Assessment of Transmission Line Proposal
on
Natural Resources throughout Northumberland, New Hampshire

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INTRODUCTION

The Town of Northumberland, New Hampshire is located in southwestern Coos County along the Connecticut River. The Town has a total area of 36.5 square miles. The Connecticut River runs along the western edge of Town, and the Upper Ammonoosuc River runs through town in a southwesterly direction, before entering the Connecticut River. Northumberland contains a wide range of ecological habitats ranging from lowland wetland complexes to higher elevation areas: Morse Mountain (1,880 ft), Cape Horn (2,040 ft), Moore Mountain (1,522 ft.) and Spaulding Hill (1,220 ft). The town's highest point is 2,860 feet above sea level on a spur of the Pilot Range in the town's eastern boundary.

Northern Pass, LLC submitted a proposal, along with several required permit applications, to construct a transmission line throughout New Hampshire. Just over 6 miles of the above-ground proposed route runs through Northumberland along the existing Right-of-Way (ROW) transmission lines. The potential effects of the transmission line throughout the State including Northumberland are extensive and include environmental, cultural, scenic and economic impacts.

In March 2016, the Northumberland Conservation Commission contacted Elise Lawson and John Severance to assist them in reviewing the permits to assess impacts on wetlands and wildlife. Both Elise (CWS #233) and John (CWS #240) have extensive experience with resource-based projects in northern New Hampshire including the following:

- 2006 - wetland assessment and ranking in Northumberland
- 4-year vernal pool inventories along the Connecticut River flood plain regions
- Wildlife habitat work for private landowners
- Several private wetland impact applications filed with the NH DES Wetlands Bureau

METHODS

Existing data used for this report include the following:

1. Maps and studies completed by Northern Pass in submitted applications
2. Existing natural resource data generated during the 2006 wetland assessment study
3. Existing maps including:
    a. USGS topographic
    b. Aerial photos
    c. US Fish and Wildlife National Wetland Inventory data
    d. US Natural Resource Conservation Service soils map: poorly and very poorly drained soils
    e. Aquifer data downloaded from the UNH GRANIT mapping database

Although the concerns are focused within the Town of Northumberland, they should be recognized and considered for the entire proposed area from Pittsburg to Deerfield, New Hampshire.

RESULTS

Impacts on Natural Resources

Wetlands and Perennial Streams

Wetlands are an essential habitat type for the majority of plant and animal species in New Hampshire. As a whole, wetlands are extremely diverse depending on the hydrology, soils, topography, and climate of an area. In addition to rivers, lakes, and ponds, there are four general types of Palustrine[1] wetlands: marsh, swamp, bog, and fen, with additional sub-types in each of these categories. This diversity extends into each individual wetland where a complex matrix of plant and wildlife species and water regimes co-exist. The resulting edge habitats within and around wetlands are frequently used by a great deal of wildlife species. It is estimated that wetlands and riparian areas (habitat along streams and rivers) are used by over 90% of the region's wildlife species and provide preferred habitat for over 40% of local species.

In 2015, the U.S. Environmental Protection Agency's (USEPA) Office of Research and Development finalized a report called: *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*.[2] The report reviews more than 1,200 peer-reviewed publications and summarizes current scientific understanding about the connectivity and mechanisms by which streams and wetlands, singly or together, affect the physical, chemical, and biological integrity of downstream waters. The report focuses on how surface and shallow subsurface connections including small or temporary streams, wetlands, and open waters affect larger waters such as rivers, lakes, reservoirs, and estuaries. It makes five major conclusions, summarized below.

1. Streams, regardless of their size or frequency of flow, are connected to downstream waters and strongly influence their function.
2. Wetlands and open waters in riparian areas (transitional areas between terrestrial and aquatic ecosystems) and floodplains are physically, chemically, and biologically integrated with rivers via functions that improve downstream water quality. These systems act as buffers to protect downstream waters from pollution and are essential components of river food webs.
3. Many wetlands and open waters located outside of riparian areas and floodplains, even when lacking surface water connections, provide physical, chemical, and biological functions that could affect the integrity of downstream waters.

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[1] Palustrine wetlands are a group of vegetated wetlands traditionally called marshes, swamps, bogs, fens. They also include the small, shallow, permanent or intermittent water bodies often called ponds.

[2] U.S. EPA. Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-14/475F, 2015.

4. Variations in the degree of connectivity are determined by the physical, chemical and biological environment, and by human activities. These variations support a range of stream and wetland functions that affect the integrity and sustainability of downstream waters.
5. Incremental contributions of individual streams and wetlands are cumulative across entire watersheds, and their effects on downstream waters should be evaluated within the context of other streams and wetlands in that watershed.

Consultants hired by Northern Pass delineated 51 wetlands, 12 perennial Streams, 4 intermittent streams, 4 ephemeral streams, and 10 vernal pools along the ROW throughout all of Northumberland (Wetland Permit Application, Appendix 31). In Northumberland along the proposed transmission line, delineated wetlands ranged from 308 square feet to 225,894 square feet or 5.2 acres. Some of the larger wetlands extend far beyond the ROW into a diverse matrix of forested, scrub-shrub, emergent, open water, and riparian habitat. All wetlands were not delineated beyond the ROW due to private landowner considerations and rights. Consultants assessed each wetland's functionality based on 14 parameters outlined in the ***Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire*** manual.[3]

Table 7. Existing Transmission Line ROW in Dummer to Whitefield Substation (N2), Summary of Wetlands, Streams, and Vernal Pools

Town (North to South)	Wetlands	Prime Wetlands	Rivers and Perennial Streams	Intermittent Streams	Ephemeral Streams	Vernal Pools
Dummer	18	None	6	8	0	5
Stark	71	None	6	11	14	15
Northumberland	51	None	12	4	4	10
Lancaster	51	None	7	0	1	3
Whitefield	49	None	2	2	2	2
Subtotal	240	None	33	25	21	35

This table was copied directly from the Wetland Permit Application. It shows the total number of all types of wetlands, streams and vernal pools documented throughout the ROW in Northumberland. Five of the 51 wetlands documented were considered to be "high quality".

[3] The ***Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire*** (NH Method) provides communities, conservation groups and professionals a practical method for evaluating wetland functions. Originally published in 1991, the NH Method was first revised in 2011 and updated in 2012 and 2013. It is currently being updated in 2015.

Table 8. Existing Transmission Line ROW in Dummer to Whitefield Substation (N2), Number of Wetlands by Dominant Wetland Cover Type

Town (North to South)	Emergent	Forested Deciduous	Forested Evergreen	Scrub/Shrub Deciduous	Un-Consolidated Bottom	Subtotal
Dummer	7	0	0	11	0	18
Stark	35	1	0	35	0	71
Northumberland	28	3	0	20	0	51
Lancaster	34	0	0	17	0	51
Whitefield	20	0	0	29	0	49
Subtotal	124	4	0	112	0	240*
Percent of Total	**51.7%**	**1.7%**	**0**	**46.7%**	**0**	

*Features crossing town boundaries were accounted for in each town in which they occurred.

This table was copied directly from the Wetland Permit Application. It breaks down the types of Palustrian weltands documented along the ROW in Northumberland.

Table 45. Permanent and Temporary Impacts by Dominant Cover Type, Existing Transmission Line ROW in Dummer to Whitefield Substation (Section N2)

Town	Permanent Impact (SF)	Temporary Impact (SF)
Dummer		
PEM	71	44,988
PSS	283	131,789
Stark		
PEM	142	62,868
PFO	20	2,435
PSS	1,229	416,074
Northumberland		
PEM	607	279,284
PSS	556	245,865
Lancaster		
PEM	679	310,349
PSS	677	240,619
Whitefield		
PEM	636	264,852
PSS	1,619	719,816
Total (SF)	**6,518**	**2,718,940**
Total (Acres)	**0.15**	**62.4**

This table was copied directly from the Wetlands Permit Application. It shows the total permanent and temporary impacts to wetlands throughout all of Northumberland. The consultants classified five of these wetlands as high quality wetlands. SF = Square feet, PEM = Palustrine Emergent Wetland type of wetland, PSS = Palustrine Scrub Shrub type of wetland

Based on previous field work and review of submitted maps, it appears that wetlands were accurately delineated and documented. However, there are concerns with permanent and temporary impacts on all of these wetlands, particularly those which are part of perennial or intermittent streams and those that extend beyond the ROW boundaries. Many of the larger wetlands have active beaver populations and contain series of beaver pond systems. Disruption of these wetlands will not only affect the impact area, but also areas downstream, and in some cases upstream habitats. Moreover all streams eventually flow into the Connecticut River, affecting water quality. The Connecticut River is the largest river in New England. It flows 410 miles from its source only 300 yards from the Canadian border, to Long Island Sound. It drains 4.5 million acres (7,000 square miles) of New Hampshire and Vermont. In 1992, NH General Court designated the Connecticut River into the New Hampshire Rivers Management and Protection Program, and in 1998 the White House designated the Connecticut as an American Heritage River (CRJC, 2016).[4]

In the 2006 Wetland study in Northumberland, six wetland complexes were inventoried and ranked in the field after initial GIS analysis using available data. All six inventoried were large areas, ranging from nearly 90 acres to over 1,036 acres. Wetland complexes ranked 1st, 4th, and 5th are all found within and beyond the existing ROW where work is proposed. Please refer to the November 2006 report[5], *Functional Assessment of Wetlands throughout Northumberland, NH* for descriptions on these wetlands as well as recommendations for protection of these wetland complexes. The report is publically available through the Northumberland Town Hall.

Although temporary and permanent impacts on all wetlands should be carefully reviewed, we noted three large area containing Palustrine and Riverine wetland complexes which are a special concern based on the following:

- Wetlands extend through and beyond the ROW. Impacts in immediate area will affect wetland diversity, quality and function downstream.
- Existence of perennial streams
- The flow of water all leads to the Connecticut and Wild Ammonoosuc Rivers
- There are extensive aquifers under the Connecticut River and associated flood plain and wetland areas within and beyond Northumberland.

The large wetland complexes that are of particular concern with the proposed project are described below.

1. **<u>Northern Area of Concern</u>**: This wetland complex was called the Gun Club Wetland Complex (#4) in the 2006 wetlands report. It is nearly 300 acres in size and lies along the northern section of the Lost Nation Road, and adjacent to the gun club area. Northern and western sections of this wetland cross the existing Public Service of New

[4] Connecticut River of Joint Commission, Inc. (CRJC), 2016. *Fast Facts.* Information and Education on the Connecticut River. http://www.crjc.org/facts.htm#top . Retrieved from the web on April 2, 2016).
[5] Watershed to Wildlife and North Country Council. 2006. *Functional Assessment of Wetlands throughout Northumberland, NH.* Report prepared for the Town of Northumberland – Northumberland Conservation Commission. Work funded by the Upper Connecticut River Mitigation and Enhancement Fund.

Hampshire (PSNH) or ROW transmission line. The wetland complex crosses the ROW more than once Roaring, Ames and Moore Brooks feed this wetland. All streams eventually all merge into Roaring Brook, and then confluence with the Wild Ammonoosuc River. The Wild Ammonoosuc River then flows into the Connecticut River. There is a large aquifer under the Wild Ammonoosuc and Connecticut Rivers in this area. The wetland complex and associate perennial streams play an important role here in slowing large amounts of runoff from the adjacent mountain slopes before they reach the main rivers and downtown area. This area of concern contains a diversity of wetland types ranging from open water, emergent, scrub-shrub, and forested wetlands. Additionally, there are 10 different types of very poorly and poorly drained soils. Because of the diversity in soils, wetland types, and surrounding upland habitats, this wetland also has the potential to be home to many species of concern.

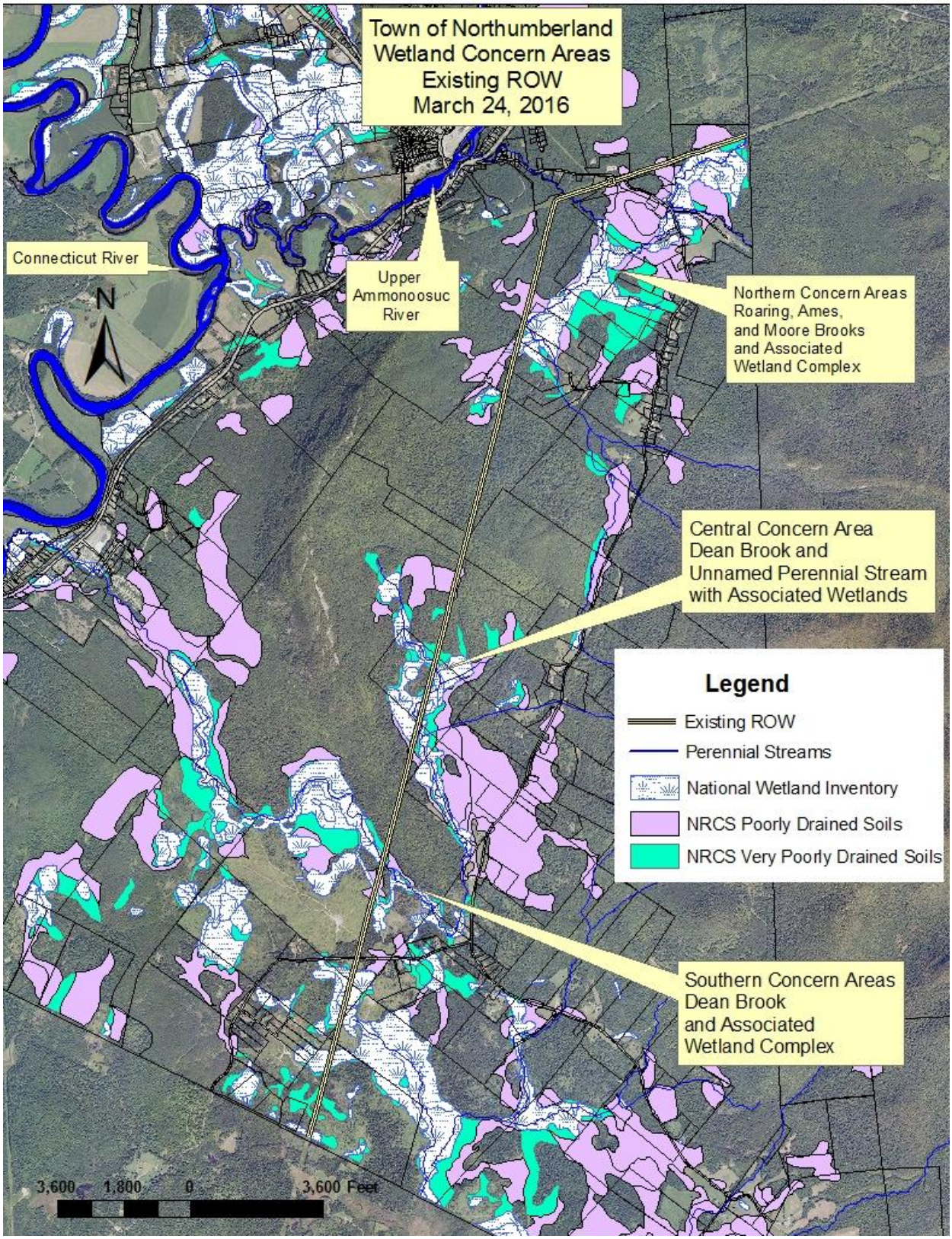
2. **Central Area of Concern**: This wetland complex along the ROW was called the Lost Nation Wetland Complex (#5) in the 2006 study. It is located between the Lost Nation Road, near the junction with Page Hill Road, and the Cape Horn Ridge. Dean Brook and an unnamed perennial stream flow from the northwest to southeast across the ROW: crossing the ROW more than once. The wetland mapped was 176 acres lying within narrow valley between steep slopes surrounding it. It is considered an important wetland not only because it contains a variety of wetland types, but also because there are large amounts of forested habitat surrounding it acting as excellent buffers and protection from erosion. The diversity of wetlands is also impacted by beaver – forested, scrub shrub, emergent and open water. The streams flow directly into the Connecticut River. If water quality is degraded during construction it will directly affect the water quality of the Connecticut River downstream.
3. **Southern Area of Concern**: This large wetland complex was called Page Hill Wetland Complex (#1) in the 2006 report, and was the highest ranked wetland in Northumberland. It spans over 1,036 acres. Due to its large size and topography, there is a great deal of diversity throughout and within it. This wetland complex lies between Northumberland/Lancaster town line and the Lost Nation Road, with a portion of Page Hill Road and the ROW bisecting it. Moreover, this complex extends for over 1,800 acres into neighboring town of Lancaster. The NWI data and classification mapped by the National Fish and Wildlife Service classified 22 different types/combinations of wetlands (Palustrine and Riverine) within this wetland, most of which were observed during field work. Extensive beaver activities are well documented in this area. Forested bogs and northern white cedar wetlands were documented.

This tamarack heath bog was a unique wetland observed in the Southen Area of Concern (Page Hill Wetland complex).

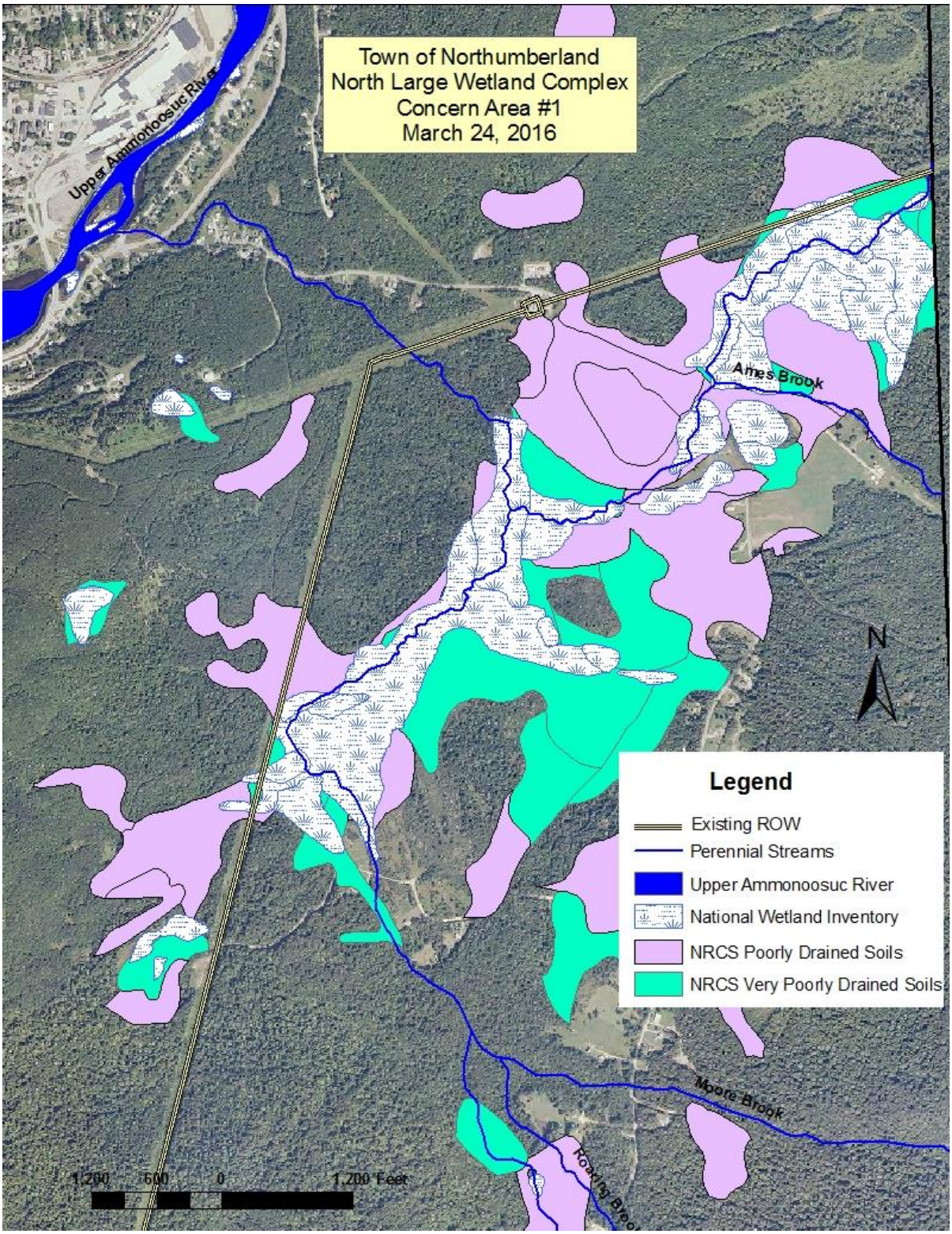
Concerns with both temporary and permanent impacts on all wetlands, but especially the three areas described above are the following:

1. Road construction which will increase public access to some of these areas and could cut off aquatic connectivity
2. Loss of biodiversity not only to wetlands, but also adjacent upland plant and animal communities
3. Increased opportunities for invasive species to establish
4. Erosion and stream bank destabilization at the site, as well as sedimentation downstream in all intermittent and perennial streams
5. Aquifer degradation. Regardless of the size, all aquifers need special consideration to ensure good water quality now and into the future. Given the worldwide water crises we are experiencing, all aquifers should be considered potential drinking water sources.
6. Impairment of surface water quality in the stream itself and in the Ammonoosuc River downstream from the potential impact area

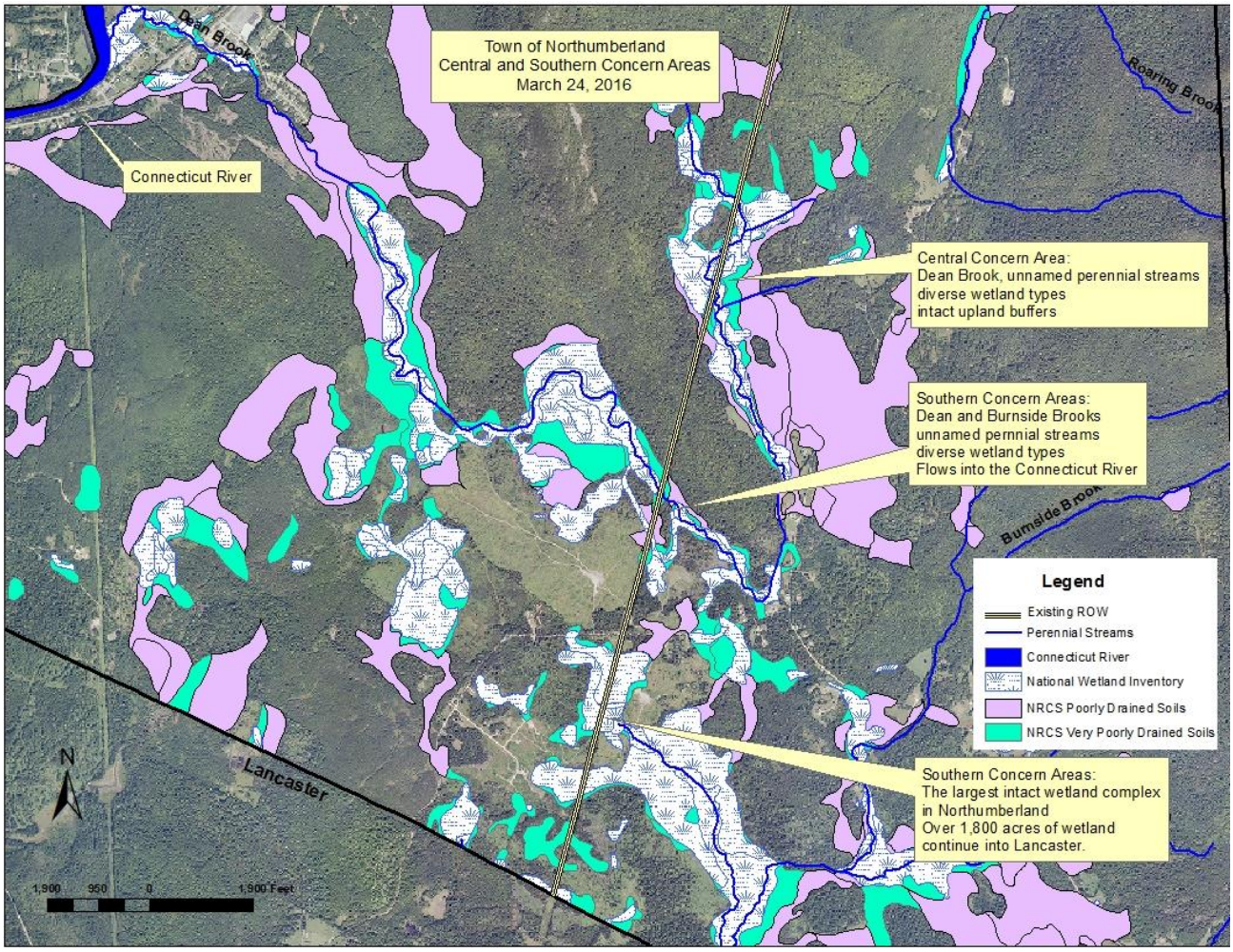
The maps below show locations of these large wetland complexes in Northumberland.



Overall all map of the larger wetland complexes all containing perennial streams. The map shows the location of the 3 large areas identified with greatest concern for wetland and adjacent upland impacts.



The large wetland complex in the northern part of the ROW in Northumberland crosses the proposed NP project several times. Ames, Moore and Roaring Brook enter the Upper Ammonoosuc and then the Connecticut Rivers, where there is an extensive stratified drift aquifer. Concerns with loss of wetland value from both permanent and temporary wetland impacts.



The Central and Southern Concern areas cross the proposed project several times. The diversity of wetland types, intact upland buffer, and perennial streams flowing into the Connecticut River will all be negatively impacted by both permanent and temporary impacts from the proposed NP project.

If the project is approved to move forward, careful monitoring of the entire area is crucial to help minimize these effects on wetlands, upland buffers, surface water, and ground water quality.

Vernal Pools

Vernal pools are distinct, often isolated, and important wetland types. Vernal pools provide essential breeding habitat for certain amphibians and invertebrates such as wood frogs (*Rana sylvatica*), yellow spotted salamanders (*Ambystoma maculatum*), marbled salamanders (*A. opacum*), and fairy shrimp (*Branchinecta lynchi*). These creatures depend on vernal pools as breeding sites because they are only temporary water bodies preventing fish and other aquatic predators from taking up residency. Reptiles such as Wood turtles (*Glyptemys insculpta*) also rely on vernal pools as an important feeding area in early spring. Vernal pools fill annually from precipitation, runoff, and rising groundwater, typically in the spring and fall.

By mid-summer, however, these wetlands are typically dry, making them a dynamic system inhabitable to specifically adapted plant and wildlife species. For this reason many unique, rare, threatened, and endangered species are linked to this wetland type. They are common in New Hampshire, and the State recognizes their value as important habitat.

Vernal pools were documented by NP consultants on three separate dates (5-25-2011, 6-21-2013 and 6-21-2013). A summary of impacts on vernal pools is shown below taken directly from the Wetland Permit application.

Table 12. Summary of Direct Impacts to Vernal Pools by Town

Town	Permanent Impact (SF)	Temporary Impact (SF)
Bethlehem	0	606
Chester	0	0
Deerfield	0	4,595
Dixville	0	510
Dummer	0	787
Lancaster	0	167
Londonderry	1,188	0
Millsfield	0	425
Northumberland	13	492
Pittsburg	0	2,213
Stark	7	2,208
Stewartstown	0	1
Whitefield	0	53
Total (SF):	**1,208**	**12,056**
Total (Acres):	**0.03**	**0.28**

The four main concerns regarding impacts on vernal pools are:

1. It is very difficult to assess the effects of temporary impacts on vernal pools. Based on the field inventory and examination of existing GIS data, there are likely many vernal pools in the ROW and work could impact them for longer than projected.
2. Each vernal pool was only documented during one season. Based on a four year study done by Watershed to Wildlife, Inc., John and Elise noted a wide variance in hydrology in many of the vernal pools inventoried over the four years. Some may have been missed, or more likely the reported size and impact area could be incorrect.
3. It is also important to assess the upland buffer around vernal pools to determine the effect on the species that not only breed in the pool, but also live most of their lives in the surrounding upland and wetland areas.

4. There could be permanent impacts if work on the transmission lines occurs during the breeding season or during time when the egg masses, insect larvae, crustaceans, tadpoles, salamanders, etc. are developing and require the water level to be undisturbed for a period of time.

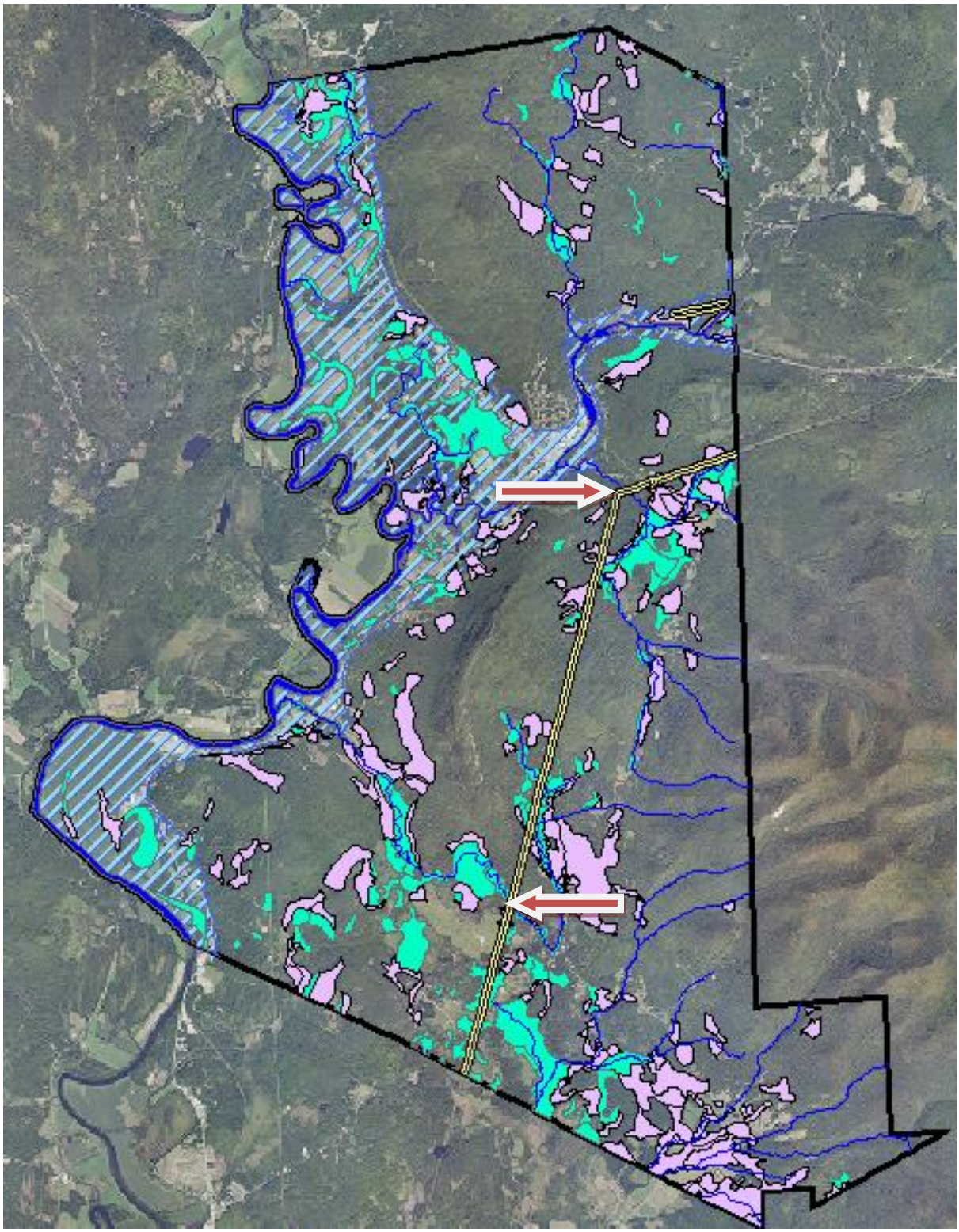
Vernal pools are a subset of wetlands with unique characteristics that support specialized sensitive species, whose existence relies on adjacent uplands as well as the vernal pool. Although not confirmed because of the time of year, vernal pool species are very likely to breed in this body of water in May. ROW power lines are visible adjacent to this pool.

Stratified-Drift Aquifers

There are three types of groundwater aquifers: Stratified-drift; till; and bedrock. The basic difference is that stratified drift and till aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are solid rock. In stratified drift aquifers, the materials are sorted sand and gravel. In till aquifers, the material is a gravel, sand, silt and clay mixture. Bedrock aquifers contain fractured rock. Stratified-drift aquifers are an important source of ground water for commercial, industrial, domestic, and public-water supplies in the State of New Hampshire. Approximately 14% of land surface in the State is underlain with stratified-drift aquifers.

Wells used by communities and private landowners draw groundwater from aquifers. The stratified-drift aquifers represent the greatest potential groundwater source for the Town of Northumberland. These aquifers contain potential usable water sources for municipal purposes and should be protected to insure their future quality and availability.

Approximately 4,468 acres or nearly 19% of the area of Northumberland is underlain with Stratified-drift aquifers. They mostly lie along the Upper Ammonoosuc and Connecticut Rivers. In Northumberland the majority of aquifers are made up of sand material. Stratified drift aquifers consisting of sand material tend to be more porous and have a higher potential for quicker transmissivity and recharge. Northumberland is fortunate to have these potential drinking water sources. Runoff, erosion, and soil compaction from this proposed project could all contribute to degradation of water quality in these aquifers.



Aquifers (shown in blue hatch) are found mostly under the Upper Ammonoosuc and Connecticut Rivers. The red arrows show areas of particular concern where water quality degredation could effect future water supply in Town.

Wildlife

All living things need food, water, cover, a space to survive, and a place to raise their young. The area where an organism lives and meets its basic needs for survival is called its habitat. Different species often have different requirements for their habitat. With increasing development by humans, habitats are rapidly disappearing and becoming less able to support life. Habitat loss is considered to be the number one cause in species decline and extinction.

The diversity and abundance of wildlife is directly correlated to the diversity and richness of habitat, plant community types, and vegetation. The Town of Northumberland contains diverse and unfragmented wildlife habitat, in part due to the Cape Horn State Forest, and in part thanks to the Town's Master Plan and private landowners invested in conserving their land.

The concern for wildlife with the proposed project by Northern Pass is primarily the displacement of many wildlife species during construction. During previous field work in Northumberland, most of the existing poles had been marked by black bear. Fur, bite marks and/or claw marks were noted on many of the random poles examined. Deer and coyote sign was also abundant. Although song bird surveys were not conducted, they would be affected both temporarily and possibly permanently during the construction of transmission lines along the ROW.

Many wildlife species tend to follow the edges of wetlands and streams. The extensive wetland complexes noted above, all cross the existing ROW, some several times. It follows that further development of the ROW will cut off travel along these wetlands and streams, at least temporarily, and possibly for long periods of time. Moreover, improvement of roads into the area will increase the likelihood of people driving along the ROW which will further impact wildlife negatively.

Black Bear often mark wooden poles along powerlines. This photo was taken along the ROW in Whitefield NH during field work for an Natural Resource Inventory.

CONCLUSION

Based on fieldwork in Northumberland, current GIS analyses and review of the wetlands application for the NP project, we believe there could be substantial negative impacts from proposed construction along the transmission line ROW though Northumberland, New Hampshire. The extent of the negative impact on all types of wetlands and vernal pools cannot be determined without comprehensive studies to provide science based data on several environmental components that make up the rich diverse matrix of the area. Because the project is so extensive throughout the North Country, the cumulative effects of this work could be quite detrimental to wetlands, wildlife habitat and wildlife movements; many extending well beyond the relatively small impact areas delineated by consultants in the ROW. If the project moves forward, at minimum, there should be careful monitoring by professional biologists to ensure best management practices. The monitoring should continue for at least 3, and ideally 5 growing seasons until the area has stabilized with a goal of revegetation with native, non-invasive species, good water quality, and no erosion.