-inch dbh), and piles of slash are found in the forested areas managed for timber. A small number of larger-sized trees (>20-inch dbh) are scattered within these areas. Some intact forest patches also occur with larger-sized trees and a sparse shrub layer. Common tree species in upland areas include balsam fir (*Abies balsamea*), yellow birch (*Betula alleghaniensis*), sugar maple (*Acer saccharum*), red spruce (*Picea rubens*), and paper and heartleaf birch (*Betula papyrifera* and *B. cordifolia*) with eastern hemlock (*Tsuga canadensis*), American beech (*Fagus grandifolia*), red maple (*Acer rubrum*), northern white cedar (*Thuja occidentalis*), gray birch (*Betula populifolia*), quaking aspen (*Populus tremuloides*), white spruce (*Picea glauca*), and pin cherry (*Prunus pensylvanica*) present at some locations. Shrub and sapling species include hobblebush (*Viburnum lantanoides*), striped maple (*Acer pensylvanicum*), mountain maple (*Acer spicatum*), red elderberry (*Sambucus racemosa*), Canada honeysuckle (*Lonicera canadensis*), and mountain-ash (*Sorbus decora*). Red raspberry (*Rubus idaeus*), highbush blackberry (*Rubus allegheniensis*), and seedlings of balsam fir tend to abound in recently cut areas. Common groundcover species include bluebead lily (*Clintonia borealis*), mountain wood fern (*Dryopteris campyloptera*), evergreen woodfern (*Dryopteris intermedia*), whorled aster (*Oclemena acuminata*), narrow beech fern (*Phegopteris connectilis*), red and painted trillium (*Trillium erectum* and *T. undulatum*), tall rattlesnake-root (*Nabalus altissimus*), spring-beauty (*Claytonia caroliniana*), trout-lily (*Erythronium americanum*), bunchberry (*Chamaepericlymenum canadense*), rose-twisted stalk (*Streptopus lanceolatus*), false Solomon's seal (*Maianthemum racemosum*), Canada mayflower (*Maianthemum canadense*), shining furmoss (*Huperzia lucidula*), bracken (*Pteridium aquilinum* ssp. *latiusculum*), and hay-scented fern (*Dennstaedtia punctilobula*).

In addition, the following species indicative of rich or semi-rich conditions are found at some locations within this section of the Project due to the prevalence of calcium-rich bedrock: blue cohosh (*Caulophyllum thalictroides*), foam-flower (*Tiarella cordifolia*), white and red baneberry (*Actaea pachypoda* and *A. rubra*), white snakeroot (*Ageratina altissima*), Christmas fern (*Polystichum acrostichoides*), Braun's holly fern (*Polystichum braunii*), silvery false spleenwort (*Deparia acrostichoides*), zig-zag goldenrod (*Solidago flexicaulis*), Dutchman's-breeches (*Dicentra cucullaria*), sweet-cicely (*Osmorhiza claytonii*), rattlesnake fern (*Botrychium virginianum*), Maryland sanicle (*Sanicula marilandica*), and maidenhair fern (*Adiantum pedatum*).

Common species in forested wetlands include red maple, yellow birch, balsam fir, red spruce, gray birch, balsam poplar (*Populus balsamifera*), and larch (*Larix laricina*), with some areas containing sugar maple, black ash (*Fraxinus nigra*), eastern hemlock, black spruce (*Picea mariana*), and northern white cedar. Other species occurring in wetlands (forested, scrub shrub,

or emergent) include speckled alder (*Alnus incana* ssp. *rugosa*), hobblebush, red osier dogwood (*Swida sericea*), highbush cranberry (*Viburnum opulus*), sensitive fern (*Onoclea sensibilis*), evergreen woodfern, dwarf raspberry (*Rubus pubescens*), tall meadow-rue (*Thalictrum pubescens*), jewelweed (*Impatiens capensis*), nodding sedge (*Carex gynandra*), sallow sedge (*Carex lurida*), three-seeded sedge (*Carex trisperma*), bluejoint (*Calamagrostis canadensis*), false hellebore (*Veratrum viride*), spotted Joe-pye weed (*Eutrochium maculatum*), rattlesnake, northeastern and fowl manna grasses (*Glyceria canadensis, G. melicaria,* and *G. striata*), bulrushes (*Scirpus* spp.), goldenrods (*Solidago* spp.), cow-parsnip (*Heracleum maximum*), flat-topped white aster (*Doellingeria umbellata*), arrow-leaved tearthumb (*Persicaria sagittata*), common cattail (*Typha latifolia*), virgin's-bower (*Clematis virginiana*), New York fern (*Parathelypteris noveboracensis*), Canada wood nettle (*Laportea canadensis*), Jack-in-the-pulpit (*Arisaema triphyllum*), bedstraw (*Galium* spp.), eastern rough sedge (*Carex scabrata*), golden-saxifrage (*Chrysosplenium americanum*), sphagnum moss (*Sphagnum* spp.), ostrich fern (*Matteuccia struthiopteris*), lady fern (*Athyrium angustum*), turtlehead (*Chelone glabra*), creeping snowberry (*Gaultheria hispidula*), and dwarf enchanter's nightshade (*Circaea alpina*).

Proposed access routes located outside of the Project ROW consist primarily of existing dirt logging roads, and all-terrain vehicle (ATV) or snowmobile trails. The logging roads are largely devoid of vegetation except along the road shoulders. Vegetation in the vicinity of these access routes generally includes species typical of open disturbed areas such as red raspberry, strawberry (*Fragaria* sp.), fireweed (*Chamerion angustifolium*), and field cinquefoil (*Potentilla simplex*). Many introduced species occur in these areas including coltsfoot (*Tussilago farfara*), common dandelion (*Taraxacum officinale*) common plantain (*Plantago major*), common tansy (*Tanacetum vulgare*), orange hawkweed (*Hieracium aurantiacum*) and yellow clover (*Trifolium aureum*).

Ten plant species with state-level special status were observed in this section of the Project: Goldie's fern (*Dryopteris goldiana*), Canada violet (*Viola canadensis*), pale jewelweed (*Impatiens pallida*), northern wild licorice (*Galium kamtschaticum*), wild leek (*Allium tricoccum* var. *tricoccum*), squirrel corn (*Dicentra canadensis*), millet grass (*Milium effusum*), dwarf scouring-rush (*Equisetum scirpoides*), and white-tinged sedge (*Carex albicans* var. *albicans*), which are state watch; and swamp buttercup (*Ranunculus caricetorum*), which is state indeterminate. Goldie's fern, Canada violet, pale jewelweed, northern wild licorice, wild leek, millet grass, squirrel corn, and dwarf scouring-rush are normally found in forested habitats, while swamp buttercup and white-tinged sedge occur in both open and wooded areas. Also occurring in this segment of the Project area are an exemplary *Moderate-gradient sandy-cobbly riverbank system*, and six rare natural community types: *Northern hardwood seepage forest*, *Rich mesic forest*, *Northern white cedar – balsam fir swamp*, *Lowland spruce-fir forest*, *Northern hardwood – black ash conifer swamp*, and *Boulder-cobble river channel*. One *Northern hardwood seepage forest* and the three *Northern white cedar – balsam fir swamps* are potentially exemplary. Seven state watch species were observed within the potentially exemplary *Northern hardwood seepage forest* community. Further discussion of special-status plants and exemplary natural communities can be found in the *Rare, Threatened, and Endangered Plants and Exemplary Natural Communities* report prepared by Normandeau and dated October 2015.

Invasive plant species (as defined and listed in the New Hampshire Prohibited Invasive Plant Species Rules, Agr 3800) were rarely encountered within the proposed ROW in this section of the Project. Two invasive species were observed in the forested areas subject to timber management: coltsfoot and reed canary grass (*Phalaris arundinacea*). Other weedy non-native species observed in these areas included helleborine (*Epipactis helleborine*), hemp-nettle (*Galeopsis tetrahit*), common plantain, and common self-heal (*Prunella vulgaris*). The invasive coltsfoot, reed canary grass, and forget-me-not (*Myosotis scorpioides*) were observed along the banks of the Connecticut River in the vicinity of the proposed underground cable section of the Project area. The weedy wall hawkweed (*Hieracium murorum*) was observed on transition area properties in Pittsburg and Clarksville. Japanese knotweed (*Fallopia japonica*), reed canary grass, and goutweed (*Aegopodium podagraria*) were observed along the proposed underground section in Clarksville and Stewartstown.

3.2 Existing Transmission Line ROW in Dummer to Whitefield Substation (Section N2)

3.2.1 Vegetation in the Project Vicinity

From this section south, the proposed Project occurs within an existing transmission line ROW. This portion of the Project is located within the Mahoosic-Rangely Lakes ecoregion subsection (Figure A-2). Topography ranges from 925 feet above msl by Otter Brook in Lancaster to 1,655 feet above msl on a ridgeline in Dummer, south of Dummer Hill. The ROW crosses areas with calcium-rich bedrock in Northumberland, Lancaster, and Whitefield (Figure A-3). Like the section to the north, till is common in surface deposits and the matrix forest communities are lowland spruce-fir forest and northern hardwood-conifer forests (Table 2, Figure A-5).

The lowland spruce-fir and northern hardwood-conifer forests dominate the flat to sloping uplands, and swamps, peatlands, marshes, and ponds occur commonly in low, wet areas. Outwash and ice-contact deposits (eskers, kames) fill low, flat valley-bottom areas dominated by upland conifer forests or wetlands. Shallow to deep rocky glacial till deposits cover the slopes of small to large hills and lower reaches of nearby mountains.

Peatlands in this section are generally larger and more abundant than elsewhere within the Project area. Rocky ridges, cliffs, and talus are infrequent, but some occur on small mountains within one to two (1–2) miles of the corridor, such as Cape Horn in Northumberland. Floodplain forests occur in the vicinity of the Project area in Stark by the Upper Ammonoosuc River and Phillip Brook and in Lancaster by the Israel River. Rare plant species in this area occur in association with rich mesic forests and northern white cedar-balsam fir swamps.

Table 2. Dominant and Characteristic Plant Communities, Dummer to Whitefield Substation

Natural Communities and Rank*	Corresponding Wildlife Action (WAP) Plan Habitat Types
Dominant/Matrix	

Natural Communities and Rank*	Corresponding Wildlife Action (WAP) Plan Habitat Types
Acadian Spruce-Fir Forests Lowland spruce-fir forest/swamp system (S3) Lowland spruce-fir forest (S3)	Lowland Spruce-Fir Forest
Laurentian Mixed Forests Northern hardwood-conifer forest system (S5) Sugar maple-beech-yellow birch forest (S5) Northern hardwood-spruce-fir forest (S4) Semi-rich mesic sugar maple forest (S3S4)	Northern Hardwood-Conifer Forest
Characteristic Patch	
Laurentian Mixed Forests Rich mesic forest system (S2S3) Rich mesic forest (S3)	Northern Hardwood-Conifer Forest No corresponding WAP habitat type
Rocky Ground Montane cliff (S3S4), rocky ridge (S3S4), and talus (S3) systems Red pine rocky ridge (S2) Rich north-temperate talus/rocky woods system (S2S3)	Cliff, Rocky Ridge, Talus
Peatlands Medium level fen system (S3S4) Sweet gale-meadowsweet-tussock sedge fen (S4) Wire sedge fen (S3) Alder wooded fen (S3S4) Poor level fen/bog system (S3) Leatherleaf-black spruce bog (S3) *Sphagnum rubellum*-small cranberry moss carpet (S3)	Peatlands
Swamps Near-boreal minerotrophic swamp system (S2S3) Northern white cedar-balsam fir swamp (S2) Northern hardwood-black ash-conifer swamp (S2S3) Black spruce peat swamp system (S3) Black spruce swamp (S3) Larch-mixed conifer swamp (S3) *Circumneutral hardwood forest seep* (S3)	No direct corresponding WAP habitat type (embedded within various forest habitats, and Peatlands)
Marshes Emergent marsh-shrub swamp system (S5) Mixed tall graminoid-scrub-shrub marsh (S4S5) Tall graminoid meadow marsh (S4) Emergent marsh (S5) Cattail marsh (S4) Aquatic bed (S4S5)	Marsh and Shrub Wetlands

Natural Communities and Rank*	Corresponding Wildlife Action (WAP) Plan Habitat Types
River Channels and Floodplains High-, moderate-, and low-gradient river channel systems (S3, S3S4, and S3S4, respectively) Floodplain forest systems (S2 to S3)	No corresponding WAP habitat (partially included in Floodplain Forest habitat) Floodplain forest

*see Appendix C for rank codes and descriptions

3.2.2 Vegetation within the Project Area

Upland sites in the Project area contain mostly tree saplings, shrubs and herbs of the surrounding forests and open habitats native to this part of the state. Common species include red maple, balsam fir, willows (*Salix* spp.), paper birch, quaking aspen, pin cherry, highbush blackberry, meadowsweet (*Spiraea alba* var. *latifolia*), red raspberry, bracken, pearly everlasting (*Anaphalis margaritacea*), eyebright (*Euphrasia americana*), hay-scented fern, spreading dogbane (*Apocynum androsaemifolium*), goldenrods (*Solidago* spp. and *Euthamia graminifolia*), broom sedge (*Carex scoparia*), strawberry (*Fragaria vesca*), yarrow (*Achillea millefolium*), fireweed, cinquefoils (*Potentilla* spp.), sweet vernal grass (*Anthoxanthum odoratum*), and common Timothy (*Phleum pratense*).

Peatlands in this section are vegetated with peat mosses (*Sphagnum* spp.), cottongrass (*Eriophorum virginicum* and *E. spissum*), Labrador tea (*Rhododendron groenlandicum*), leatherleaf (*Chamaedaphne calyculata*), black spruce, larch, mountain holly (*Nemopanthus mucronatus*), wild raisin (*Viburnum nudum* var. *cassinoides*), round-leaved sundew (*Drosera rotundifolia*), boreal bog sedge (*Carex magellanica*), few-flowered sedge (*Carex pauciflora*), silvery sedge (*Carex canescens*), delicate sedge (*Carex leptalea*), crested wood fern (*Dryopteris cristata*), Robbins' ragwort (*Packera schweinitziana*), purple avens (*Geum rivale*), small green woodland orchid (*Platanthera clavellata*), ragged-fringed orchid (*Platanthera lacera*), small purple-fringed orchid (*Platanthera psycodes*), beaked sedge (*Carex rostrata*), wild calla (*Calla palustris*), three-leaved false Solomon's seal (*Maianthemum trifolia*), three-way sedge (*Dulichium arundinaceum*), white beaksedge (*Rhynchospora alba*), pitcher plant (*Sarracenia purpurea*), small cranberry (*Vaccinium oxycoccos*), little club-spur bog orchid (*Platanthera clavellata*), black chokeberry (*Aronia melanocarpa*), bog laurel (*Kalmia polifolia*), sheep laurel (*Kalmia angustifolia*), rhodora (*Rhododendron canadense*), and creeping snowberry.

Rich fen-like conditions were observed in some areas indicated by plants such as yellow sedge (*Carex flava*), porcupine sedge (*Carex hystericina*), and the state indeterminate narrowleaf sedge (*Carex grisea*). The rich fen-like areas are generally small and do not represent natural communities.

Other species observed in wetlands in this section of the Project area include red maple, balsam fir, willows, gray birch, speckled alder, northern white cedar, meadowsweet, steeplebush (*Spiraea tomentosa*), wild raisin, bluejoint, nodding sedge, bulrushes, spotted Joe-pye weed, rattlesnake mannagrass, common soft rush (*Juncus effusus*), Canada rush (*Juncus canadensis*),

asters (*Symphyotrichum* spp. and *Doellingeria umbellata*), marsh fern (*Thelypteris palustris* var. *pubescens*), sensitive fern, interrupted fern (*Osmunda claytoniana*), cinnamon fern (*Osmunda cinnamomea*), ostrich fern, New York fern, common cattail, sallow sedge, common fox sedge (*Carex vulpinoides*), awl-fruited sedge (*Carex stipata*), woolly-fruited sedge (*Carex lasiocarpa*), eastern rough sedge, tussuck sedge (*Carex stricta*), prickly sedge (*Carex echinata*), bottle-shaped sedge (*Carex utriculata*), lesser purple-fringed bog orchid (*Platanthera psycodes*), arrow-leaf tearthumb, jewelweed, swamp candles (*Lysimachia terrestris*), fowl mannagrass, bluejoint, water pennywort (*Hydrocotyle americana*), nodding ladies'-tresses (*Spiranthes cernua*), creeping bentgrass (*Agrostis stolonifera*), water avens (*Geum rivale*), blueflag iris (*Iris versicolor*), and narrow-leaved gentian (*Gentiana linearis*).

Narrowleaf sedge was the only rare plant species observed in this section of the Project. Invasive plants were infrequently encountered and included reed canary grass, glossy buckthorn (*Frangula alnus*), forget-me-not, and purple loosestrife (*Lythrum salicaria*).

3.3 Whitefield Substation to Transition Station 5 in Bethlehem (Section C1)

3.3.1 Vegetation in the Project Vicinity

The Whitefield Substation to Bethlehem Transition Station section of the Project occurs within two ecoregion subsections: Mahoosic-Rangely Lakes and Vermont Piedmont (Figure A-2). These are mountainous, cold-climate regions with higher mountains occurring in the Mahoosic-Rangely Lakes subsection, with the two subsections receiving about equal amounts of precipitation (Table B-2). Many rivers and streams are located in the vicinity of the Project area in this section, including the Ammonoosuc River, Baker Brook, Black Brook, and Chase Brook. Elevations range from 860 feet above msl, by an unnamed stream in Dalton, to 1,300 feet above msl in Whitefield and Bethleham along the upper slopes of an unnamed hill. Northern species with centers of distribution in boreal Canada and adjacent portions of the United States predominate, including balsam fir, red spruce, paper birch, and heartleaf birch. Sugar maple and American beech, which have more temperate distributions centered in eastern North America, are also common. Northern hardwood-conifer forests and lowland spruce-fir forests are matrix communities in most of this area (Table 3, Figure A-6). Patch communities include floodplain forests (along the Ammonoosuc River in Bethlehem), wet meadow and shrub wetlands, swamps, a number of small peatlands, and hemlock-hardwood-pine forest systems.

This segment of the Project area does not cross any mapped areas of calcium-rich bedrock, although areas with calcium-rich bedrock are somewhat common elsewhere within the Vermont Piedmont ecoregion subsection (Figure A-3). Many rare plants in the Mahoosic-Rangely Lakes and Vermont Piedmont subsections are associated with calcium-rich cliff, talus slope, swamp, fen, or aquatic natural communities and habitats. Exemplary natural communities occurring in nearby areas include a *Northern white cedar balsam fir swamp* and a *Northern white cedar seepage forest* (both in Whitefield).

Table 3. Dominant and Characteristic Plant Communities, Whitefield Substation to Transition Station 5 in Bethlehem

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Dominant/Matrix	
Laurentian Mixed Forests Northern hardwood-conifer forest system (S5) Sugar maple-beech-yellow birch forest (S5) Northern hardwood-spruce-fir forest (S4) Semi-rich mesic sugar maple forest (S3S4)	Northern Hardwood-Conifer Forest
Acadian Spruce-Fir Forests Lowland spruce-fir forest/swamp system (S3) Lowland spruce-fir forest (S3)	Lowland Spruce-Fir Forest
Characteristic Patch	
Laurentian Mixed Forests Rich mesic forest system (S2S3) Rich mesic forest (S3) Hemlock-hardwood-pine forest system (S5)	Northern Hardwood-Conifer Forest No corresponding WAP habitat type Hemlock-Hardwood-Pine Forest
Acadian Spruce-Fir Forests Lowland spruce-fir forest/swamp system (S3) Lowland spruce-fir forest (S3)	Lowland Spruce-Fir Forest (a patch community within the White Mountains)
Peatlands Medium level fen system (S3S4) Sweet gale-meadowsweet-tussock sedge fen (S4) Alder wooded fen (S3S4) Poor level fen/bog system (S3) Leatherleaf-black spruce bog (S3) Sphagnum rubellum-small cranberry moss carpet (S3)	Peatlands
Swamps Northern white cedar-balsam fir swamp (S2) Northern white cedar seepage forest (S2) Northern hardwood-black ash-conifer swamp (S2S3) Red spruce swamp (S3) Black spruce peat swamp system (S3) Black spruce swamp (S3)	No direct corresponding WAP habitat type (embedded within various forest habitats, and Peatlands)
Marshes Emergent marsh-shrub swamp system (S5) Mixed tall graminoid-scrub-shrub marsh (S4S5) Tall graminoid meadow marsh (S4) Emergent marsh (S5) Cattail marsh (S4) Aquatic bed (S4S5)	Marsh and Shrub Wetlands

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
River Channels and Floodplains High- and moderate-gradient river channel systems (S3 and S3S4, respectively) Herbaceous riverbank/floodplain (S4)	No corresponding WAP habitat (partially included in Floodplain Forest habitat)

*see Appendix C for rank codes and descriptions

3.3.2 Vegetation within the Project Area

Upland portions of the Project area contain common native plants, including early successional trees and shrubs, and disturbance-tolerant herbaceous species. Common species include birches (*Betula* spp.), balsam fir, quaking aspen, red spruce, raspberries and blackberries (*Rubus* spp.), hay-scented fern, meadowsweet, bracken, broom sedge, and fern allies (of the family *Lycopodiaceae*).

Species encountered in shrub, marsh, and peatland areas were similar to those described for the Dummer to Whitefield Substation section. Wetland plants observed include gray birch, meadowsweet, steeplebush, speckled alder, nodding sedge, prickly sedge, bottle-shaped sedge, sallow sedge, tussock sedge, swamp candles, fowl mannagrass, Labrador tea, sweet gale (*Myrica gale*), flat-topped goldenrod (*Euthamia graminifolia*), bristly bog blackberry (*Rubus setosus*), and rough-stemmed goldenrod (*Solidago rugosa*). No state threatened, endangered, watch, or indeterminate plant species or exemplary natural communities were observed within this segment of the Project area.

High to moderate gradient rocky riverbanks are occasional in the Project area along major brooks. Common species in these habitats include flat-topped white aster, twisted sedge (*Carex torta*), sallow sedge, fowl mannagrass, soft rush (*Juncus effusus*), northern short husk grass (*Brachyelytrum septentrionale*), and strawberry. No invasive plant species were observed during RTE plant surveys in this segement.

3.4 Transition Station 5 in Bethlehem to Transition Station 6 in Bridgewater (Section UG1)

3.4.1 Vegetation in the Project Vicinity

The segment of the Project area between the transition stations in Bethlehem and Bridgewater will be constructed underground within the road ROWs of Routes 302, 18, 116, 112, and 3. This segment crosses the White Mountain National Forest via the ROWs of Routes 116 and 112. It begins in the Mahoosic-Rangely Lakes subsection in Bethlehem. Portions of this segment located in Sugar Hill, Franconia, and the northern part of Easton are located within the Vermont Piedmont ecoregion subsection; those in south Easton, Woodstock, Thornton and most of Campton are in the White Mountain subsection; and areas of this segment in southwest Easton, south Campton, Plymouth and northern Bridgewater are in the Sunapee Uplands subsection (Figure A-2). The Sunapee Uplands ecoregion subsection has a slightly warmer climate than the

other two subsections, the effect of both diminished latitude and elevation (Table B-2). Northern hardwood-conifer and lowland spruce-fir forests are prevalent to the north, while hemlock-hardwood pine forests become increasingly more common moving south through this segment (Table 4, Figure A-7). Hemlock-hardwood-pine forest occurs on both sandy terrace deposits and glacial till surface deposits. The relative abundance of these species varies with site condition and land use history. In general, however, pine is often more abundant on coarse terrace and outwash soils, hemlock on coarse or rocky soils, and hardwoods on finer textured soils. Eastern hemlock, red oak (*Quercus rubra*), American beech, and white pine (*Pinus strobus*) are notably more abundant in the Pemigewasset River valley than to the north and in the mountains. These species and many others of the region have temperate distributions centered in eastern North America south of Canada. Northern hardwoods (sugar maple, yellow birch, and paper birch) and northern conifers (red spruce and balsam fir) occur in the northern portion of this section and are occasional southward in cold valley bottom settings though, in general, diminish in prevalence with increased distance from the mountains.

Patch natural communities in this segment include high elevation spruce-fir forest systems, which occur near Route 112 in Woodstock and farther away in other areas in the White Mountains, and scattered peatlands, swamps, wet meadows, and shrub wetlands (Figure A-7, Table 4). In addition, rocky ridges, cliffs and talus occur in the White Mountains near (but outside of) the Project area, including at Kinsman's Notch near Route 112 in Woodstock, Russell Crag in Woodstock and Thornton, and Mt. Moosilauke in Benton. Also, river channel and floodplain communities are common along the Pemigewasset River, which flows in proximity to much of this segment (from Woodstock south). Swamps and marshes may be less abundant here than in other sections due the prevalence of coarse, well-drained soils that occur on high terraces along the river. Elevations in this segment range from 460 feet above msl, near the Pemigewasset River in Plymouth, to 1,880 feet above msl where Route 112 crosses Kinsman's Notch in Woodstock.

The Project route in this segment passes through mapped areas of calcium-rich bedrock in the towns of Sugar Hill, Franconia, Campton, and Plymouth (Figure A-3). These bedrock areas are generally buried beneath deep outwash deposits or otherwise do not express themselves in surface soil, as evidenced by the lack of calciphile vegetation observed in this area. Rare plants in the vicinity of this section of corridor are mostly associated with wetlands and aquatic and riverside natural communities and habitats.

Table 4. Dominant and Characteristic Plant Communities, Transition Station 5 in Bethlehem to Transition Station 6 in Bridgewater

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Dominant/Matrix	

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Laurentian Mixed Forests Hemlock-hardwood-pine forest system (S5) Hemlock-oak-northern hardwood forest (S4) Hemlock-beech-oak-pine forest (S5) Northern hardwood-conifer forest system (S5) Sugar maple-beech-yellow birch forest (S5)	Hemlock-Hardwood-Pine Forest Northern Hardwood-Conifer Forest
Acadian Spruce-Fir Forests Lowland spruce-fir forest (S3)	Lowland Spruce-Fir Forest
Characteristic Patch	
Laurentian Mixed Forests Dry red oak-white pine forest (S3S4) Hemlock forest (S4) Hemlock-white pine forest (S4) Semi-rich mesic sugar maple forest (S3S4) Rich mesic forest (S3)	Inclusions in Hemlock-Hardwood-Pine Forest
Acadian Spruce-Fir Forests Lowland spruce-fir forest (S3) High elevation spruce-fir forest system (S4) High elevation spruce-fir forest (S4)	Lowland Spruce-Fir Forest High Elevation Spruce-Fir Forest
Rocky Ground Montane cliff (S3S4), Rocky ridge (S3S4) and Talus (S3) systems	Cliff, Rocky Ridge, Talus
Peatlands Medium level fen system (S3S4) Poor level fen/bog system (S3) Sweet gale-meadowsweet-tussock sedge fen (S4) Highbush blueberry-sweet gale-meadowsweet shrub thicket (S4)	Peatlands
Swamps Temperate Minerotrophic swamp system (S4) Red maple-sensitive fern forest (S3S4) Temperate peat swamp system (S4?) Red maple-Sphagnum basin swamp (S4) Black gum-red maple basin swamp (S2S3)	No direct corresponding WAP habitat type (embedded within various forest habitats, and Peatlands)
Marshes Emergent marsh-shrub swamp system (S5) Mixed tall graminoid-scrub-shrub marsh (S4S5) Tall graminoid meadow marsh (S4) Emergent marsh (S5) Cattail marsh (S4) Aquatic bed (S4S5)	Marsh and Shrub Wetlands

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
River Channels and Floodplains High-, moderate-and low-gradient river channel systems (S3, S3S4, and S3S4, respectively) Dry river bluff (S3) Herbaceous riverbank/floodplain (S4) Mixed alluvial shrubland (S4) Dwarf cherry river channel (S2) Major river silver maple floodplain forest system (S2) Silver maple-false nettle-sensitive fern floodplain forest (S2) Sugar maple-silver maple-white ash floodplain forest (S1S2)	No corresponding WAP habitat (partially included in Floodplain Forest habitat) Floodplain Forest

*see Appendix C for rank codes and descriptions

3.4.2 Vegetation within the Project Area

This segment of the Project is limited to the area within 33 feet of the centerline of Routes 302, 18, 116, 112, and 3. Vegetation in this segment of the Project is restricted to unpaved areas within this ROW. These paved roads, from center line to outer edge, are approximately 12 feet wide with sandy shoulders that are generally 1 to 2 feet wide. Residential and commercial development is present along many portions of these routes, including along most of Route 3. In some locations the Project area extends slightly into the treeline along the edge of the road; in other areas there are no trees or saplings within the ROW. A mixture of native upland and wetland species and common introduced species were observed. Species occurring in the uplands include gray birch, quaking aspen, paper birch, eastern hemlock, white pine, sugar maple, balsam fir, red spruce, striped maple, American beech, red oak, yarrow, field cinquefoil, hay-scented fern, bracken, common ragweed (*Ambrosia artemisiifolia*), rabbit-foot clover (*Trifolium arvense*), poverty grass (*Danthonia spicata*), little bluestem (*Schizachyrium scoparium*), and grasses associated with lawns. Wetland species include red maple, gray birch, yellow birch, eastern hemlock, balsam fir, larch, speckled alder, meadowsweet, swamp dewberry (*Rubus hispidus*), rough-stemmed goldenrod, sensitive fern, asters, soft rush, woolgrass (*Scirpus cyperinus*), rattlesnake grasses (*Glyceria* spp.), fringed sedge (*Carex crinita*), and common cattail.

Invasive plant species in this segment include reed canary grass, Japanese knotweed, and burning bush (*Euonymus alatus*). Reed canary grass was observed in a few wetlands in this section. Extensive infestations of Japanese knotweed were encountered along Route 3 in Plymouth. Burning bush was also observed along Route 3, although mainly as an ornamental shrub. No state threatened, endangered, watch, or indeterminate plant species were observed within this segment of the Project area. An exemplary *High-gradient rocky riverbank system* occurs in the Project area in Easton.

3.5 Transition Station 6 in Bridgewater to Franklin Converter Terminal (Section C2)

3.5.1 Vegetation in the Project Vicinity

This segment occurs mostly within the Sunapee Uplands ecoregion subsection and transitions into the Sebago-Ossipee Hills and Plains subsection in the southern portion of the segment in Franklin (Figure A-2). Being closer to the coast, the Sebago-Ossipee Hills and Plain ecoregion subsection has a milder climate and longer growing season than the Sunapee Uplands subsection (Table B-2). Hemlock-hardwood pine forests are dominant in this segment (Table 5, Figure A-8). Some small patches of northern hardwood-conifer forest and lowland spruce-fir forests still occur but are relatively uncommon compared to farther north. Most of this segment is located near the Pemigewasset River. Consequently, river channel and floodplain natural communities are common. Almost all exemplary natural communities occurring in the vicinity of this Project segment are associated with rivers. Other natural communities include wet meadow/shrub wetlands, swamps, and small, sparsely scattered peatlands.

Mapped areas of calcium-rich bedrock occur along this Project segment in New Hampton and Franklin (Figure A-3). However, based on field observations of vegetation in the Project ROW at these locations, surface soils are apparently not influenced by calcium-rich bedrock in these areas. Elevations range from about 340 feet above msl by the Pemigewasset River in Hill to about 1,000 feet above sea level along a hill in Bristol.

Table 5. Dominant and Characteristic Plant Communities, Transition Station 6 in Bridgewater to Franklin Converter Terminal

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Dominant/Matrix	
Laurentian Mixed Forests Hemlock-hardwood-pine forest system (S5) Hemlock-oak-northern hardwood forest (S4) Hemlock-beech-oak-pine forest (S5)	Hemlock-Hardwood-Pine Forest
Characteristic Patch	
Laurentian Mixed Forests Northern hardwood-conifer forest system (S5) Sugar maple-beech-yellow birch forest (S5) Dry red oak-white pine forest (S3S4) Hemlock forest (S4) Hemlock-white pine forest (S4) Semi-rich mesic sugar maple forest (S3S4) Rich mesic forest (S3)	Northern Hardwood-Conifer Forest Inclusions in Hemlock-Hardwood-Pine Forest
Acadian Spruce-Fir Forests Lowland spruce-fir forest (S3)	Lowland Spruce-Fir Forest

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Peatlands Medium level fen system (S3S4) Sweet gale-meadowsweet-tussock sedge fen (S4) Highbush blueberry-sweet gale-meadowsweet shrub thicket (S4)	Peatlands
Swamps Temperate Minerotrophic swamp system (S4) Red maple-sensitive fern forest (S3S4) Temperate peat swamp system (S4?) Red maple-Sphagnum basin swamp (S4) Black gum-red maple basin swamp (S2S3)	No direct corresponding WAP habitat type (embedded within various forest habitats, and Peatlands)
Marshes Emergent marsh-shrub swamp system (S5) Mixed tall graminoid-scrub-shrub marsh (S4S5) Tall graminoid meadow marsh (S4) Emergent marsh (S5) Cattail marsh (S4) Aquatic bed (S4S5)	Marsh and Shrub Wetlands
River Channels and Floodplains High-, moderate-, and low-gradient river channel systems (S3, S3S4, and S3S4, respectively) Dry river bluff (S3) Herbaceous riverbank/floodplain (S4) Mixed alluvial shrubland (S4) Dwarf cherry river channel (S2) Major river silver maple floodplain forest system (S2) Silver maple-false nettle-sensitive fern floodplain forest (S2) Sugar maple-silver maple-white ash floodplain forest (S1S2)	No corresponding WAP habitat (partially included in Floodplain Forest habitat) Floodplain Forest

*see Appendix C for rank codes and descriptions

3.5.2 Vegetation within the Project Area

Vegetation observed in uplands within this portion of the Project area is demonstrably less northern in nature. Common native species include red oak, blueberries (*Vaccinium* spp.), blackberries and raspberries, whorled loosestrife (*Lysimachia quadrifolia*), bracken, spreading dogbane, hay-scented fern, little bluestem, and common hairgrass (*Deschampsia flexuosa*). Shrubs include common juniper (*Juniperus communis* var. *depressa*) and sweet fern (*Comptonia peregrina*).

Non-native pasture grasses and herbs are common, including sweet vernal grass, orchard grass (*Dactylis glomerata*), common Timothy, Kentucky bluegrass (*Poa pratensis*), sheep's fescue (*Festuca ovina*), red fescue (*Festuca rubra*), awnless brome grass (*Bromus inermis*), and purple milkwort (*Polygala sanguinea*).

Wetland species observed within this segment include speckled alder, red maple, gray birch, meadowsweet, winterberry (*Ilex verticillata*), crested wood fern, cinnamon fern, interrupted fern, sensitive fern, northern lady fern, Robbins' ragwort, dark green bulrush (*Scirpus atrovirens*), and common cattail. Invasive plant species occurring within this section of the Project include glossy buckthorn, reed canary grass, autumn olive (*Elaeagnus umbellata*), and honeysuckles (*Lonicera* spp.). No state threatened, endangered, watch, or indeterminate plant species or exemplary natural communities were observed within this segment of the Project area.

3.6 Franklin Converter Terminal to Deerfield Substation (Section S1)

3.6.1 Vegetation in the Project Vicinity

The climate continues to be moderate on this section of corridor compared to sections farther north. South of Franklin, the Project enters the Merrimack River valley, part of the Gulf of Maine Coastal Plain subsection (Figure A-2), crossing extensive sand plains in the Concord vicinity, then climbs across low hills comprised of glacial till to Deerfield. Elevations range from 260 feet above msl along the Merrimack River to 340 feet above msl across much of the Merrimack River sand plain centered around Concord, with hills ranging between 400 and 800 feet between Pembroke and Deerfield.

The warmer climate in this region, in combination with frequent historical fires associated with the Merrimack River valley sand plain, has demonstrative effects on the vegetation. Numerous species, absent farther north, are present in this area including pitch pine (*Pinus rigida*), scrub oak (*Quercus ilicifolia*), black oak (*Quercus velutina*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), and many others. These species have geographic distributions centered farther south in the Appalachian Mountain or coastal plain regions, reaching their northern extent in southern New Hampshire or adjacent southern Maine.

Hemlock-hardwood-pine forest is the dominant matrix forest type (Table 6, Figure A-9) on glacial till uplands and sand plains with no fire history. Various types of Appalachian oak and pine forests occur as small to large patches on low elevation sand plains and on warm, south-facing hillsides. Pitch pine-scrub oak woodlands dominate the sand plains of the Merrimack River, although development and fire suppression has initiated a progressive shift to compositions with more fire-intolerant species such as white pine, birches, and red maple.

Swamps, marshes, and small peatlands are occasional on the sand plains, but more abundant on the bedrock-controlled terrain eastward (from Pembroke to Deerfield). Rocky ridges, cliffs, and talus slopes are rare along this section of corridor. Peatlands are occasional. Floodplain forests occur along the Merrimack River between Franklin and Concord, along the Soucook River by the Concord/Pembroke border, by the Suncook River in Allenstown, and in association with Back Creek and Bean River near the Deerfield Substation (Figure A-9).

Calcium-rich bedrock (calc-silicates) is present in the Concord and Allenstown vicinity (Figure A-3). Much of this rock is buried deep beneath outwash deposits and has no influence on surface soils and plant communities. Historical botanical records in these towns contain a paucity of rare plants indicative of rich, fertile soils along this section of the Project area. Rare

plants in these areas are mostly associated with Appalachian oak and pine forests and openings (including pitch pine-scrub oak woodlands), wetlands, and aquatic habitats.

Table 6. Dominant and Characteristic Plant Communities, Franklin Converter Terminal to Deerfield Substation

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Dominant/Matrix	
Laurentian Mixed Forests Hemlock-hardwood-pine forest system (S5) Hemlock-beech-oak-pine forest (S5)	Hemlock-Hardwood-Pine Forest
Characteristic Patch	
Appalachian Oak and Pine Forests Appalachian oak-pine forest system (S3) Dry Appalachian oak forest (S3) Semi-rich oak-sugar maple forest (S2S3) Pitch pine sand plain system Pitch pine-scrub oak woodland (S1S2, G2) Laurentian Mixed Forests Dry red oak-white pine forest (S3S4) Hemlock forest (S4) Hemlock-white pine forest (S4)	Appalachian Oak Pine Forest Pine Barrens Inclusions in Hemlock-Hardwood-Pine Forest
Peatlands Medium level fen system (S3S4) Sweet gale-meadowsweet-tussock sedge fen (S4) Highbush blueberry-sweet gale-meadowsweet shrub thicket (S4) Winterberry-cinnamon fern wooded fen (S4) Temperate peat swamp system	Peatlands
Swamps Temperate Minerotrophic swamp system (S4) Red maple-sensitive fern forest (S3S4) Red maple-Sphagnum basin swamp (S4) Black gum-red maple basin swamp (S2S3)	No direct corresponding WAP habitat type (embedded within various forest habitats, and Peatlands)
Marshes Emergent marsh-shrub swamp system (S5) Mixed tall graminoid-scrub-shrub marsh (S4S5) Tall graminoid meadow marsh (S4) Emergent marsh (S5) Cattail marsh (S4) Aquatic bed (S4S5) Drainage marsh-shrub swamp system	Marsh and Shrub Wetlands

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
River Channels and Floodplains Low-gradient river channel systems (S3S4) Dry river bluff (S3) Riverwash plain and dunes (S1) Major river silver maple floodplain forest system (S2) Silver maple-false nettle-sensitive fern floodplain forest (S2)	No corresponding WAP habitat (partially included in Floodplain Forest habitat) Floodplain Forest

*see Appendix C for rank codes and descriptions

3.6.2 Vegetation within the Project Area

Vegetation in this section of the Project area is similar to that described for the North Woodstock Substation to Franklin Converter Terminal section. The major difference is the appearance of southern Appalachian oak and pine region species, particularly in the dry sand plain habitats in Canterbury, Concord, and Pembroke. Notable species in this section of the Project area (absent or sparse farther north) include pitch pine, scrub oak, black oak, white oak, big bluestem (*Andropogon gerardii*), Canadian frostweed (*Helianthemum canadense*), bluecurls (*Trichostema dichotomum*), sand jointweed (*Polygonella articulata*), round-headed bush-clover (*Lespedeza capitata*), bastard toadflax (*Comandra umbellata*), late low blueberry, perennial umbrella sedge (*Cyperus lupulinus*), smooth crabgrass (*Digitaria ischaemum*), tumble grass (*Eragrostis spectabilis*), eastern New Jersey tea (*Ceanothus americanus*), numerous goldenrods, and panic grasses (*Dicanthelium* spp.). Several rare species occur along this section of ROW, including the state threatened wild lupine (*Lupinus perennis*); state endangered spiked needle grass (*Aristida longespica* var. *geniculata*), licorice goldenrod (*Solidago odora*), blunt-leaved milkweed (*Asclepias amplexicaulis*), and butterfly milkweed (*Asclepias tuberosa*); state watch toothed white-topped aster (*Seriocarpus asteroides*); and the state indeterminate branching needle grass (*Aristida basiramea*) and fall witchgrass (*Digitaria cognata*). All of these common and rare species occur most frequently in disturbed openings within the Project corridor resulting from wheeled vehicle use. Areas with little or no vehicular use tend to be dominated by little bluestem and woody plants, including various tree saplings (oaks, pines, birches), American hazelnut (*Corylus americana*), blueberries (*Vaccinium* spp.), and sweet fern.

Wetland vegetation is similar to the North Woodstock Substation to Franklin Converter Terminal section in terms of the common species observed. In general, wetlands are infrequent on the sand plains in the Canterbury/Concord vicinity. However, some disturbed, wet sandy areas are present where wetland sand plain species were observed. Species in these settings included lance-leaved violet (*Viola lanceolata*), one-flowered muhly (*Muhlenbergia uniflora*), needle beak sedge (*Rhynchospora capillacea*), mud rush (*Juncus pelocarpus*), small-flowered gerardia (*Agalinis paupercula*), hair sedge (*Bulbostylis capillaris*), and rough bentgrass (*Agrostis scabra*).

Invasive, non-native species in this section include purple loosestrife, reed canary grass, autumn olive, honeysuckles, glossy buckthorn, oriental bittersweet (*Celastrus orbiculatus*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), burning bush, and leafy spurge (*Euphorbia esula*).

3.7 Deerfield Substation to Scobie Pond Substation—Alternating Current (AC) System Support Project

3.7.1 Vegetation in the Project Vicinity

This section of the Project is located within the Gulf of Maine Coastal Plain (Figure A-2). Elevations in the vicinity range from approximately 670 feet above msl along the slopes west of Pawtuckaway State Park in Deerfield to approximately 210 feet above msl by North Branch River in Raymond. Like the Franklin Converter Terminal to Deerfield Substation section, this section is characterized by a more moderate climate compared to that of the more northern portions of the Project; a consequence of its southerly location, proximity to the coast, and flat relief. Calcium-rich bedrock underlies a large portion of this section (Figure A-3) with surface deposits of till in much of this area. Calcium-rich conditions are likely present in surface soils in some areas in the vicinity of the Project area as evidenced by the natural community and rare plant element occurrences mapped in the vicinity (i.e., rich and semi-rich forest communities and plant species indicative of calcium-rich conditions). Hemlock-hardwood-pine forest and Appalachian oak and pine forest are the most common forest types (Table 7, Figure A-10). Rocky ridges, cliffs, and talus occur at a few locations near the Project area in Deerfield/Nottingham (Pawtuckaway Mountains) and in Raymond (Dumplingtown Hill and vicinity). Floodplain forest occurs in association with the Lamprey River in Deerfield and Raymond and by the North Branch River in Raymond (Figure A-10). Rare plant species in the vicinity of this section are mostly associated with rich forests and Appalachian oak and pine forests and openings.

Table 7. Dominant and Characteristic Plant Communities, Deerfield Substation to Scobie Pond Substation

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Dominant/Matrix	
Laurentian Mixed Forests Hemlock-hardwood-pine forest system (S5) Hemlock-beech-oak-pine forest (S5)	Hemlock-Hardwood-Pine Forest
Appalachian Oak and Pine Forests Appalachian oak-pine forest system (S3) Dry Appalachian oak forest (S3)	Appalachian Oak Pine Forest

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types
Characteristic Patch	
<u>Appalachian Oak and Pine Forests</u> Rich Appalachian oak rocky woods system Rich Appalachian oak rocky woods (S2) Appalachian oak-pine rocky ridge (S3) Chestnut oak forest/woodland (S1S2) Red oak-ironwood-Pennsylvania sedge woodland (S2) Semi-rich oak-sugar maple forest (S2S3) Pitch pine sand plain system Pitch pine-scrub oak woodland (S1S2, G2) <u>Laurentian Mixed Forests</u> Dry red oak-white pine forest (S3S4) Hemlock forest (S4) Hemlock-white pine forest (S4) Rich mesic forest (S3)	Inclusions in Appalachian Oak Pine Forest Inclusions in Hemlock-Hardwood-Pine Forest No direct corresponding WAP habitat
<u>Rocky Ground</u> Temperate ridge-cliff talus system Temperate acidic cliff (S4) Red oak-black birch wooded talus (S3S4)	Cliff, Rocky Ridge, Talus
<u>Peatlands</u> Poor level fen/bog system (S3) Medium level fen system (S3S4) Temperate peat swamp system (S4?)	Peatlands
<u>Swamps</u> Temperate Minerotrophic swamp system (S4) Red maple-sensitive fern forest (S3S4) Red maple-Sphagnum basin swamp (S4) Black gum-red maple basin swamp (S2S3)	No direct corresponding WAP habitat type (embedded within various forest habitats, and Peatlands)
<u>Marshes</u> Emergent marsh-shrub swamp system (S5) Mixed tall graminoid-scrub-shrub marsh (S4S5) Tall graminoid meadow marsh (S4) Emergent marsh (S5) Cattail marsh (S4) Aquatic bed (S4S5) Drainage marsh-shrub swamp system Herbaceous seepage marsh (S3)	Marsh and Shrub Wetlands
<u>River Channels and Floodplains</u> Low-gradient river channel systems (S3S4) Floodplain forest systems (S2 to S3)	No corresponding WAP habitat (partially included in Floodplain Forest habitat) Floodplain Forest

Natural Communities and Rank*	Corresponding Wildlife Action Plan (WAP) Habitat Types

*see Appendix C for rank codes and descriptions

3.7.2 Vegetation within the Project Area

Uplands in this section of the Project area include the following species: white pine, gray birch, white oak, red oak, black oak, scarlet oak (*Quercus coccinea*), scrub oak, pitch pine, quaking aspen, common juniper, staghorn sumac (*Rhus hirta*), winged sumac (*Rhus copallinum*), sweet fern, sassafras (*Sassafras albidum*), highbush blackberry, beaked hazelnut (*Corylus cornuta*), pin cherry, black cherry (*Prunus serotina*), bush-honeysuckle (*Diervilla lonicera*), sheep laurel, little bluestem, downy goldenrod (*Solidago puberula*), gray goldenrod (*Solidago nemoralis*), sand jointweed, panic grasses, tumble grass, round-headed bush-clover, bracken, wintergreen (*Gaultheria procumbens*), poverty grass, bluecurls, orange-grass, pinweed (*Lechea* spp.), blueberries, smooth crabgrass, sweet everlasting (*Pseudognathalium obtusifolium*), rabbit-foot clover, mugwort (*Artemesia vulgaris*), cinquefoils, hay-scented fern, and Canada mayflower.

Vegetation in wetlands includes red maple, gray birch, yellow birch, eastern hemlock, speckled alder, willows, meadowsweet, steeplebush, maleberry, highbush blueberry, grape (*Vitis* spp.), rough-stemmed goldenrod, Canada goldenrod (*Solidago canadensis*), New York fern, interrupted fern, sensitive fern, common cattail, flat-topped white aster, flat-topped goldenrod, cinnamon fern, royal fern, bristly dewberry, and bluejoint.

Rare plant species observed in this section of the Project include the state endangered spiked needle grass, hairy thoroughwort (*Eupatorium* cf. *pubescens*), licorice goldenrod, and two sensitive plant species; the state watch American chestnut (*Castanea dentata*) and early azalea (*Rhododendron prinophyllum*); and the state indeterminate branching needle grass.

A number of invasive species were observed within this section of the Project area including purple loosestrife, reed canary grass, burning bush, spotted knapweed (*Centauria stoebe*), autumn olive, glossy buckthorn, black locust (*Robinia pseudoacacia*), and honeysuckles.

4 Summary

The Project area between the U.S. border with Canada and the Scobie Pond Substation in Londonderry traverses a broad diversity of the state's physical features and natural vegetation. Differences in climate, bedrock geology, surface geology, soil texture and fertility levels, topography, historical wildfire, land use history, and numerous other factors significantly affect the distribution of plants and natural communities.

Forests cover approximately 80% of the state; the remainder comprises a diverse mosaic of smaller woodlands, wetlands, riparian areas, fields, and human development. Spruce-fir and northern hardwood forests dominate in the White Mountains and northward; mixes of hardwoods, hemlock, and white pine dominate in central areas; and pitch pine and oaks appear in forests in the southern section where they are locally abundant on the extensive sand plains of the Merrimack River valley.

The pattern illustrated by this shift in tree composition from north to south is mirrored by similar changes among shrubs and herbaceous species. Similar changes occur within other groups of natural communities, such as peatlands and swamps, from north to south. Natural community types also shift within each section with local changes in topography, bedrock type, and soil conditions.

Other coarse-scale patterns are evident across the Project area. Peatlands are large and common in the cold climate and flat terrain north of the White Mountains and generally smaller and less frequent to the south of the mountains. Marshes, shrub thickets, and forested swamps occur throughout. Rocky ground, cliffs, rocky ridges, and talus slopes occur infrequently and occupy a small proportion of the landscape in the immediate vicinity of the Project. Floodplain forests occur along the major rivers. Most of the rare species in natural communities occur in wetlands, aquatic habitats, nutrient-rich forests, or pine barrens.

The maintenance regime in the existing Eversource ROW and other activities that occur along the transmission corridor, including mowing or cutting as well as recreational activities that produce wheel tracks, produces an environment that favors species tolerant of or reliant on disturbance, open canopy, and sunny conditions. This is also true for Project areas occurring within road ROWs. Many native early successional forest trees, upland shrubs, and marsh shrubs and herbs occur in these settings within the Project area. The vegetation assemblages are least similar to natural communities in areas that would otherwise be forested; vegetation assemblages are most similar to corresponding natural communities in portions of the Project where trees are naturally low in abundance, such as in open wetlands.

The vast majority of vegetation in the Project area consists of native species or non-invasive, non-native species (such as common pasture grasses). Native species predominate in the northern section of the Project that is currently forested. Non-native, invasive species are generally present at low frequencies, especially in the northern portion of the Project; they are most frequent and abundant near roads in developed areas and agricultural fields. Most of the

documented rare plant species within the existing transmission line ROW are dependent on open (non-forested) conditions that are partially or entirely maintained by the maintenance regime, disturbance associated with recreational activities, or both. Much of the northern section of the Project has been intensively logged, although it does include some areas of intact forest that has not been disturbed in recent decades. Most of the rare plant species observed in the forested portions of the Project area are strongly associated with forested habitats and would unlikely be found in habitats with an open tree canopy.

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6 Appendices

Appendix A. Figures

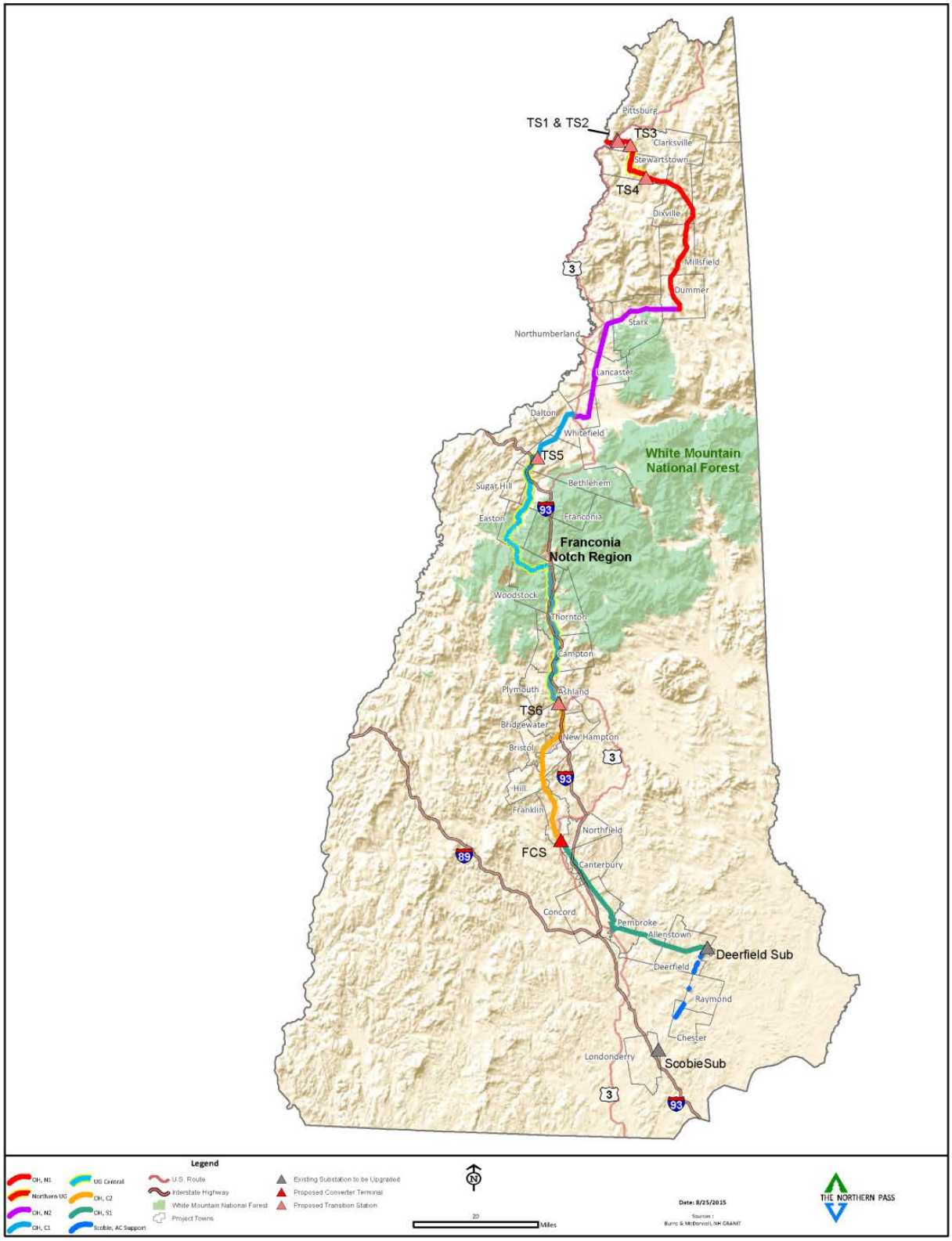

Figure A-1. Northern Pass Transmission Line Overview.

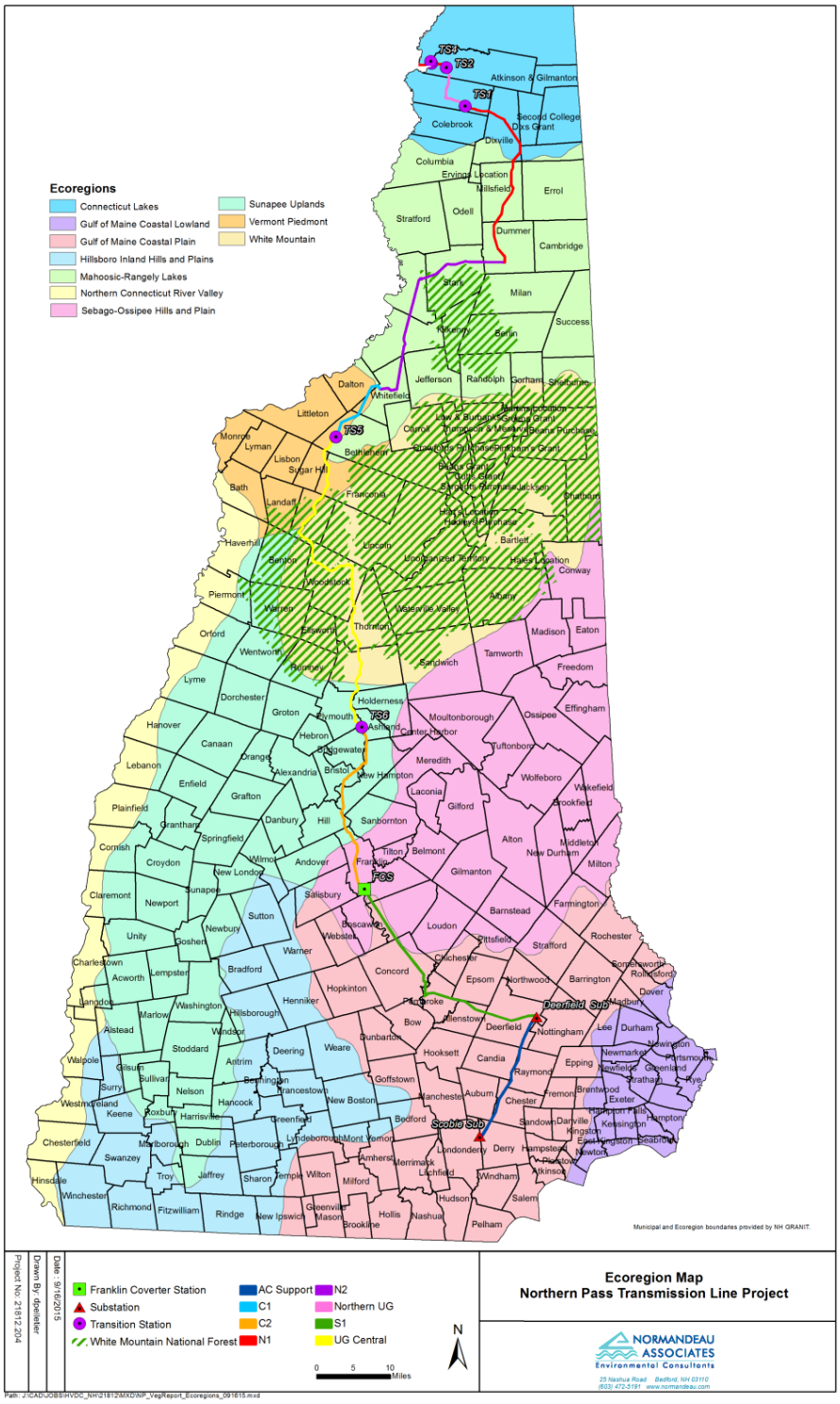

Figure A-2. Ecoregion map.

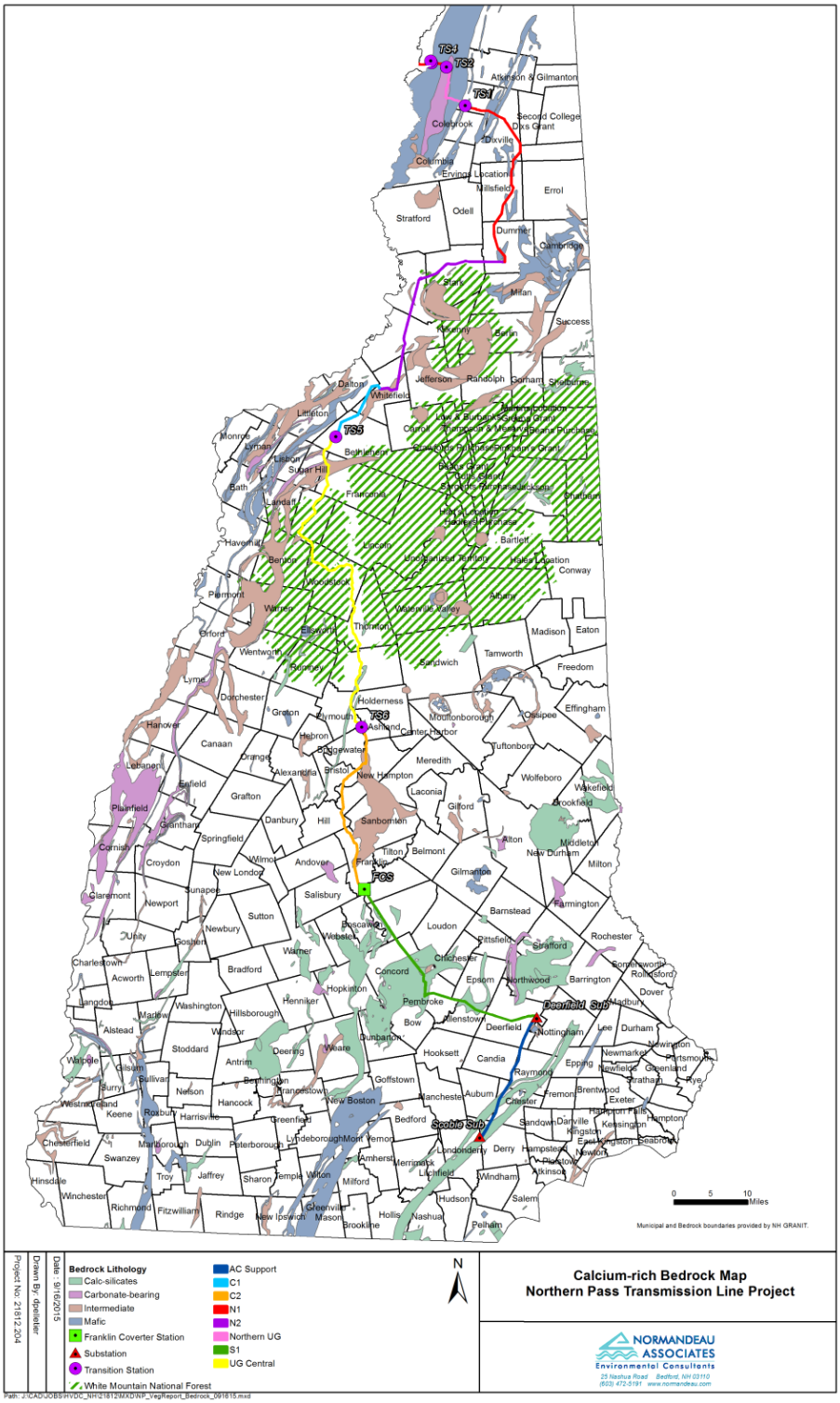

Figure A-3. Calcium-rich Bedrock map.

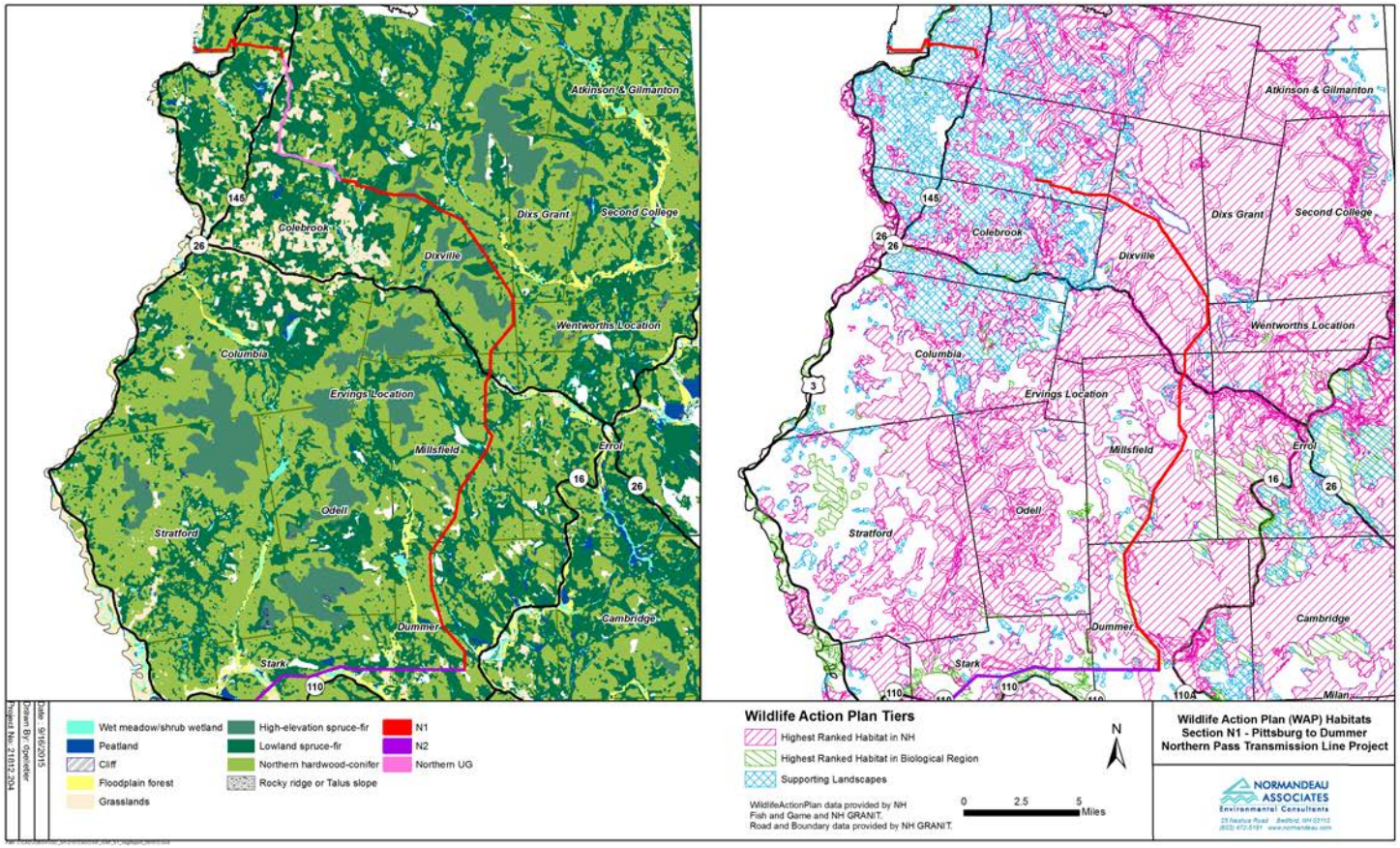

Figure A-4. Wildlife Action Plan (WAP) Habitats, Section N1—U.S./Canada Border to Dummer.

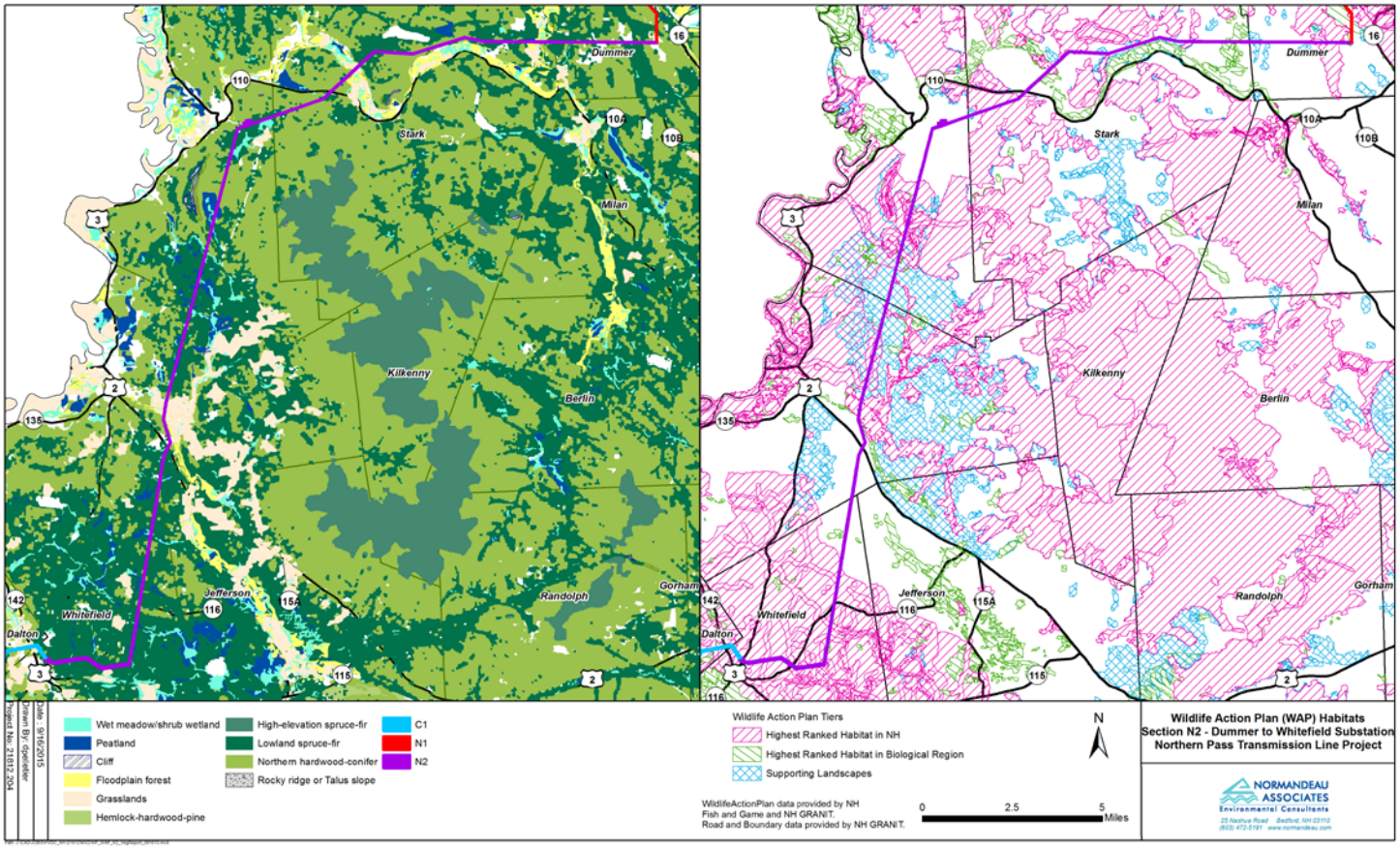

Figure A-5. Wildlife Action Plan (WAP) Habitats, Section N2—Dummer to Whitefield Substation.

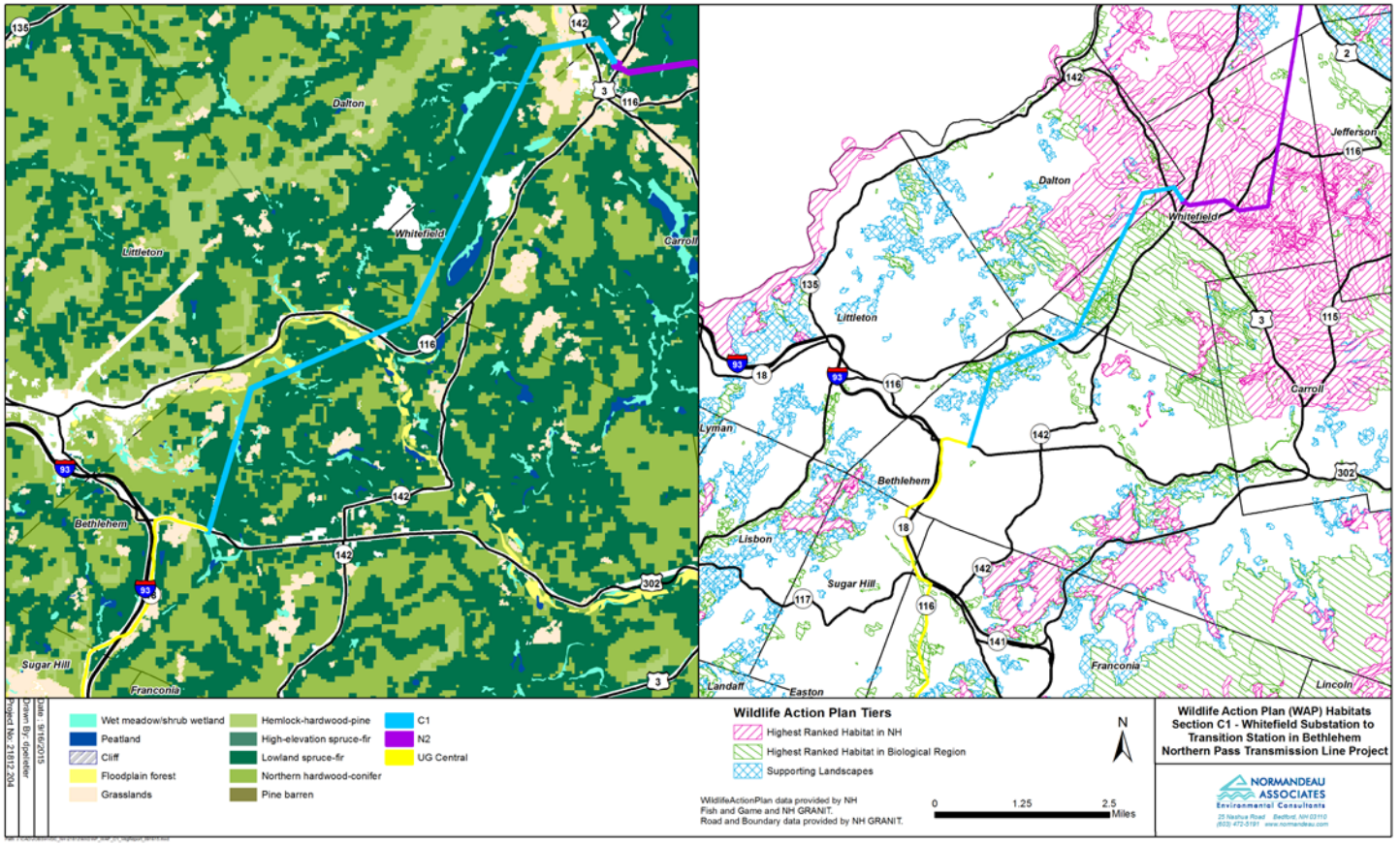

Figure A-6. Wildlife Action Plan (WAP) Habitats, Section C1—Whitefield Substation to Transition Station 5 in Bethlehem.

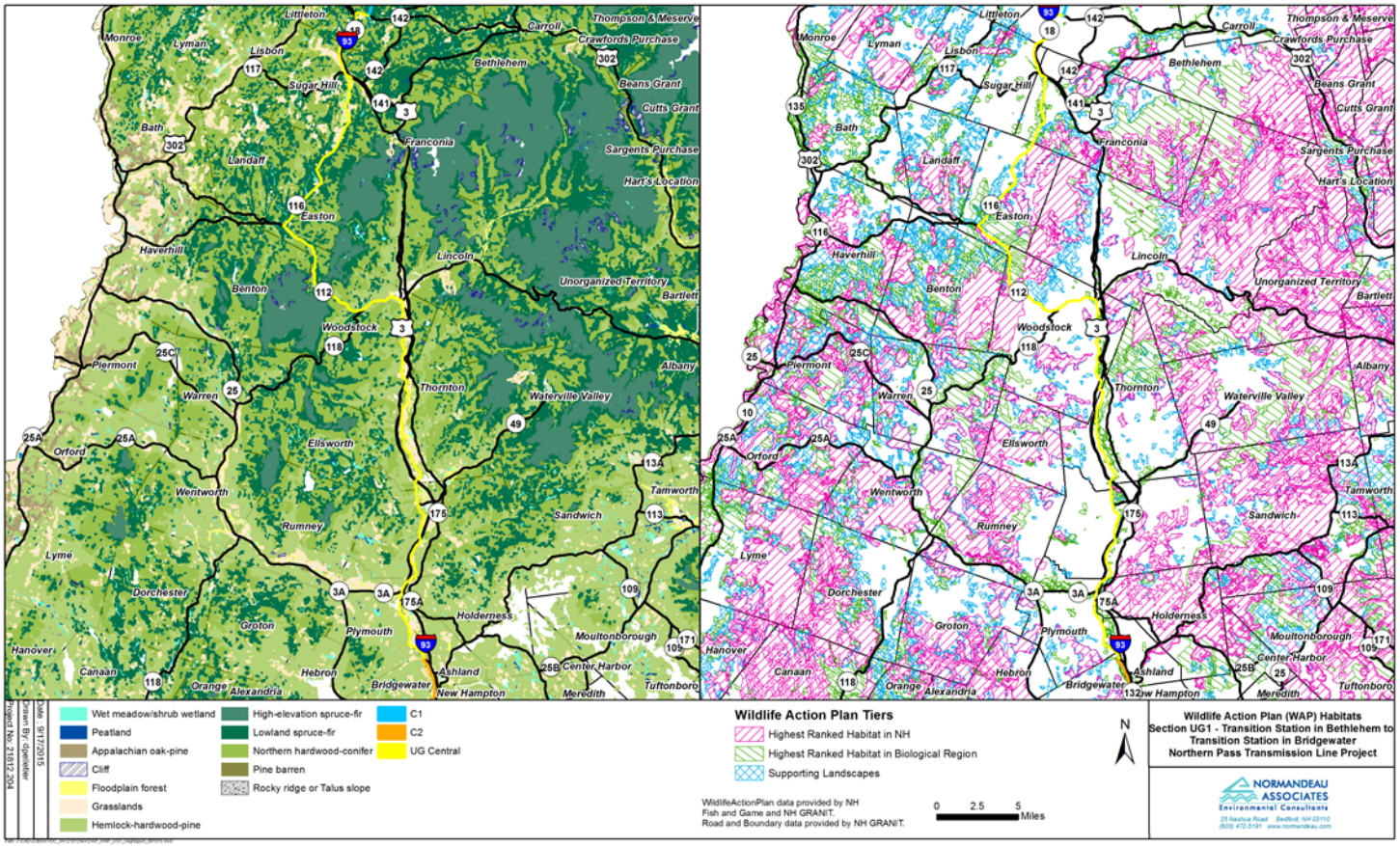

Figure A-7. Wildlife Action Plan (WAP) Habitats, Section UG1—Transition Station 5 in Bethlehem to Transition Station 6 in Bridgewater.

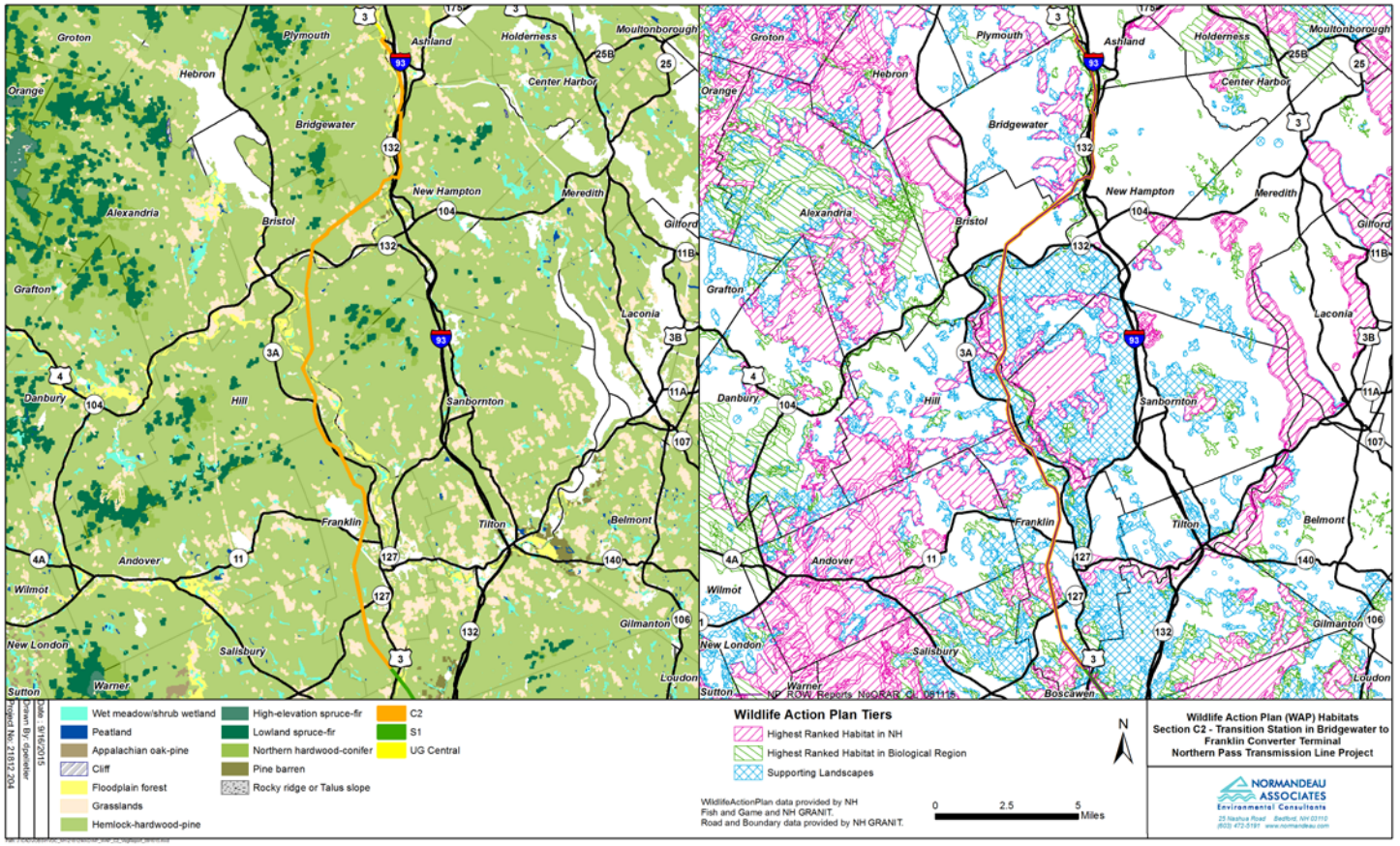

Figure A-8. Wildlife Action Plan (WAP) Habitats, Section C2—Transition Station 6 in Bridgewater to Franklin Converter Terminal.

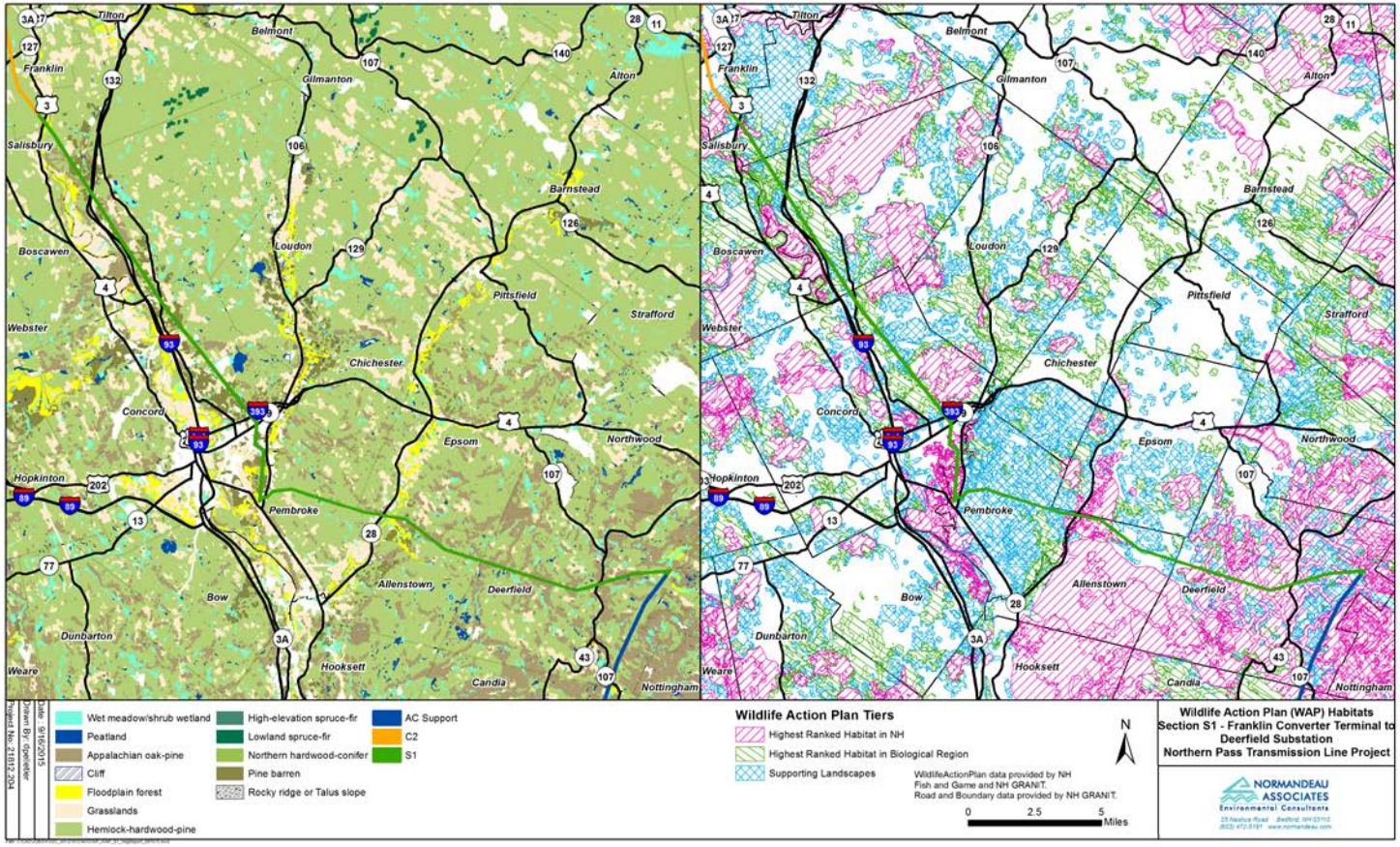

Figure A-9. Wildlife Action Plan (WAP) Habitats, Section S1—Franklin Converter Terminal to Deerfield Substation.

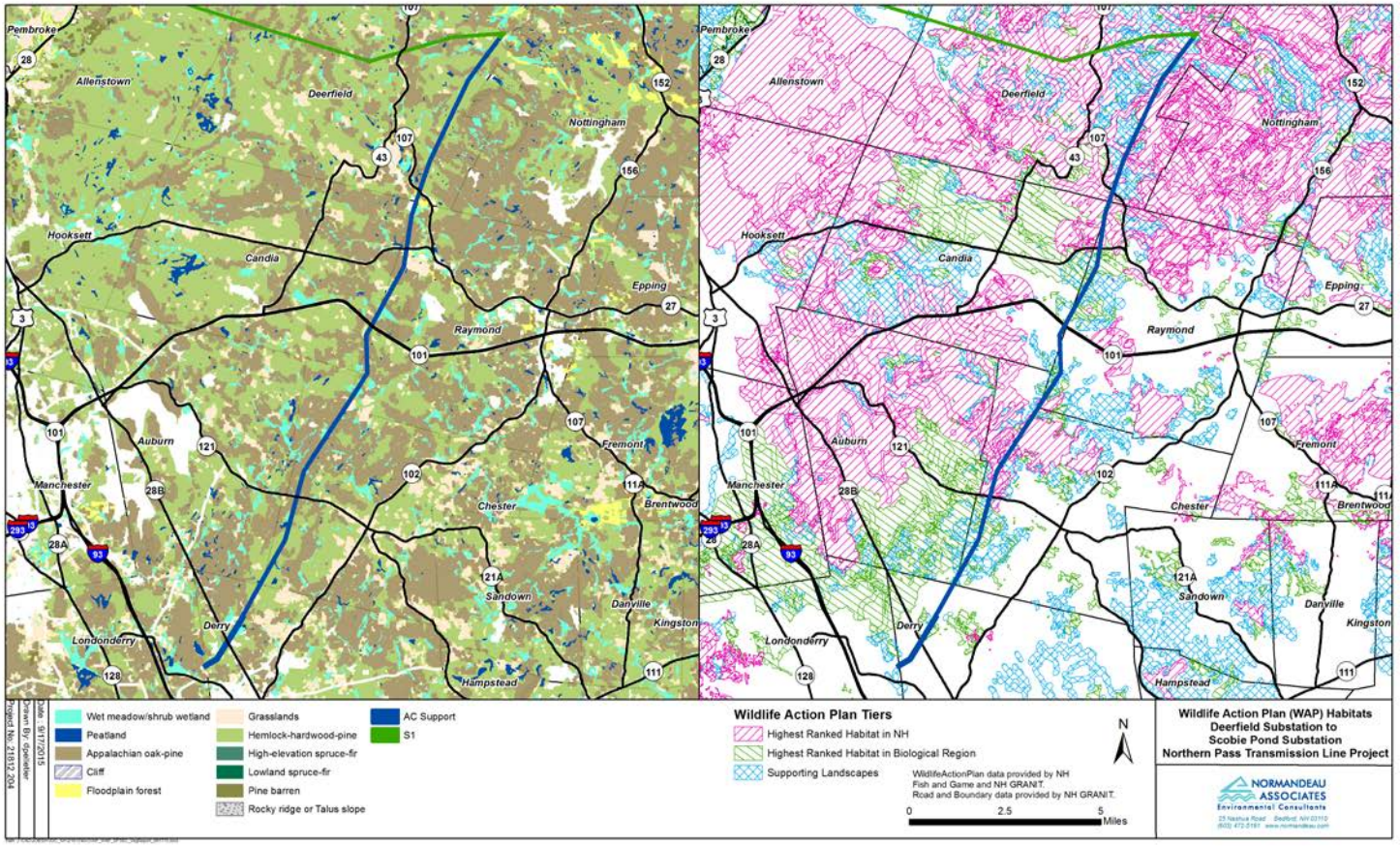

Figure A-10. Wildlife Action Plan (WAP) Habitats, Deerfield Substation to Scobie Pond Substation.

Appendix B. USFS Ecoregion Tables

Table B-1. U.S. Forest Service National Hierarchical Framework of Ecological Units

Planning and Analysis Scale	Ecological Units	Purpose, Objectives, and General Use	General Size Range
Ecoregion Global	Domain	Broad applicability for modeling and sampling, strategic planning and assessment, and international planning	Millions to tens of thousands of square miles
Continental	Division		
Regional	Province		
Subregion	Section	Forest, area-wide planning and watershed analysis	Thousands to hundreds of acres
	Subsection		
Landscape	Landtype association	Forest, area-wide planning and watershed analysis	Thousands to hundreds of acres
Land unit	Landtype association	Project and management area planning and analysis	Hundreds to less than 10 acres
	Landtype phase		

Notes: The Forest Service National Hierarchical Framework of Ecological Units from the U.S. Forest Service's Introduction: Ecological Subregions of the United States. Website: http://www.fs.fed.us/land/pubs/ecoregions/intro.html Accessed 10/22/2013.

Table B-2. U.S. Forest Service Ecoregions within the Northern Pass Transmission Line Route

Subsection	Connecticut Lakes (M211Af)	Mahoosic-Rangely Lakes (M211Ae)	White Mountains (M211Ad)	Vermont Piedmont (M211Ba)	Sunapee Uplands (M211Bc)	Sebago-Ossipee Hills and Plains (221Al)	Gulf of Maine Coastal Plain (221Ai)
Section	White Mountains (M211A)			New England Piedmont (M211B)		Lower New England Section (221A)	
Province	Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow (M211)					Eastern Broadleaf Forest (221)	
Division	M210 Warm Continental Division - Mountain Provinces					Hot Continental Division (220)	
Domain	Humid Temperate Domain (200)						

Notes: The table shows the seven ecoregion subsections occurring within the transmission line project area and the broader ecoregion classifications to which they belong. Locations of ecoregion subsections are shown on Figure A-2. Ecoregion descriptions are provided below. Ecoregion information obtained from the U.S. Forest Service web page: http://www.na.fs.fed.us/sustainability/ecomap/provinces/. Ecoregion subsection descriptions obtained from Keys et al. 1995. *Ecological Units of the Eastern United States: First Approximation*. Available from http://www.srs.fs.usda.gov/econ/data/keys/index.htm.

Domain:
Humid Temperate Domain: Located in the middle latitudes (30 to 60 degrees N). Climate is influenced by both tropical and polar air masses. Areas have pronounced seasons, with strong annual cycles of temperature and precipitation. Contains forests of broadleaf deciduous and needleleaf evergreen trees.

Divisions:
Warm Continental Division: Located south of the eastern area of the subarctic climate, in the region between lat. 40 and 55 N. and from the continental interior to the east coast. Located between the source regions of polar continental air masses to the north and maritime or continental tropical air masses to the south, it is subject to strong seasonal contrasts in temperature. Precipitation is ample all year, but is substantially greater during the summer. This area has cold snowy winters and warm summers. The average temperature during the coldest month is below 32F. The average temperature during the hottest month never exceeds 72F. Includes needleleaf and mixed needleleaf-deciduous forest which grows throughout the colder northern parts, extending into the mountain regions of the Adirondacks and northern New England. Here soils are Spodosols with a low supply of bases and a horizon in which organic matter, iron, and aluminum have accumulated. They are strongly leached, but have an upper layer of humus. Cool temperatures inhibit bacterial activity that would destroy this organic matter in tropical regions. Soils are deficient in calcium, potassium, and magnesium, and are generally acid. Thus, they are poorly suited to crop production, even though adequate rainfall is generally assured; but conifers thrive in them.

Hot Continental Division: Characterized by hot summers and cool winters. The boundary between this division and the one above is the isotherm of 72F (22C) for the warmest month. In the warmer sections of the Hot Continental Division, the frost-free or growing season continues for 5 to 6 months, in the colder sections only 3 to 5 months. Snow cover is deeper and lasts longer in the northerly areas. Vegetation is winter deciduous forest, dominated by tall broadleaf trees that provide a continuous dense canopy in summer, but shed their leaves completely in winter. Lower layers of small trees and shrubs are weakly developed. In spring, a luxuriant ground cover of herbs quickly develops, but is greatly reduced after trees reach full foliage and shade the ground. Soils are chiefly Inceptisols, Ultisols, and Alfisols, rich in humus and moderately leached, with a distinct light-colored leached zone under the dark upper layer. The Ultisols have a low supply of bases and a horizon in which clay has accumulated. Where topography is favorable, diversified farming and dairying are the most successful agricultural practices.

Provinces:
Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow: Has a modified continental climatic regime with long, cold winters and warm summers. Annual precipitation evenly distributed. Landscape is mountainous and was previously glaciated. Forest vegetation is a transition between boreal on the north and broadleaf deciduous to the south.

Eastern Broadleaf Forest: This province has a continental-type climate of cold winters and warm summers. Annual precipitation is greater during summer, water deficits infrequent. Topography is variable, ranging from plains to low hills of low relief along Atlantic coast. Interior areas are high hills to semi-mountainous, parts of which were glaciated. Vegetation is characterized by tall, cold-deciduous broadleaf forests that have a high proportion of mesophytic species.

Sections:
White Mountains: has a maturely dissected, irregular highland characterized by clusters of low, rounded mountains and scattered monadnocks with many glacial features. Rock formations include sedimentary quartzite, slate, and schist with extensive area of igneous rocks including granites, diorite, gabbro, and basalt. Forest vegetation consists of spruce-fir, maple-beech-birch, and aspen-birch cover types.

New England Piedmont: This section is a maturely dissected peneplain with open, low mountains and monadnocks. Rocks are mainly quartzite, slate, and schist with large areas of gneiss metamorphics and a belt of volcanics. Forest vegetation consists of maple-beech-birch and aspen-birch cover types.

Lower New England Section: The landscape is a combination of broad, hilly plateaus with features including a basin, plain, and ridge. Bedrock geology is varied and complex, consisting of sedimentary, igneous, and metamorphic rocks. Forest vegetation includes oak-hickory, white-red-jack pine, maple-beech-birch, and aspen-birch cover types.

Subsections:
Connecticut Lakes: low mountains (1,000–4,000 feet); Wis. sandy loam till; sand gravel deposits, bedrock: Dev. sandstone; Precam. Gneiss; soil taxa: Haplorthods, Borohemists, Epiaquents; Frigid-Cryic, udic, aquic; average precipitation: 41 inches; temperature: 39F; growing season: 107 days; potential vegetation: red spruce-balsam fir, sugar maple-birch-beech forests, alpine communities, calcareous fens; surface water: common lakes and ponds, few rivers and streams, few wetlands; human uses: forestry agriculture, recreation.

Mahoosic-Rangely Lakes: high mountains (1,200–1,400 feet); Wis. Sandy loam till, outwash sand-gravel, bedrock: Devonian granite-grandiorite; soil taxa: Haplorthods, Cryorthods, Borofolist; Frigid-Cryic, udic-aquic; average precipitation: 38 inches; temperature: 40F; growing season: 115 days; potential vegetation: red spruce-balsam fir, sugar maple-birch-beech forests, alpine communities; surface water: common lakes and ponds, common river and streams, few large wetlands; human uses: forestry, recreation.

White Mountains: high mountains (1,000–6,000 feet); Wis. Sandy till, outwash sand-gravel, bedrock: Paleozoic granite-tonalite-pelite; soil taxa: Haplorthods, Borofolists, Cryorthods, Epiaquents; Frigid-Cryic, udic-aquic; average precipitation: 47 inches; temperature: 41F; growing season: 116 days; potential vegetation: red-spruce- balsam fir, sugar maple-birch-beech

forests, alpine communities; surface water: common rivers and streams, few lakes and ponds, few wetlands; human uses: forestry, recreation, development.

Vermont Piedmont: open low mountains (500–2,500 feet); L. Wis. sandy loamy till; Paleozoic meta-sedimentary-limestone-intrusives, Proterozoic gneiss-amphibolite; soil taxa: Haplorthod, Fragiorthod, Humaquept, Haplaquept, Dystrochrept; Frigid, udic; average precipitation: 39 inches; temperature 42F; growing season: 114 days; potential vegetation: sugar maple-birch-beech, n. red oak-hardwood mesic forests, red spruce-balsam fir forest, n. white cedar limestone woodlands; surface water: streams, small-medium rivers-small lakes common, few large wetlands; human uses: agriculture, forestry, quarrying, recreation.

Sunapee Uplands: low mountains (50–1,600 feet); Wis. Sandy loam till, outwash sand-gravel, bedrock: Devonian metasedimentary rocks; soil taxa: Dystrochrepts, Haplorthods, Borohemists; Frigid, mesic, udic; average precipitation: 42 inches; temperature: 44 F; growing season: 121 days; potential vegetation: sugar maple-birch-beech forest, n. red oak hardwood mesic forest, red spruce-balsam fir forest; surface water: common ponds, lakes, and streams; human uses: forestry, agriculture, recreation.

Sebago-Ossipee Hills and Plains: glaciated high hills-open low mtns (100–2,200 feet); Wis. Sandy till; outwash sand-gravel; Paleozoic intrusive granite-gneiss-schist; soil taxa: Haplorthods, Dystrochrepts, Haplaquepts; Frigid, udic; average precipitation: 43 inches; temperature: 45F; growing season: 128 days; potential vegetation: hemlock-white pine-oak-sugar maple-birch-beech forest, red maple-red spruce swamp; surface water: large lake-wetland complexes; many streams; human uses: forest, residential, agriculture.

Gulf of Maine Coastal Plain: glaciated plain-hills (100–1,400 feet); Wis. Sandy till; sand-gravel-silt in valleys Paleozoic intrusives, schist-granite-gneiss; soil taxa: Dystrochrepts, Udorthents, Udipsamments; Mesic, udic; average precipitation: 44 inches; temperature: 48 F; growing season: 156 days; potential vegetation: hemlock-white pine-oak, sugar maple-birch-beech, red oak-hardwood mesic forests; surface water: many small lakes, reservoirs, streams; human uses: forest, agriculture, residential.

Appendix C. Global and State Rank Codes

Ranks describe rarity both throughout a species' range (globally, or "G" rank) and within New Hampshire (statewide, or "S" rank). The rarity of sub-species and varieties is indicated with a taxon ("T") rank. For example, a G5T1 rank shows that the species is globally secure (G5) but the sub-species is critically imperiled (T1).

Code	*Examples*		*Description*
1	G1	S1	Critically imperiled because extreme rarity (generally one to five occurrences) or some factor of its biology makes it particularly vulnerable to extinction.
2	G2	S2	Imperiled because rarity (generally six to 20 occurrences) or other factors demonstrably make it very vulnerable to extinction.
3	G3	S3	Either very rare and local throughout its range (generally 21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction because of other factors.
4	G4	S4	Widespread and apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
5	G5	S5	Demonstrably widespread and secure, although the species may be quite rare in parts of its range, particularly at the periphery.
U	GU	SU	Status uncertain, but possibly in peril. More information needed.
H	GH	SH	Known only from historical records, but may be rediscovered. A G5 SH species is widespread throughout its range (G5), but considered historical in New Hampshire (SH).
X	GX	SX	Believed to be extinct. May be rediscovered, but evidence indicates that this is less likely than for historical species. A G5 SX species is widespread throughout its range (G5), but extirpated from New Hampshire (SX).

Modifiers are used as follows.

Code	*Examples*		*Description*
Q	G5Q	GHQ	Questions or problems may exist with the species' or sub-species' taxonomy, so more information is needed.
?	G3?	3?	The rank is uncertain due to insufficient information at the state or global level, so more inventories are needed. When no rank has been proposed the global rank may be "G?" or "G5T?"

When ranks are somewhat uncertain or the species' status appears to fall between two ranks, the ranks may be combined. For example:

G4G5	The species may be globally secure (G5), but appears to be at some risk (G4).
G5T2T3	The species is globally secure (G5), but the sub-species is somewhat imperiled (T2T3).
G4?Q	The species appears to be relatively secure (G4), but more information is needed to confirm this (?). Further, there are questions or problems with the species' taxonomy (Q).
G3G4Q S1S2	The species is globally uncommon (G3G4), and there are questions about its taxonomy (Q). In New Hampshire, the species is very imperiled (S1S2).