THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF JAMES A. MUNTZ

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name, title, and business address.

A. My name is James A. Muntz. I am the President of Transmission for Eversource Energy formerly known as Northeast Utilities ("Eversource" or "Company"). My business address is 56 Prospect Street, Hartford, Connecticut, 06103.

Q. Briefly summarize your educational background and work experience.

A. I hold a Bachelor of Science degree in Engineering and a Bachelor of Arts degree in Economics from Swarthmore College. I also earned a Master's in Business Administration (MBA) in Financial Management from Drexel University.

Immediately prior to becoming the President of Transmission, I was the Senior Vice President of Transmission. I also held the position of Vice President of Transmission Projects and Vice President of Customer Operations. Before joining Eversource, I held various leadership positions with Exelon / PECO in Pennsylvania, including Vice President positions in Transmission, Fossil Hydro Generation, and Nuclear. See Officer Profile at Attachment A.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q: What is the purpose of your testimony?

A. The Northern Pass transmission project ("Northern Pass" or the "Project") is being proposed by Northern Pass Transmission LLC ("NPT"). NPT is wholly owned by Eversource Transmission Ventures, Inc. ("Ventures"), itself a wholly-owned subsidiary of Eversource, a publicly-held public utility holding company. NPT is a single purpose entity created to construct, own, operate and maintain the Project.

My testimony describes the Project's inception and the route selection process, how the Project design was modified over time, the federal permitting process, and NPT's participation in the expected request for clean energy proposals from the States of Connecticut, Massachusetts, and Rhode Island ("Tri-State Clean Energy RFP"). In addition, I offer information about the Applicants' technical and managerial capability to construct and operate the Project.

Project Inception and Route Selection

Q. How did the Project arise?

A. Northern Pass arose in direct response to a longstanding, demonstrated need in New Hampshire and the New England region for a more diverse, low cost, clean energy supply.

When the Project was first conceived, regional energy prices were largely driven by high cost oil and gas, with the price of each tending to move in parallel. In the intervening years, changes in the energy market drove numerous generators to retire, leaving the region with fewer resources to meet its energy needs. Today, energy prices are primarily driven by the cost and availability of natural gas, a fuel that is in short supply at certain times of the year due to gas pipeline capacity constraints in New England. Northern Pass was designed to bring a reliable source of competitively priced, clean, renewable hydro power into the region, thereby delivering energy savings as well as environmental and economic benefits to the State of New Hampshire and the New England region.

The Project was developed in partnership with Hydro-Québec, a known and reliable producer and supplier of clean, renewable energy. Hydro-Québec has been reliably supplying energy to New England since the mid-1980s. Together NPT and Hydro-Québec have developed the necessary project elements on each side of the U.S./Canadian border to ensure a viable solution for meeting our energy and environmental needs. Notably, siting is already underway for the line supporting the Canadian portion of the Project.

The framework for the NPT and Hydro-Québec relationship is a transmission service agreement ("TSA") that has been reviewed and accepted by the Federal Energy Regulatory Commission ("FERC"). The TSA establishes a transparent mechanism for ensuring recovery of NPT's investment in building and operating the Project. This approach provides for reliable delivery of power by Hydro-Québec and predictable cost recovery. For additional information relating to the TSA, please see the pre-filed testimony of Michael Auseré.

Q. Describe the revised Project route announced in May 2013.

A. Following the inception of the Project, NPT made numerous changes. Initially, the Project was an all overhead design. In 2013, NPT altered the Project to include some underground segments and proposed a new overhead route for a portion of the North Section, the approximately 40 mile stretch where there is no existing transmission right-of-way ("ROW").

The Project was modified so that the route would travel from the U.S./Canadian border east and south through a less densely populated area of New Hampshire than the original route. Specifically, the towns in this portion of the North Section have a 70% lower population than the towns in which the original proposed route was located. In addition, the construction of the project in the North Section was modified so that it would be located on land that an affiliate of

NPT has purchased or leased, or obtained easements from willing landowners. Compared to the original preferred route, this portion of the proposed route used fewer parcels of land and included two underground segments, approximately 0.7 mile and 7.5 miles in length respectively. This route also included the use of additional existing ROW in the towns of Dummer, Stark and Northumberland.

The 2013 reconfiguration of the proposed route in the North Section also avoided all lakes or ponds that are subject to regulation under the New Hampshire Shoreland Water Quality Protection Act.

Q. Why is the Proposed Route the best choice among the alternatives?

A. The Proposed Route builds on the 2013 changes and provides the appropriate balance among several important considerations, including public concerns over iconic viewsheds, environmental and economic impacts as well as technical feasibility and the availability of land rights necessary to support the Project. Significantly, the new proposed route now includes approximately 60 miles of underground construction and, for some other areas, uses lower profile towers and monopoles rather than lattice structures. The underground construction eliminates visual impacts from the line in the White Mountain National Forest, Franconia Notch, the Rocks Estate area, and along the Appalachian Trail. From the original proposed design released in 2009, to the May 2013 alterations, to the current preferred route, NPT has modified the Project to meet many of the concerns raised by citizens in New Hampshire.

Q. Why won't the entire project be constructed underground?

A. The Project, as now proposed, balances several key priorities, including access to clean, reliable and low cost power for the State and the region; use of a reliable, proven technology; and, protection of New Hampshire's most sensitive resources. In order to balance these priorities, NPT proposed targeted incorporation of underground construction that will still maintain the economic viability of the Project while addressing the consistent concerns raised over potential impacts of an overhead line in the White Mountain National Forest and surrounding areas. The Project as proposed strikes an appropriate balance among these priorities; underground construction of the entire Project would disrupt this balance and render the Project economically infeasible.

Q. Please describe the changes in design and technology that resulted in a reduction in capacity from 1,200 megawatts to 1,090 megawatts.

A. The proposed reduction in the Project design capacity from 1200 MW to 1090 MW was precipitated by public concerns over potential impacts on New Hampshire's most sensitive resources. In response, NPT focused on limiting such impacts by proposing to construct the lines underground in selected areas.

The decision to shift significantly more of the Project underground forced a reduction in the Project design capacity because of supply, constructability and cost constraints associated with the type of cable required to build a 1200 MW design using traditional converter technology. Those supply and constructability constraints were eliminated when the Project switched to a different type of HVDC converter and cable technology. The limits on the amount of electric power this alternative cable and converter technology can deliver necessitated a reduction in the Project design capacity.

<u>Federal Permitting Process</u>

Q. Please provide a general description of the federal EIS process.

A. The National Environmental Policy Act ("NEPA") requires federal agencies to consider the potential environmental effects of their actions in advance of agency decision-making. More specifically, every "major Federal action significantly affecting the quality of the human environment" must be accompanied by "a detailed statement by the responsible official" that includes, among other things, an identification of the environmental impacts, adverse impacts that cannot be avoided and alternatives to the proposed action. These detailed statements are called Environmental Impact Statements or EISs. NEPA also requires federal agencies to consult with other federal and state agencies with relevant expertise or jurisdiction and to provide the public the opportunity for comment on the impacts of a proposed Federal action and reasonable alternatives through the EIS process.

Because it involves an international border crossing, the Project was required to seek a Presidential Permit from the U.S. Department of Energy ("DOE") to construct, operate and maintain electricity transmission facilities at the New Hampshire/Canada border. Before DOE can act on the NPT application for a Presidential Permit, a NEPA review is required.

Accordingly, DOE issued a Notice of Intent to prepare an EIS. Through the EIS process, a federal agency broadly consults with others interested in a proposed action. For a privately sponsored project like NPT that requires multiple federal and state permits, one agency takes the lead responsibility for the preparation of the EIS, and other agencies participate as cooperating agencies. In the case of NPT, DOE is the lead federal agency; the U.S. Forest Service, the Army Corps of Engineers, the U.S. Environmental Protection Agency and the State of N.H. Office of Energy and Planning are cooperating agencies. Other federal agencies actively working with DOE on the NPT EIS include the U.S. Fish and Wildlife Service, and the National Park Service. Additionally, the N.H. Division of Historic Resources (which serves as the State Historic Preservation Officer) has been coordinating with DOE in connection with its role under the National Historic Preservation Act.

The EIS process also includes multiple opportunities for public input. DOE issued a Notice of Intent to prepare an EIS in February 2011, inviting public comment. DOE held seven public meetings in New Hampshire to accept comment in 2011. DOE subsequently extended the scoping period because NPT announced its intention to prepare an amended application. After NPT filed an amended application in July 2013, DOE invited further public comment and held four additional scoping meetings in New Hampshire. That comment period closed in November 2013, and in March 2014, DOE issued a scoping report summarizing the public comments it had received. In May 2014, DOE issued a Scoping Report Alternatives Addendum, identifying alternatives to the Proposed Action, i.e., the project NPT proposed, that DOE had concluded, as of that date, it would also evaluate in its DEIS.

Based on information received from NPT, in the public comments, from data collection in the field and its own extensive analysis, DOE's environmental contractor and its specialized subcontractors prepared resource reports describing their findings and analysis. The reports were then summarized in the DEIS, which DOE issued for public comment on July 21, 2015. Based on the additional underground proposed by NPT after issuance of the DEIS, DOE decided to issue a supplemental DEIS followed by a period for additional public comment, currently scheduled to conclude on December 31, 2015. In addition to written comments, the DOE has indicated that it will hold three public hearings in December 2015 for the purpose of accepting public comment.

Following the collection and analysis of public comments, DOE will prepare a Final EIS. No less than 30 days after it issues the Final EIS, DOE will decide whether to issue a Presidential Permit that would allow the construction of electric transmission facilities at the border between

Canada and New Hampshire, and it will issue a Record of Decision (ROD) reflecting its conclusion. It is currently expected that the Final EIS will be issued during mid-2016, prior to the conclusion of the New Hampshire SEC proceeding.

Q. Please provide a summary of the alternatives analysis conducted in the federal EIS process, as represented by the DEIS.

A. As described in my response to the foregoing question about the EIS process, NEPA requires that an EIS include considerations of reasonable alternatives to a Proposed Action. In some cases, the only alternative to a Proposed Action that is considered in an EIS is the "No Action" alternative, which simply means the Proposed Action would not go forward. More commonly, however, one or more alternative means of meeting the same "purpose and need" of the Proposed Action are identified.

In the case of NPT, through its extensive public comment process and its consultations with other interested federal and state agencies, DOE identified in the Scoping Report Alternatives Addendum a total of 24 potential alternatives, including the Proposed Action and the No Action alternatives. Some of those 24 alternatives represented partial variations on either the Proposed Action or another alternative. For example, the Alternatives Addendum identified a variety of possible underground routes, either for the full length of the transmission line or for some segment thereof.

The Alternatives Addendum noted that the ongoing review in the EIS process could result in changes or additions to the 24 alternatives listed there. DOE further noted that the analysis it was conducting in the NEPA process would enable it to determine which of the alternatives were reasonable and therefore should be analyzed in detail in the DEIS and which alternatives were not feasible and therefore should be eliminated from detailed study.

Based on the analysis undertaken in the preparation of the DEIS, DOE concluded that there were 6 alternatives that deserved detailed analysis: the No Action alternative, the Proposed Action, the Proposed Action underground in the same corridor and three other alternatives with five overhead and underground routing variations. The DEIS identified another 16 alternatives that it concluded did not warrant detailed analysis, generally because they were not feasible from a physical or an engineering perspective, or because they did not meet the purpose and need at issue.

Overall, the Proposed Action was determined to have "low to moderate" impacts, with the identified impacts being primarily visual. These have been mitigated through additional underground segments, largely assessed in the DEIS within Alternatives 4c and 5c. These additional underground segments serve to eliminate visual impacts in the White Mountain National Forest, the Franconia Notch area, the Rocks Estate, and along the Appalachian National Scenic Trail. In other areas, as previously described, visual impacts have been mitigated by use of monopoles and lower structures.

Q. Is there a relationship between the federal EIS process and the State siting process?

A. There is no direct relationship between the federal EIS process and the State siting process. While there is substantial overlap with respect to subjects that each process analyzes, including consideration of the public interest, they each proceed independently. However, the DOE public comment period will occur early in the New Hampshire SEC process and thus, may further inform that process.

Q. Provide a summary of the Presidential Permit process.

A. DOE is required to approve the construction, connection, operation and maintenance of facilities for the transmission of electric power at the international borders between both the United States and Canada and the United States and Mexico. The necessary authorization is called a Presidential Permit. Because the Project would transmit electric power from Canada to New England, it requires a Presidential Permit.

In order to issue a Presidential Permit, DOE must find that a project would not impair reliability of the domestic electric power supply and is otherwise in the public interest. DOE has issued regulations requiring applicants for Presidential Permits to provide certain information to DOE to enable DOE to make the required determinations. DOE must also comply with NEPA before it can issue a Presidential Permit.

Specifically, for a project of the scope of NPT, DOE requires an applicant to submit information describing:

- The applicant, including any partners and any foreign ownership interests or agreements with foreign entities;

- The legal authority of the applicant to undertake the proposed project, including an opinion of counsel indicating that the project will be constructed, operated and maintained in accordance with all applicable law;
- Contracts with any foreign entities for the delivery of power from a proposed project;
- The technical features of the proposed project, including the number of circuits, the operating voltage, the nature and design of the conductors and conductor spacing and clearances (side and line-to-ground), structure design, spacing and wind and ice loading strengths;
- Details regarding any underground or underwater segments, including technical diagrams;
- Impacts on the bulk power system, including power transfer capability, system power flow plots with and without the proposed project, interference information and relay protection;
- Maps, plans, descriptions and location of the border-crossing facilities;
- Environmental impacts, including on wetlands, flood plains and other water resources, on wildlife habitats and threatened and endangered species, on federal and Indian lands, and on historic and cultural resources.
- Details concerning the proposed transmission right-of-way, including the width, and the plans for operations and maintenance of the transmission right-of-way; and
- Alternatives to the proposed routing.

Based on the information submitted by the applicant and the views of other federal and state agencies and comments submitted by the public in the NEPA process, DOE determines whether it can make the required public interest and reliability determinations and issue a Presidential Permit. Importantly, in the DEIS, DOE states that its "Proposed Action is to issue a Presidential permit for the Project." See DEIS p. 2-3.

DOE does not make a final determination on the Presidential Permit until after it has consulted with the Secretary of State and the Secretary of Defense and issued a ROD in the NEPA process. If DOE concludes a project should be permitted but the Secretary of State or the

Secretary of Defense opposes issuance of the Presidential Permit, the President must make the final decision.

Tri-State Clean Energy RFP

Q. Please provide an overview of the Tri-State Clean Energy RFP.

A. Connecticut, Massachusetts, and Rhode Island are preparing to issue a request for proposals for Clean Energy and Transmission in order to identify projects that will advance the clean energy goals of those three states. Those states are expected to select one or more projects through the RFP process and pay for the selected project(s).

Q. Will NPT participate in the Tri-State Clean Energy RFP?

A. Yes, NPT expects to participate.

Q. How will the Tri-State Clean Energy RFP affect New Hampshire?

A. If Northern Pass is selected and constructed, New Hampshire customers will not bear any of the expenses but will still experience the State and regional benefits of the Project.

Technical and Managerial Capability

Q. Please provide an overview of the Applicants' technical and managerial capability to construct and operate the project.

A. NPT is a subsidiary of Eversource, operator of New England's largest utility system, serving more than 3.6 million electric and natural gas customers across Connecticut, Massachusetts and New Hampshire. Eversource is both a Fortune 500 and Standard & Poor's 500 energy company. Eversource owns and operates approximately 4,270 circuit miles of transmission lines, 72,000 pole miles of distribution lines and 578 transmission and distribution stations.

Eversource is a leading expert in building, owning and operating transmission facilities. It is an Edison Award recipient for outstanding development and construction of four critical projects. It has approximately $7.6 billion in transmission rate base. Over the three years ended December 31, 2014, Eversource invested over $2.0 billion[1] in transmission related assets.

Eversource is currently enhancing the reliability of the electric grid with a number of significant construction projects involving high-voltage transmission lines in Connecticut,

[1] Ibid, page 34 – sum of 2012-2014 transmission capital expenditures.

Massachusetts and New Hampshire. Its electric transmission investment over the next five years is projected to be approximately $3.9 billion, inclusive of NPT.

In recent years, Eversource has been working on a significant number of other transmission projects including the Greater Springfield Reliability Project (GSRP), the Interstate Reliability Project (Interstate), and the Central Connecticut Reliability Project, which are three of the four major projects that are part of the New England East-West Solution. Jerry Fortier, the Project Director for Northern Pass, led construction efforts for each of these major projects.

For additional information concerning the Project and the Applicants' technical and managerial capabilities, please see the pre-filed Testimony of Jerry Fortier.

Q. Do you have any concluding comments to make?

A. Yes. The Northern Pass Project will deliver much needed reliable, competitively priced, clean, and renewable hydropower to New Hampshire and the New England region at no cost to New Hampshire customers. The benefits to New Hampshire are significant. Through the Forward New Hampshire Plan, approximately $3.8 billion in benefits will inure to the State over the first twenty years of commercial operation. The Project has made numerous changes to its route and design to reflect concerns raised by the general public, abutters, environmental groups, state and local officials.

Q. Does this conclude your testimony?

A. Yes, it does.

Northeast Utilities

Officer Profile

JAMES A. MUNTZ

James A. Muntz is the President of Transmission for Northeast Utilities (NU). Muntz has overall leadership and management responsibility for NU's Transmission operations in Connecticut, New Hampshire and Massachusetts. He also has responsibility for the Northern Pass and other development activities. NU Transmission has placed almost $5 billion in service over the last 8 years, ensuring regional reliability and largely eliminating 'congestion' charges for customers.

A native of Philadelphia, Pennsylvania, Muntz joined CL&P in 2002 as Vice President of Customer Operations, moving to Transmission in 2005.

Previously, Jim held various leadership positions with Exelon/PECO in Pennsylvania, including Vice President positions in Transmission, Fossil Hydro Generation, and Nuclear.

Muntz graduated from Swarthmore College in Pennsylvania with a Bachelor of Science degree in Engineering and a Bachelor of Arts degree in Economics, and earned an MBA in Financial Management from Drexel University.

Jim resides in West Hartford with his wife, Deb, and three college age children.

July 2014

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF WILLIAM J. QUINLAN

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Personal Background

Q. Please state your name, title, and business address.

A. My name is William J. Quinlan and I am the President and Chief Operating Officer at Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH"). My business address is 780 North Commercial St, Manchester, New Hampshire 03101.

Q. Briefly summarize your educational background and work experience.

A. I graduated from Villanova University in 1982 with a Bachelor of Science in Mechanical Engineering. I received my Master of Business Administration from the University of New Haven in 1989 and a Juris Doctorate from the University of Connecticut School of Law in 1992.

I joined Northeast Utilities ("NU") in 1984 as an assistant engineer in the nuclear program. In 1993, I joined the NU legal department as an attorney and eventually became Deputy General Counsel. From 2003 to 2007, I served as President and Chief Operating Officer of NU Enterprises, Inc. ("NUEI"), the holding company for NU's competitive businesses. Subsequently, I became Vice President/Customer Solutions at the Connecticut Light and Power Company ("CL&P") and Yankee Gas Services Company ("Yankee Gas"), responsible for key customer facing and technology functions. I also served as Vice President/Field Maintenance, overseeing operations, maintenance, transportation, supply chain and facilities functions. Immediately prior to assuming my current position, I served as Senior Vice President/Emergency Preparedness for the NU operating companies, CL&P and Yankee Gas. In that role, I was responsible for leading preparation for and response to emergencies, as well as establishing protocols to partner effectively with federal, state, and municipal officials. Please see my biography at Attachment A for additional details.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, although I will be submitting testimony for the Seacoast Reliability Project in the near future.

Q. What is the purpose of your testimony?

A. I provide an overview of the Northern Pass Transmission Project ("Northern Pass" or the "Project") as proposed by Northern Pass Transmission LLC ("NPT"), and explain the benefits that the Forward New Hampshire Plan ("Forward NH Plan" or the "Plan"), including the Project, will bring to the State of New Hampshire.

Q. What is your role with respect to the Plan?

A. I led the effort to develop the Plan, which was designed to provide specific benefits to New Hampshire beyond the benefits naturally occurring from the delivery of 1,090 MW of low carbon, competitively priced power from Hydro Québec. The Project will lower energy costs in New Hampshire by over $80 million annually, create thousands of jobs, increase Gross Domestic Product by over $210 million during construction, pay an estimated $30 million in taxes per year, and reduce CO_2 emissions annually by over 3.3 million tons. The Plan recognizes that New Hampshire, as host to the Project, deserves to receive unique and direct benefits.

Project Overview

Q. Please describe the Northern Pass Project.

A. The Project is a proposed +/- 320 kV HVDC electric transmission line with 1,090 MW transfer capability running approximately 192 miles from the international border between Canada and Pittsburg, New Hampshire to Franklin, New Hampshire, where it will connect with a 345 kV alternating current ("AC") line that will ultimately interconnect with the existing transmission system in Deerfield, New Hampshire. The Project is designed to deliver reliable, competitively priced, clean renewable hydropower into New Hampshire and the New England region. As proposed, the Project includes approximately 60 miles of underground construction around sensitive viewsheds such as the White Mountain National Forest, Franconia Notch area, the Rocks Estate area and along the Appalachian Trail. The remaining overhead sections are located on NPT leased properties, existing transmission rights of way or public roadways. Based on feedback from our visual and historical consultants and from the public at a series of Public Information Sessions, the Project substituted additional single streamlined structures (i.e. "monopoles") in place of lattice structures at a variety of locations.

Q. How will Northern Pass help to address energy challenges in the State and the region?

A. Northern Pass is an important step in addressing New Hampshire's and the region's energy supply diversity problem because it will enable the delivery up to 1,090 MW of electricity that is base load (non-intermittent) and will not depend on natural gas. The Project will directly address the volatility of electricity prices during winter months by reducing the region's dependence on natural gas by adding 5% of non-gas fired generation to the regional supply mix. Also, the Project is estimated to generate approximately $80 million per year in savings for New Hampshire customers alone.

Q. What segments of the Project will be constructed underground?

A. The Project includes three underground segments. The first underground segment is in the vicinity of the Route 3 bridge-crossing of the Connecticut River in Pittsburg and Clarksville. This underground segment will be approximately 0.7 miles long.

The second underground segment is located in Clarksville and Stewartstown. This underground segment will be approximately 7.5 miles long. It begins on property owned or leased by NPT in Clarksville, continues onto Route 145 and progresses along Old County Road into Stewartstown where it will continue onto North Hill Road, Bear Rock Road and to property owned or leased by NPT on Heath Road, where it will transition to an overhead line.

The third underground cable segment is approximately 52 miles in length and starts in the Town of Bethlehem where the transmission ROW intersects Route 302, travels to and along Route 18 and ends at the intersection of the transmission ROW and Route 3 in Bridgewater. The route would be constructed along Routes 18, 116, 112 and 3. The towns that this underground cable would be located within include Bethlehem, Sugar Hill, Franconia, Easton, Woodstock, Thornton, Campton, Plymouth and Bridgewater.

Q. Please explain how the proposed underground segments were chosen.

A. As a result of extensive public outreach and feedback received through the outreach process, NPT assessed options for underground segments that would avoid impacts in and around the most sensitive areas of the State. A variety of factors were considered in determining the location of the proposed underground segments. These factors included availability of aerial ROW and public highway corridors; public concerns about potential visual impacts; the existence of sensitive viewsheds in and around the White Mountain National Forest, the Franconia Notch area, the Rocks Estate area and along the Appalachian Trail; the technical feasibility of underground construction in a given area; and, the ability to acquire land rights to support underground construction and associated transition stations. The preferred route was confirmed following the issuance of the Draft Environmental Impact Statement ("DEIS") by the Department of Energy ("DOE") on July 21, 2015.

Q. Please explain why additional underground construction is being proposed.

A. During the federal environmental process, numerous comments suggested utilizing road corridors as an alternative to existing aerial rights of way. In addition, a consistent theme of the public comments urged more use of underground placement to reduce impacts on New Hampshire's most sensitive resources. The present proposal strikes a balance between the use of existing aerial rights of way and some public highway corridors.

New Hampshire Benefits

Q. Please describe the Forward NH Plan.

A. Since Northern Pass was initially announced in 2010, Project representatives have met with hundreds of people from across the State to listen to their concerns and receive input on the proposed Project. The Forward NH Plan was developed to address the two leading concerns expressed about the Project as previously proposed. Specifically, I have heard consistently that the Project did not provide clear benefits to New Hampshire and that an overhead line through the White Mountains and surrounding areas was incompatible with people's affection for the area.

As a result of this input, the Forward NH Plan includes a redesign of the Project route and numerous benefits specifically designed for the State of New Hampshire. The Forward NH Plan will provide access to a reliable, clean, renewable energy source, which will diversify the regional energy market at no cost to New Hampshire customers and provide approximately $3.8 billion in benefits from the Project over a 20 year period.

Q. How does the Forward NH Plan address the concerns you have heard regarding the White Mountains and the surrounding areas?

A. The route has been redesigned to replace overhead lines in and around the White Mountain National Forest, the Franconia Notch area, the Rocks Estate area, and along the Appalachian Trail with a new 52-mile section of underground line. The new route incorporates portions of the underground route alternatives studied by the DOE and eliminates potential visual impacts to some of the State's most sensitive scenic resources. In addition, monopole structures are being used at certain locations along the overhead portion of the route to minimize or avoid potential visual impacts in these areas.

Q. Please describe the energy cost savings that New Hampshire customers will realize once the Project is commissioned.

A. The Project will provide approximately $80 million in annual savings to New Hampshire businesses and residential customers due to energy and capacity market price suppression from the injection of low cost hydropower into the New England transmission system. In addition, PSNH will enter into a power purchase agreement ("PPA") with Hydro-Québec for reliable clean hydroelectric power solely for the benefit of its customers. This agreement will provide beneficial pricing and price stability to help insulate PSNH customers from the volatility of the power markets. It is estimated that the PPA will provide customer savings of approximately $100 million over the term of the PPA.

Q. How will New Hampshire workers benefit from the Forward NH Plan?

A. Northern Pass will create over 2,600 jobs in New Hampshire at the peak of construction. There will be opportunities for local workers to train for jobs on power line projects and for local contractors and businesses to bid on work related to construction of the Project. In addition, Northern Pass will also provide a boost to New Hampshire businesses, including suppliers, restaurants and lodging.

The Project is committed to a "New Hampshire First" approach which will ensure that new jobs created by the Project are made available to New Hampshire workers first. A Project Labor Agreement ("PLA"), which all NPT contractors will be required to adhere to, will also help to ensure that New Hampshire workers are the first to benefit from the construction of the Project. PSNH and NPT have developed and implemented an innovative training program, the New Hampshire Energy Jobs Partnership, which is providing highly desirable job opportunities and careers for New Hampshire residents.

NPT has also established a $7.5 million North Country Jobs Creation Fund, and provided initial seed money in the amount of $200,000. The fund is directed by local individuals and the money has been and will be spent toward important economic development and job creation opportunities in the region.

Q. What impact will the Forward NH Plan have on tax revenues?

A. The Project will also provide significant tax benefits to the State and the local host communities, while not requiring any additional local or governmental services. NPT will pay over $30 million in local, county and state property taxes in its first year of operation.

Q. How will the Plan impact New Hampshire's economy?

A. The Project will significantly increase economic growth in the State. At the peak of construction in 2018, NPT will increase New Hampshire's Gross Domestic Product (GDP) by approximately $214 million and by approximately $2.2 billion during construction and beyond. During commercial operation, local economic impacts are primarily driven by retail electricity savings; however, NPT is also providing additional support to New Hampshire with over $3.5 million per year of direct spending in the form of operations and maintenance expenditures for Northern Pass' infrastructure and other community funding initiatives.

Q. Please describe any additional New Hampshire-specific economic benefits from the Project.

A. As part of its commitment to New Hampshire, NPT will establish the Forward New Hampshire Fund ("Forward NH Fund" or the "Fund"), a $200 million ($10 million a year for 20 years) fund targeted to support community betterment, clean energy innovation, tourism and economic development. The emphasis for this Fund will be on host communities and, in particular, host communities in the North Country. The Fund will operate through an Advisory Board structure including municipal and community leaders, representatives of the business community, environmental organizations, North Country leaders and other key stakeholders.

Q. Please describe the New Hampshire-specific environmental benefits associated with the Project.

A. The Project will help achieve the New Hampshire Climate Action Plan objectives, and help to meet the Regional Greenhouse Gas Initiative goals by eliminating over 3.3 million tons of carbon dioxide (CO_2) emissions per year in New England, which is the equivalent of removing approximately 690,000 passenger vehicles from the road annually.

As part of the NH Forward Plan, NPT has established a $3 million natural resources partnership with the National Fish and Wildlife Foundation ("NFWF"). Through this partnership, NPT and the NFWF will pursue national resource initiatives aimed at restoring and sustaining healthy forests and rivers. The two organizations will also collaborate with environmental organizations, governmental agencies, research universities, and the University of New Hampshire in pursuing their objectives.

Q. How does the Forward NH Plan impact new or existing renewable resources?

A. The Project will improve the Coos Transmission Loop and by completing important upgrades to the electric transmission system in the North Country. By improving the Coos Loop, the Project will enhance the electric system in the North Country and unlock up to 100 MWs of existing and future sources of renewable energy for the State and region.

Q. Please describe any additional benefits specifically targeted for New Hampshire's North Country.

A. In the North Country, NPT has committed up to 5,000 acres of land for natural resource preservation, recreational activities, and additional mixed uses that are important to the North Country's future. As I previously noted, the allocation of funds from the Forward NH Fund will prioritize projects benefitting host communities in the North Country.

Q. Do you have any concluding comments to make?

A. Yes, the Forward NH Plan was designed to ensure that the State of New Hampshire receives direct and significant benefits as the host of Northern Pass. First, the Plan benefits New Hampshire residents by providing a new source of economic clean energy to the region through the construction and operation of the Project. The Plan incorporates a total of over 60 miles of underground construction through some of the state's most sensitive scenic areas to avoid potential visual impacts to these important resources. In addition, the Plan reduces carbon emissions and energy costs, provides energy cost stability, increases tax revenues, jobs and overall economic growth. Finally, the Plan includes a $200 million fund that will be focused on community betterment, clean energy innovation, economic development and tourism—four key areas of concern identified by New Hampshire stakeholders.

Q. Does this conclude your testimony?

A. Yes, it does.

EVERSOURCE Energy

WILLIAM J. QUINLAN

President, New Hampshire Operations

Quinlan is responsible for ensuring the safe and reliable delivery of electricity to over 500,000 of Eversource's NH customers, as well as overseeing the construction, operation, and maintenance of Eversource's NH's electricity infrastructure.

Most recently, Quinlan served as Senior Vice President/Emergency Preparedness for Northeast Utilities (NU) operating companies Connecticut Light and Power Company (CL&P) and Yankee Gas, where he was responsible for leading preparation for and response to emergencies, as well as establishing protocols to partner effectively with federal, state, and municipal officials.

Previously, Quinlan served as Vice President/Customer Solutions at CL&P and Yankee Gas, overseeing key customer-facing and technology functions, including engineering, metering, Smart Grid, distributed generation, energy efficiency, community relations, account executives, and economic development. He also served the companies as Vice President/Field Maintenance, overseeing the operations, maintenance, transportation, supply chain, and facilities functions.

Quinlan has extensive operations, policy, legal, regulatory, technology and business experience, first joining NU in 1984 as an assistant engineer in the nuclear program. In 1993, he joined NU's Legal Department as an attorney and later became deputy general counsel. From 2003 to 2007, Quinlan served as President and Chief Operating Officer of NU Enterprises, Inc. (NUEI), the holding company for NU's competitive businesses. Before joining NU, he was employed by the General Electric Company at its Knolls Atomic Power Laboratory in upstate New York.

A native of New Haven, Connecticut, Quinlan graduated from Villanova University in 1982 with a Bachelor of Science in Mechanical Engineering. He received a Master of Business Administration from the University of New Haven in 1989 and a Juris Doctorate from the University of Connecticut School of Law in 1992. Quinlan is vice chairman of the electric industry's National Response Executive Committee and member of the University of Connecticut's Foundation Board, New Hampshire Business and Industry Association Board and the American Red Cross-Northern New England Region Board. He was formerly on the boards for Connecticut Yankee, Maine Yankee, and Yankee Atomic power companies.

March 2015

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF MICHAEL J. AUSERÉ

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name and business address.

A. My name is Michael J. Auseré. My business address is 107 Selden Street, Berlin, CT 06037.

Q. By whom are you employed and in what capacity?

A. I am the Vice President of Energy Planning & Economics. I am employed by Eversource Energy Service Company ("Eversource Service Company").[1] Eversource Service Company is a wholly-owned subsidiary of Eversource Energy ("Eversource"),[2] a public utility holding company system. Eversource Service Company provides centralized services such as accounting, finance, treasury, legal, purchasing and administrative functions to Eversource's subsidiaries including Northern Pass Transmission LLC ("NPT"). NPT is wholly-owned by Eversource Transmission Ventures, itself a wholly-owned subsidiary of Eversource, which is publicly held public utility holding company and is a single purpose entity formed for the sole purpose of constructing and operating the Northern Pass Transmission Project ("Northern Pass" or the "Project").

Q. What are your areas of responsibility in this position?

A. My responsibilities include business development, market analysis and project analysis for Eversource and its subsidiaries. I report to the Executive Vice President of Enterprise Energy Strategy & Business Development.

Q. Please describe your employment experience and educational background.

A. Prior to my current position, I was the Vice President of Financial Planning & Analysis at Eversource. I was responsible for corporate financial forecasting, planning and analysis and transaction support for Eversource and its subsidiaries.

I came to Eversource in 2009 from Energy Future Holdings ("EFH") in Dallas, Texas where I served as Vice President of Planning and Analysis for its electric generation and wholesale marketing and trading businesses. Prior to that position, I was Vice President and

---

[1] On February 2, 2015, Northeast Utilities Service Company commenced doing business as Eversource Energy Service Company. Effective July 1, 2015, Northeast Utilities Service Company changed its name to Eversource Energy Service Company.

[2] On February 2, 2015, Northeast Utilities and each of its wholly owned utility subsidiaries commenced doing business as Eversource Energy. Effective April 30, 2015, Northeast Utilities changed its name to Eversource Energy.

Controller for EFH's retail and wholesale marketing and trading businesses. Before joining EFH in 2000, I spent eight years with PricewaterhouseCoopers in work that was heavily focused on the energy sector. My assignments included lead manager of the worldwide audit of ExxonMobil.

I graduated from the University of Texas at Austin with a Bachelor of Business Administration in Accounting and a Master in Professional Accounting. See my biography at Attachment A.

Q. What is the purpose of your testimony?

A. My testimony will demonstrate that NPT has the financial capability to construct and operate the Project. Attachments B and B-1 are statements of assets and liabilities for Eversource and Public Service Company of New Hampshire d/b/a Eversource ("PSNH") as required by Site 301.03 (b) (7) and (h) (6). I also describe the decommissioning plan for the Project.

Q. What is the basis for your position?

A. NPT's financial capability to construct and operate the NPT Line in continuing compliance with the terms and conditions of a Certificate issued by the Site Evaluation Committee is based on (1) the financial strength of NPT's parent, Eversource, and Eversource's experience financing, constructing, and operating transmission facilities in New England; (2) the contract NPT executed with Hydro Renewable Energy Inc. ("HRE"), i.e., the Transmission Service Agreement ("TSA") approved by the Federal Energy Regulatory Commission ("FERC"); and, (3) the financial strength of HRE's parent, Hydro-Québec ("HQ").

Q. Please describe NPT.

A. As shown in Attachment C, the Eversource organization chart, NPT is a direct, wholly owned subsidiary of Eversource Energy Transmission Ventures, Inc. ("EETV"), which is in turn a direct, wholly-owned subsidiary of Eversource. EETV was formed as a holding company to own transmission related businesses that are not owned by Eversource's state regulated utility subsidiaries. NPT was formed as a single purpose entity to construct, own and operate the NPT Line. NPT's principal place of business is New Hampshire. The financial strength of Eversource, which operates New England's largest energy delivery system, assures that adequate funds will be available to NPT for construction of the NPT Line.

Q. Please describe HRE.

A. HRE is a single-purpose entity that is an indirect, wholly-owned subsidiary of HQ. HRE and NPT are counter-parties to the TSA, which is described below.

Q. Please describe the TSA.

A. The TSA is a bilateral, cost-based, FERC approved, transmission service agreement pursuant to which NPT will provide firm transmission service to HRE over the NPT Line in exchange for payment of NPT's costs for developing, constructing, operating and maintaining the Project. HQ (or a subsidiary of HQ) will have the opportunity to recover its transmission payments through sales of electricity into the New England market. The essential elements of the arrangement between NPT and HRE contemplate that: (1) NPT will construct, finance, and own Northern Pass; (2) NPT will provide firm transmission service to HRE over Northern Pass,, which will permit HQ (or a subsidiary of HQ) to sell power into New England; and (3) HRE will pay NPT for firm transmission service pursuant to a FERC-approved, cost-based formula rate that will enable NPT to recover the costs of development and construction plus a return on investment over a period of 40 years. Attachment D provides an illustration of the participants and the cash flow of the TSA.

The TSA was approved by FERC on February 11, 2011, in Docket No. ER11-2377. Amendments to the TSA were accepted by FERC on January 13, 2014, in Docket No. ER14-597. FERC had previously determined, in Docket No. EL09-20, that the structure of the transaction as a participant-funded, cost-based transmission project is consistent with long-standing open access policies. The cash flows under the TSA will provide NPT the financial capability to operate the Project over its useful life, the ability to collect all of its costs in a timely manner from a reliable counter-party, and the ability to decommission the Project when it is retired from service.[3]

[3] Eversource and H.Q. Energy Services (U.S.) Inc. intend to respond to a Clean Energy Request for Proposals (RFP) sponsored by the states of Massachusetts, Connecticut, and Rhode Island, which is expected to be released in 2015. If the project is selected, some costs may be passed through to customers in the three states. Eversource anticipates that the TSA would be amended as necessary to reflect a successful bid.

Eversource

Q. Please provide an overview of Eversource.

A. Eversource is a public utility holding company subject to regulation by Federal Energy Regulatory Commission ("FERC") under the Public Utility Holding Company Act of 2005. Eversource engages in the energy delivery business through the following regulated wholly-owned utility subsidiaries:[4] The Connecticut Light and Power Company ("CL&P"); NSTAR Electric Company ("NSTAR Electric"); PSNH, Western Massachusetts Electric Company ("WMECO"); NSTAR Gas Company ("NSTAR Gas"); and Yankee Gas Services Company ("Yankee Gas"). Eversource's regulated subsidiaries have combined electric and natural gas customers of over 3.6 million[5] in Massachusetts, Connecticut and New Hampshire. While Eversource's regulated subsidiaries own both transmission and distribution assets, Eversource manages the transmission and distribution segments as separate businesses. Attachment E is a map of the Eversource service territories.

Eversource's electric distribution segment consists of the distribution businesses of CL&P, NSTAR Electric, PSNH and WMECO, which are engaged in the distribution of electricity to retail customers in Connecticut, eastern Massachusetts, New Hampshire and western Massachusetts, respectively, plus the regulated electric generation businesses of PSNH and WMECO. Eversource's natural gas distribution segment consists of the distribution businesses of NSTAR Gas and Yankee Gas, which are engaged in the distribution of natural gas to retail customers in eastern Massachusetts and Connecticut, respectively. CL&P, NSTAR Electric, PSNH and WMECO each owns and maintains transmission facilities that are part of an interstate power transmission grid over which electricity is transmitted throughout New England. These transmission facilities comprise Eversource's electric transmission business.

Eversource is ranked number 359 on the 2014 Fortune 500 list of largest U.S. companies with an equity market capitalization of approximately $16 billion.[6] Eversource's equity trades on the New York Stock Exchange. Eversource has over $7.5 billion of outstanding publicly traded long-term debt. Eversource, with an A (stable) corporate credit rating from S&P, has the

[4] On February 2, 2015, Eversource's wholly-owned utility subsidiaries commenced doing business as Eversource Energy.
[5] Eversource 2014 Form 10-K, Selected Consolidated Sales Statistics, page 27.
[6] At September 30, 2015, Eversource's closing price was $50.62 with 317 million shares outstanding.

strongest S&P credit rating among the 53 shareholder-owned electric utility companies in the United States. Over the last three years Eversource had internally generated approximately $4.5 billion in cash flows from operations.[7] As indicated in the Eversource Consolidated Financial Data included in Attachment F, Eversource is a large, stable and profitable enterprise.

Q. Please describe Eversource's experience in financing energy infrastructure.

A. Eversource has a proven track record of financing large energy projects. As of June 30, 2015, the net book value of the property, plant and equipment associated with all of Eversource's business segments was $19.1 billion.[8] During the three years ended December 31, 2014, Eversource invested over $4.5 billion[9] in new energy infrastructure. With respect to Eversource's transmission segment, the total assets were over $7.6 billion[10] as of December 31, 2014. Over the three years ended December 31, 2014, Eversource invested over $2.0 billion[11] in transmission related assets. As indicated in Attachment G, Eversource financed its investments in new energy infrastructure with a combination of internally generated cash flows and debt.

Q. Please describe Eversource's future plans to develop new energy infrastructure.

A. For the four years ending December 31, 2018, Eversource plans to invest $8.4 billion[12] in new energy infrastructure. As indicated in Attachment H, Eversource plans to invest $3.9 billion in electric transmission infrastructure, including the Project. Eversource plans to finance these new investments with internally generated cash and new debt issuances. It does not anticipate issuing new common stock.

Q. What are Eversource's corporate credit ratings?

A. Eversource is rated by the three major credit rating agencies. As indicated in Attachment I, Eversource has an investment grade rating and a stable long-term outlook from each of the agencies. On April 23, 2015, S&P raised the corporate credit ratings of Northeast Utilities (now Eversource) from an A- (positive outlook) to an A (stable outlook) making Eversource the highest S&P-rated company among the 53 shareholder-owned electric utility

---

[7] Eversource 2014 Form 10-K, page 67 – sum of 2012-2014 Net Cash Flows Provided by Operating Activities.
[8] Eversource June 30, 2015, Form 10-Q, page 1.
[9] Eversource 2014 Form 10K, page 67 – sum of 2012-2014 Investments in Property, Plant and Equipment.
[10] Ibid, page 136.
[11] Ibid, page 34 – sum of 2012-2014 transmission capital expenditures.
[12] Ibid, page 36.

companies in the United States.

Q. Do these credit ratings contemplate Eversource's plans to invest $8.4 billion in new energy infrastructure over the next four years?

A. Yes. In their evaluation of Eversource's balance sheet strength, the rating agencies consider Eversource's forecast of expected capital expenditures, including its planned investment in the Project.

<u>Development of Northern Pass</u>

Q. How much has Eversource invested in the Project to date?

A. Eversource has provided all of NPT's equity and debt financing to date. As of June 30, 2015, NPT has financed its investment in Northern Pass with $90.5 million of Eversource capital. Of this amount, $52.9 million was financed through intercompany loans from Eversource and $37.6 million was financed by equity contributions from Eversource. Including NPT's Retained Earnings of $13.1 million as of June 30, 2015, the $90.5 million of debt and equity funding from Eversource has allowed NPT to maintain a capital structure of approximately 50 percent equity and 50 percent debt, which is consistent with the TSA that requires NPT to use commercially reasonable efforts to maintain a capital structure equal to 50 percent equity and 50 percent debt from and after the development phase of the Project. Additionally, Eversource, through its indirect wholly-owned New Hampshire real estate subsidiary Renewable Properties, Inc. ("RPI"), has invested $49.7 million in the acquisition of certain properties where the Project will be constructed.

In the aggregate, Eversource has invested $140.2 million in the Project through June 30, 2015, an indication of Eversource's commitment and ability to finance the project. NPT has capitalized costs that relate to planning, developing, permitting and siting the project into a FERC construction work in progress account. Costs incurred to date are for the legal, environmental, engineering and communications efforts for the Department of Energy Presidential Permit, the New Hampshire Site Evaluation Committee Permit, the US Forest Service Permit, the ISO New England Inc. Elective Transmission Upgrade Approval, the Army Corp of Engineers Permit and FERC-related requirements.

<u>Construction of Northern Pass</u>

Q. What is the total expected cost of Northern Pass?

A. The total expected cost of the Project is approximately $1.6 billion. Except for the properties acquired by RPI, all of the costs associated with the development and construction of the Project will be incurred by NPT.

Q. How will NPT finance the construction of Northern Pass?

A. As discussed above, the TSA requires NPT to use commercially reasonable efforts to closely maintain a capital structure of 50 percent equity and 50 percent debt. Consequently, NPT expects to fund half of the development and construction cost with equity from Eversource and half with debt.

Q. Please describe the expected source of NPT's debt during construction of the NPT Line.

A. As noted above, Eversource has provided all of NPT's debt via intercompany financings. At this early stage of the Project, inter-company loans from Eversource are an efficient approach for NPT to incur debt. NPT is evaluating alternative approaches to borrowing and may continue to fund construction through inter-company loans or borrow directly from third parties. For example, the TSA recognizes the possibility that HQ could enter into a construction loan agreement with NPT.

Q. Will Eversource be able to fund half of the construction of the Project with equity contributions?

A. Yes. As I previously discussed, Eversource and its subsidiaries invested over $4.5 billion in new energy infrastructure during the three years ended December 31, 2014. Of this amount, $2.0 billion pertained specifically to electric transmission assets similar to the Project. Eversource funded these investments with its strong cash flows combined with the issuance of long- and short- term debt.

A large portion of the cash flows generated by the operating companies are earnings. Quarterly, each of the operating companies dividend a portion of their earnings to Eversource, the parent company. Eversource uses the cash dividends received from its subsidiaries to pay its expenses, dividends to its shareholders and make new equity contributions into its subsidiaries.

I believe that Eversource will continue to have strong cash flows and ready access to the capital markets into the foreseeable future.

Q. What insurance will NPT carry?

A. The TSA requires NPT and its construction contractors to carry adequate insurance to provide coverage against liability or damage resulting from the construction or operation of the Project. Types of insurance and coverage amounts will be comparable to other projects of similar size and character currently operated by Eversource companies and consistent with "good utility practices." All premiums and other costs of property, liability or other insurance obtained by NPT will be recoverable under the formula rate in the TSA.

Operation of Northern Pass

Q. Please describe NPT's source of capital once the Project is in-service.

A. Once Northern Pass commences operation, NPT will begin receiving monthly revenue from HRE under the formula rate in the TSA. These revenues will provide ample cash flows to satisfy its obligations to debt and equity investors and meet its working capital needs. During commercial operation of the Project, NPT is obligated by the TSA to use commercially reasonable efforts to maintain the same 50 percent equity and 50 percent debt capital structure that it closely maintained during development and construction. This capital structure and strong cash flows provided under the TSA should enable NPT to obtain an investment grade credit rating that will allow it to access the public bond markets. Additionally, as an Eversource company, NPT will continue to have access to Eversource's short term borrowing facilities.

Q. How are NPT's revenues determined under the TSA?

A. Under the TSA, NPT will use a FERC-approved formula rate to calculate HRE's payment obligations for transmission service over Northern Pass. The formula rate recovers a return on investment plus associated income taxes, depreciation expense, operation and maintenance expenses, administrative and general expenses, municipal tax expense and other expenses associated with the Project. The formula rate calculates costs on a prospective basis and then trues up such projected costs to actual costs in order for NPT to recover the annual revenue requirements associated with the Project.

Decommissioning of Northern Pass

Q. Please describe the plan to decommission Northern Pass.

A. Section 9.3 of the TSA addresses decommissioning of the Project, which includes "the work required to (a) retire the NPT Line and dismantle the materials, equipment and structures comprising the NPT Line and (b) restore and rehabilitate any land affected by the construction or dismantlement of the NPT Line, in each case, as required by Applicable Law." NPT will begin to collect the costs of decommissioning over the last sixty months of commercial operation. Six months before the decommissioning payment period begins, NPT will provide a plan to the management committee set up under the TSA, which will include an estimate of decommissioning costs and a description of the scope and frequency of progress reports for monitoring decommissioning. HRE is obligated to pay for decommissioning costs as part of the FERC-approved formula rate.

Hydro-Québec

Q. Please describe the financial strength of HQ.

A. HQ is Canada's largest electric utility and is one of the largest power generators and transmission companies in North America. HQ is a crown corporation incorporated under the Hydro-Québec Act and is owned by the province of Québec. HQ has been selling power to the New England energy market for the past several decades. HQ operates in a resilient economy with adequate cash and investment balances, and exceptional access to capital. See Attachment J for HQ's credit ratings.

Q. What assurances does NPT have that HRE will be able to meet its financial obligations under the TSA?

A. The TSA requires HRE's parent, HQ, to provide NPT a guaranty of HRE's current and future payment obligations. Once construction begins, the guaranty is required to cover the amount of NPT's incurred project costs plus earnings and projected decommissioning costs.

<u>Conclusion</u>

Q. In your opinion, will NPT have the requisite financial capability to construct and operate the Project?

A. Yes, NPT currently has and will continue to have the financial capability to construct and operate the Project. NPT also has the financial capability to decommission the Project, if necessary.

Q. Does that conclude your testimony?

A. Yes.

Attachment A
Biography of Michael J. Auseré

EVERSOURCE Energy

Michael J. Auseré is Vice President – Energy Planning & Economics for Eversource Energy (formerly Northeast Utilities). Michael's responsibilities include business development, market analysis and project analysis for Eversource and its subsidiaries. Prior to his current role, Michael was the Vice President – Financial Planning & Analysis and was responsible for corporate financial forecasting, planning and analysis and transaction support for Eversource and its subsidiaries.

Michael joined Eversource in 2009 from Energy Future Holdings (EFH) in Dallas, Texas, where he was Vice President of Planning and Analysis for EFH's electricity generation and wholesale marketing and trading businesses. Michael also previously served as Vice President and Controller for EFH's retail and wholesale marketing and trading businesses. Formerly known as TXU Corporation, EFH is the largest power generator in Texas.

Prior to joining EFH in 2000, Michael spent eight years with PricewaterhouseCoopers in work that was heavily focused on the energy sector. His assignments included lead manager on the worldwide audit of ExxonMobil.

Michael is a Certified Public Accountant who graduated from the University of Texas in Austin with a Bachelor of Business Administration in Accounting and a Master in Professional Accounting.

Attachment B

Eversource Energy Statement of Assets and Liabilities

NORTHEAST UTILITIES AND SUBSIDIARIES
CONSOLIDATED BALANCE SHEETS

(Thousands of Dollars)	As of December 31, 2014	2013
ASSETS		
Current Assets:		
Cash and Cash Equivalents	$ 38,703	$ 43,364
Receivables, Net	856,346	765,391
Unbilled Revenues	211,758	224,982
Taxes Receivable	337,307	16,629
Fuel, Materials and Supplies	349,664	303,233
Regulatory Assets	672,493	535,791
Prepayments and Other Current Assets	226,194	197,659
Total Current Assets	2,692,465	2,087,049
Property, Plant and Equipment, Net	18,647,041	17,576,186
Deferred Debits and Other Assets:		
Regulatory Assets	4,054,086	3,758,694
Goodwill	3,519,401	3,519,401
Marketable Securities	515,025	488,515
Other Long-Term Assets	349,957	365,692
Total Deferred Debits and Other Assets	8,438,469	8,132,302
Total Assets	$ 29,777,975	$ 27,795,537
LIABILITIES AND CAPITALIZATION		
Current Liabilities:		
Notes Payable	$ 956,825	$ 1,093,000
Long-Term Debt - Current Portion	245,583	533,346
Accounts Payable	868,231	742,251
Regulatory Liabilities	235,022	204,278
Other Current Liabilities	828,720	702,776
Total Current Liabilities	3,134,381	3,275,651
Deferred Credits and Other Liabilities:		
Accumulated Deferred Income Taxes	4,467,473	4,029,026
Regulatory Liabilities	515,144	502,984
Derivative Liabilities	409,632	624,050
Accrued Pension, SERP and PBOP	1,638,558	896,844
Other Long-Term Liabilities	874,387	923,053
Total Deferred Credits and Other Liabilities	7,905,194	6,975,957
Capitalization:		
Long-Term Debt	8,606,017	7,776,833
Noncontrolling Interest - Preferred Stock of Subsidiaries	155,568	155,568
Equity:		
Common Shareholders' Equity:		
Common Shares	1,666,796	1,665,351
Capital Surplus, Paid In	6,235,834	6,192,765
Retained Earnings	2,448,661	2,125,980
Accumulated Other Comprehensive Loss	(74,009)	(46,031)
Treasury Stock	(300,467)	(326,537)
Common Shareholders' Equity	9,976,815	9,611,528
Total Capitalization	18,738,400	17,543,929
Commitments and Contingencies (Note 11)		
Total Liabilities and Capitalization	$ 29,777,975	$ 27,795,537

The accompanying notes are an integral part of these consolidated financial statements.

NORTHEAST UTILITIES AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF INCOME

(Thousands of Dollars, Except Share Information)	For the Years Ended December 31, 2014	2013	2012
Operating Revenues	$ 7,741,856	$ 7,301,204	$ 6,273,787
Operating Expenses:			
Purchased Power, Fuel and Transmission	3,021,550	2,482,954	2,084,364
Operations and Maintenance	1,427,589	1,514,986	1,583,070
Depreciation	614,657	610,777	519,010
Amortization of Regulatory Assets, Net	10,704	206,322	79,762
Amortization of Rate Reduction Bonds	-	42,581	142,019
Energy Efficiency Programs	473,127	401,919	313,149
Taxes Other Than Income Taxes	561,380	512,230	434,207
Total Operating Expenses	6,109,007	5,771,769	5,155,581
Operating Income	1,632,849	1,529,435	1,118,206
Interest Expense:			
Interest on Long-Term Debt	345,001	340,970	316,987
Interest on Rate Reduction Bonds	-	422	6,168
Other Interest	17,105	(2,693)	6,790
Interest Expense	362,106	338,699	329,945
Other Income, Net	24,619	29,894	19,742
Income Before Income Tax Expense	1,295,362	1,220,630	808,003
Income Tax Expense	468,297	426,941	274,926
Net Income	827,065	793,689	533,077
Net Income Attributable to Noncontrolling Interests	7,519	7,682	7,132
Net Income Attributable to Controlling Interest	$ 819,546	$ 786,007	$ 525,945
Basic Earnings Per Common Share	$ 2.59	$ 2.49	$ 1.90
Diluted Earnings Per Common Share	$ 2.58	$ 2.49	$ 1.89
Weighted Average Common Shares Outstanding:			
Basic	316,136,748	315,311,387	277,209,819
Diluted	317,417,414	316,211,160	277,993,631

The accompanying notes are an integral part of these consolidated financial statements.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

	2014	2013	2012
Net Income	$ 827,065	$ 793,689	$ 533,077
Other Comprehensive Income/(Loss), Net of Tax:			
Qualified Cash Flow Hedging Instruments	2,037	2,049	1,971
Changes in Unrealized Gains/(Losses) on Other Securities	315	(940)	217
Changes in Funded Status of Pension, SERP and PBOP Benefit Plans	(30,330)	25,714	(4,356)
Other Comprehensive Income/(Loss), Net of Tax	(27,978)	26,823	(2,168)
Comprehensive Income Attributable to Noncontrolling Interests	(7,519)	(7,682)	(7,132)
Comprehensive Income Attributable to Controlling Interest	$ 791,568	$ 812,830	$ 523,777

The accompanying notes are an integral part of these consolidated financial statements.

NORTHEAST UTILITIES AND SUBSIDIARIES
CONSOLIDATED STATEMENTS OF COMMON SHAREHOLDERS' EQUITY

(Thousands of Dollars, Except Share Information)	Common Shares Shares	Common Shares Amount	Capital Surplus, Paid In	Retained Earnings	Accumulated Other Comprehensive Income/(Loss)	Treasury Stock	Total Common Shareholders' Equity
Balance as of January 1, 2012	177,158,692	$ 980,264	$ 1,797,884	$ 1,651,875	$ (70,686)	$ (346,667)	$ 4,012,670
Net Income				533,077			533,077
Shares Issued in Connection with NSTAR Merger	136,048,595	680,243	4,358,027				5,038,270
Other Equity Impacts of Merger with NSTAR			2,938	421			3,359
Dividends on Common Shares - $1.32 Per Share				(375,527)			(375,527)
Dividends on Preferred Stock				(7,029)			(7,029)
Issuance of Common Shares, $5 Par Value	408,018	2,040	11,287				13,327
Long-Term Incentive Plan Activity			(3,897)				(3,897)
Issuance of Treasury Shares to Fund ESOP	438,329		8,454			8,043	16,497
Other Changes in Shareholders' Equity			8,574				8,574
Net Income Attributable to Noncontrolling Interests				(103)			(103)
Other Comprehensive Loss					(2,168)		(2,168)
Balance as of December 31, 2012	314,053,634	1,662,547	6,183,267	1,802,714	(72,854)	(338,624)	9,237,050
Net Income				793,689			793,689
Dividends on Common Shares - $1.47 Per Share				(462,741)			(462,741)
Dividends on Preferred Stock				(7,682)			(7,682)
Issuance of Common Shares, $5 Par Value	560,848	2,804	8,274				11,078
Long-Term Incentive Plan Activity			(10,748)				(10,748)
Issuance of Treasury Shares	659,077		17,381			12,087	29,468
Other Changes in Shareholders' Equity			(5,409)				(5,409)
Other Comprehensive Income					26,823		26,823
Balance as of December 31, 2013	315,273,559	1,665,351	6,192,765	2,125,980	(46,031)	(326,537)	9,611,528
Net Income				827,065			827,065
Dividends on Common Shares - $1.57 Per Share				(496,524)			(496,524)
Dividends on Preferred Stock				(7,519)			(7,519)
Issuance of Common Shares, $5 Par Value	288,941	1,445	5,164				6,609
Long-Term Incentive Plan Activity			(9,569)				(9,569)
Issuance of Treasury Shares	1,420,837		37,817			26,070	63,887
Other Changes in Shareholders' Equity			9,657	(341)			9,316
Other Comprehensive Loss					(27,978)		(27,978)
Balance as of December 31, 2014	316,983,337	$ 1,666,796	$ 6,235,834	$ 2,448,661	$ (74,009)	$ (300,467)	$ 9,976,815

The accompanying notes are an integral part of these consolidated financial statements.

Attachment B-1
PSNH Financial Statements – Source 2014 Northeast Utilities Form 10-K

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE AND SUBSIDIARY
CONSOLIDATED BALANCE SHEETS

	As of December 31,	
(Thousands of Dollars)	2014	2013
ASSETS		
Current Assets:		
Cash	$ 489	$ 130
Receivables, Net	80,151	76,331
Accounts Receivable from Affiliated Companies	3,194	90
Unbilled Revenues	40,181	38,344
Fuel, Materials and Supplies	148,139	128,736
Regulatory Assets	111,705	92,194
Prepayments and Other Current Assets	42,392	24,100
Total Current Assets	426,251	359,925
Property, Plant and Equipment, Net	2,635,844	2,467,556
Deferred Debits and Other Assets:		
Regulatory Assets	293,115	219,346
Other Long-Term Assets	39,228	39,891
Total Deferred Debits and Other Assets	332,343	259,237
Total Assets	$ 3,394,438	$ 3,086,718
LIABILITIES AND CAPITALIZATION		
Current Liabilities:		
Notes Payable to NU Parent	$ 90,500	$ 86,500
Long-Term Debt - Current Portion	-	50,000
Accounts Payable	93,349	82,920
Accounts Payable to Affiliated Companies	33,734	22,040
Regulatory Liabilities	16,044	20,643
Accumulated Deferred Income Taxes	36,164	28,596
Other Current Liabilities	38,969	51,729
Total Current Liabilities	308,760	342,428
Deferred Credits and Other Liabilities:		
Accumulated Deferred Income Taxes	587,292	500,166
Regulatory Liabilities	51,372	51,723
Accrued Pension, SERP and PBOP	93,243	15,272
Other Long-Term Liabilities	50,155	46,247
Total Deferred Credits and Other Liabilities	782,062	613,408
Capitalization:		
Long-Term Debt	1,076,286	999,006
Common Stockholder's Equity:		
Common Stock	-	-
Capital Surplus, Paid In	748,240	701,911
Retained Earnings	486,459	438,515
Accumulated Other Comprehensive Loss	(7,369)	(8,550)
Common Stockholder's Equity	1,227,330	1,131,876
Total Capitalization	2,303,616	2,130,882
Commitments and Contingencies (Note 11)		
Total Liabilities and Capitalization	$ 3,394,438	$ 3,086,718

The accompanying notes are an integral part of these consolidated financial statements.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF INCOME

(Thousands of Dollars)	For the Years Ended December 31, 2014	2013	2012
Operating Revenues	$ 959,500	$ 935,402	$ 988,013
Operating Expenses:			
Purchased Power, Fuel and Transmission	313,732	269,754	319,253
Operations and Maintenance	261,848	267,797	263,234
Depreciation	98,436	91,581	87,602
Amortization of Regulatory Liabilities, Net	(29,602)	(20,387)	(24,086)
Amortization of Rate Reduction Bonds	-	19,748	56,645
Energy Efficiency Programs	14,286	14,494	14,245
Taxes Other Than Income Taxes	71,417	67,196	66,025
Total Operating Expenses	730,117	710,183	782,918
Operating Income	229,383	225,219	205,095
Interest Expense:			
Interest on Long-Term Debt	45,116	44,370	46,228
Interest on Rate Reduction Bonds	-	(154)	2,687
Other Interest	233	1,960	1,313
Interest Expense	45,349	46,176	50,228
Other Income, Net	2,045	3,455	3,008
Income Before Income Tax Expense	186,079	182,498	157,875
Income Tax Expense	72,135	71,101	60,993
Net Income	$ 113,944	$ 111,397	$ 96,882

The accompanying notes are an integral part of these consolidated financial statements.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

Net Income	$ 113,944	$ 111,397	$ 96,882
Other Comprehensive Income, Net of Tax:			
Qualified Cash Flow Hedging Instruments	1,162	1,162	1,162
Changes in Unrealized Gains/(Losses) on Other Securities	19	(54)	13
Changes in Funded Status of SERP Benefit Plan	-	(3)	2
Other Comprehensive Income, Net of Tax	1,181	1,105	1,177
Comprehensive Income	$ 115,125	$ 112,502	$ 98,059

The accompanying notes are an integral part of these consolidated financial statements.

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF COMMON STOCKHOLDER'S EQUITY

(Thousands of Dollars, Except Stock Information)	Common Stock Stock	Common Stock Amount	Capital Surplus, Paid In	Retained Earnings	Accumulated Other Comprehensive Income/(Loss)	Total Common Stockholder's Equity
Balance as of January 1, 2012	301	$ -	$ 700,285	$ 388,910	$ (10,832)	$ 1,078,363
Net Income				96,882		96,882
Dividends on Common Stock				(90,674)		(90,674)
Allocation of Benefits - ESOP			767			767
Other Comprehensive Income					1,177	1,177
Balance as of December 31, 2012	301	-	701,052	395,118	(9,655)	1,086,515
Net Income				111,397		111,397
Dividends on Common Stock				(68,000)		(68,000)
Allocation of Benefits - ESOP			859			859
Other Comprehensive Income					1,105	1,105
Balance as of December 31, 2013	301	-	701,911	438,515	(8,550)	1,131,876
Net Income				113,944		113,944
Dividends on Common Stock				(66,000)		(66,000)
Capital Contributions from NU Parent			45,000			45,000
Allocation of Benefits - ESOP			1,329			1,329
Other Comprehensive Income					1,181	1,181
Balance as of December 31, 2014	301	$ -	$ 748,240	$ 486,459	$ (7,369)	$ 1,227,330

The accompanying notes are an integral part of these consolidated financial statements.

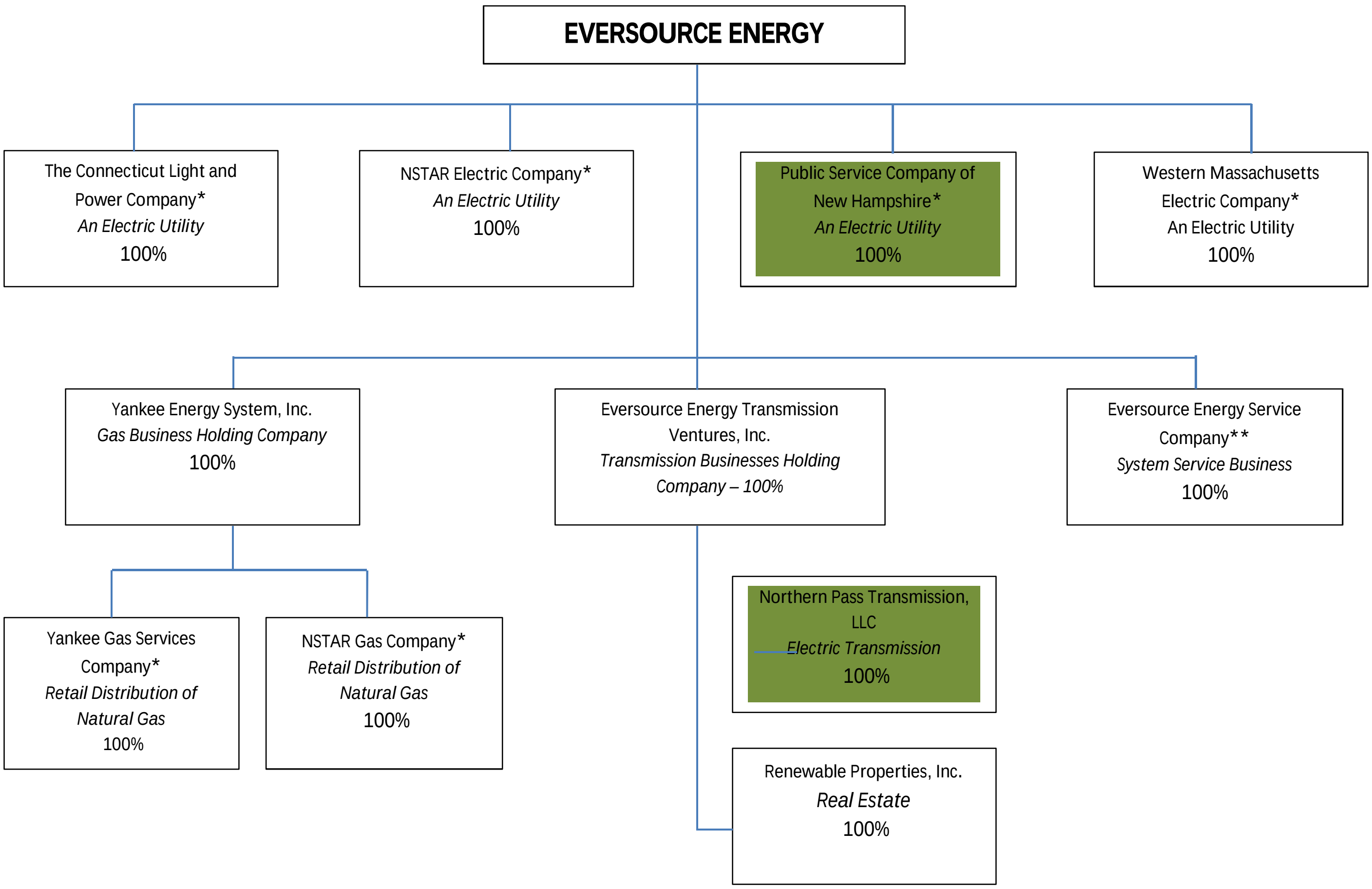
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE AND SUBSIDIARY
CONSOLIDATED STATEMENTS OF CASH FLOWS

(Thousands of Dollars)	For the Years Ended December 31, 2014	2013	2012
Operating Activities:			
Net Income	$ 113,944	$ 111,397	$ 96,882
Adjustments to Reconcile Net Income to Net Cash Flows			
Provided by Operating Activities:			
Depreciation	98,436	91,581	87,602
Deferred Income Taxes	94,813	75,693	58,552
Pension, SERP and PBOP Expense	7,197	26,846	26,312
Pension and PBOP Contributions	(2,482)	(112,964)	(96,880)
Regulatory Underrecoveries, Net	(11,875)	(8,481)	(183)
Amortization of Regulatory Liabilities, Net	(29,602)	(20,387)	(24,086)
Amortization of Rate Reduction Bonds	-	19,748	56,645
Proceeds from DOE Damages Claim	14,453	-	-
Other	10,095	16,079	11,205
Changes in Current Assets and Liabilities:			
Receivables and Unbilled Revenues, Net	(15,576)	2,412	(84)
Fuel, Materials and Supplies	(19,403)	(33,391)	25,897
Taxes Receivable/Accrued, Net	(23,857)	26,462	(9,752)
Accounts Payable	17,796	2,632	(15,248)
Other Current Assets and Liabilities, Net	(5,972)	(9,520)	13,436
Net Cash Flows Provided by Operating Activities	247,967	188,107	230,298
Investing Activities:			
Investments in Property, Plant and Equipment	(256,159)	(186,009)	(203,902)
Decrease in Notes Receivable from Affiliate	-	-	55,900
(Increase)/Decrease in Special Deposits	(1,013)	22,040	4,200
Other Investing Activities	(139)	(88)	(135)
Net Cash Flows Used in Investing Activities	(257,311)	(164,057)	(143,937)
Financing Activities:			
Cash Dividends on Common Stock	(66,000)	(68,000)	(90,674)
Increase in Short-Term Debt	4,000	23,200	-
Issuance of Long-Term Debt	75,000	250,000	-
Retirements of Long-Term Debt	(50,000)	(198,235)	-
Retirements of Rate Reduction Bonds	-	(29,294)	(56,074)
Increase in Notes Payable to NU Parent	-	-	63,300
Capital Contributions from NU Parent	45,000	-	-
Other Financing Activities	1,703	(4,084)	(476)
Net Cash Flows Provided by/(Used in) Financing Activities	9,703	(26,413)	(83,924)
Net Increase/(Decrease) in Cash	359	(2,363)	2,437
Cash - Beginning of Year	130	2,493	56
Cash - End of Year	$ 489	$ 130	$ 2,493

The accompanying notes are an integral part of these consolidated financial statements.

Attachment C

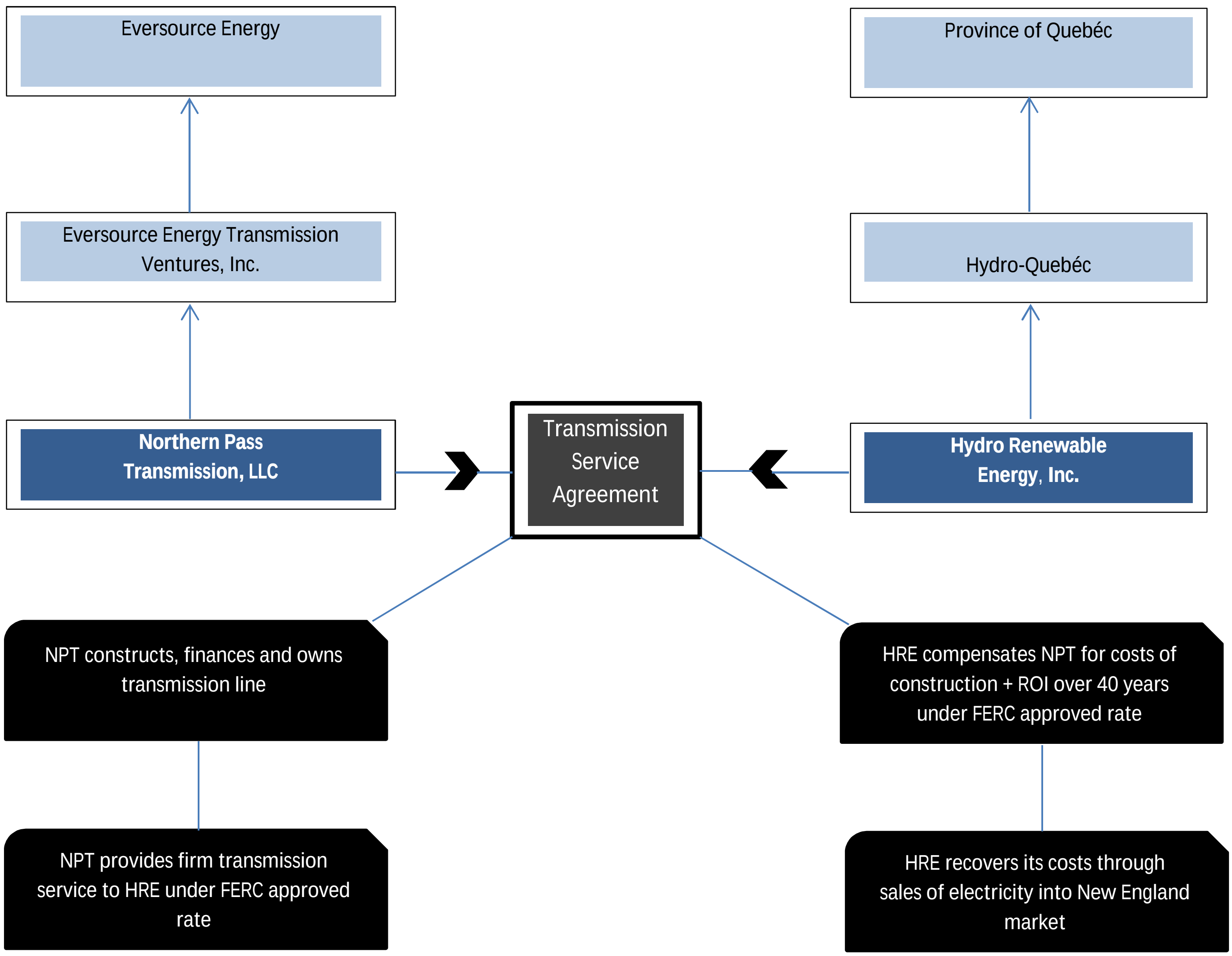
Eversource Energy Corporate Chart
Of Major Subsidiaries
Effective April 30, 2015



***dba Eversource Energy**

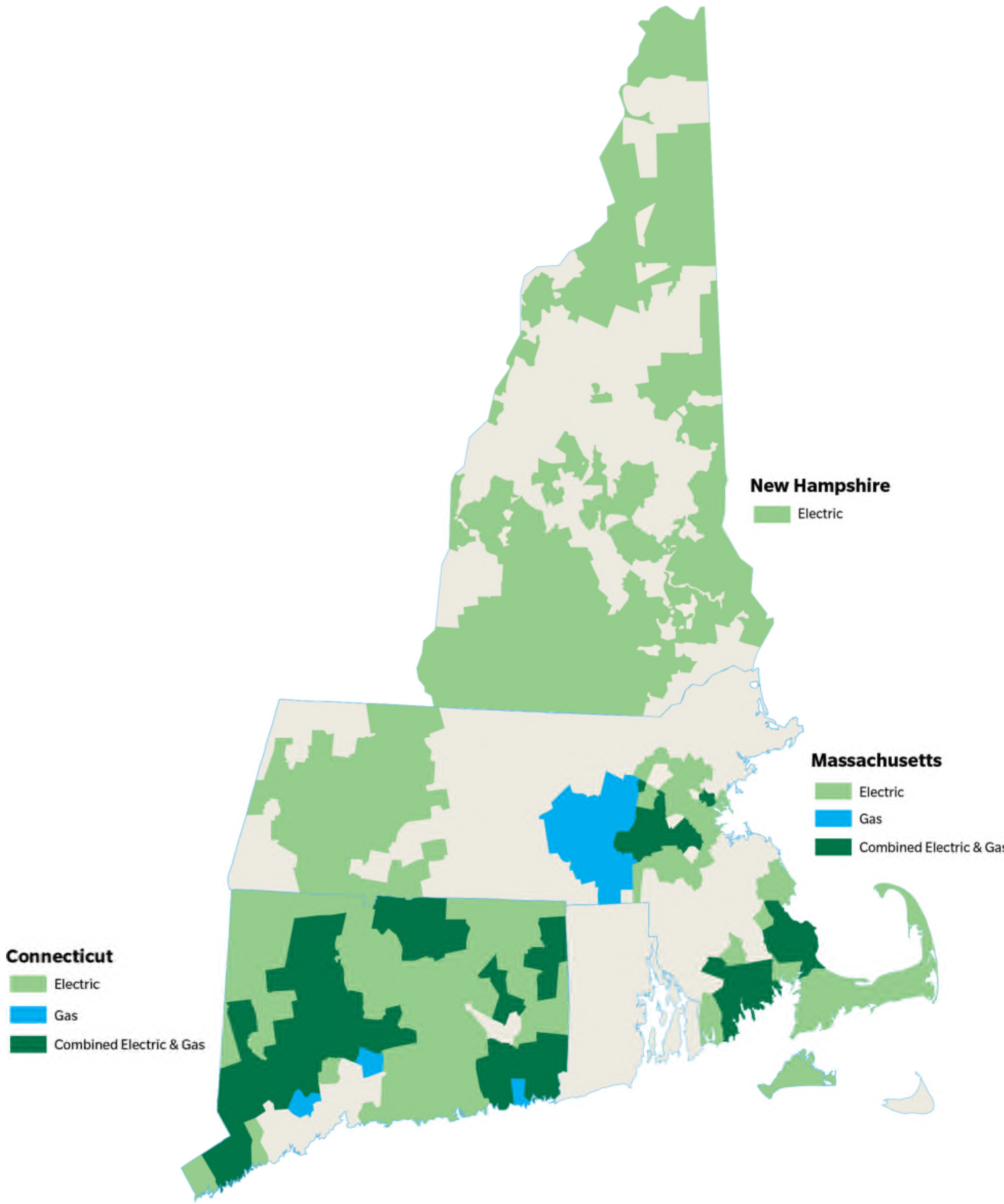
Attachment D

The Transmission Service Agreement



Attachment E

Eversource Service Territory Map



Attachment F

Eversource Energy Selected Consolidated Financial Data – Balance Sheet and Income Statement

(Millions of Dollars)	**2014**	**2013**	**2012**
Balance Sheet Data:			
Property, Plant and Equipment, Net	$18,647	$17,576	$16,605
Total Assets	29,778	27,796	28,303
Total Capitalization (a)	18,984	18,077	17,356
Income Statement Data:			
Operating Revenues	7,742	7,301	6,274
Net Income	827	794	533

(a) Includes portions due within one year

Source: 2014 Eversource Energy Form 10-K, page 26

Attachment G

Eversource Energy Selected Consolidated Cash Flow Data – Funds from Operations and Debt Issuances

(Millions of Dollars)	**2014**	**2013**	**2012**	**Total**
Net Cash Flows Provided by Operating Activities	$ 1,635	$ 1,664	$ 1,161	$ 4,460
Issuance of Long-Term Debt	725	1,680	850	3,255
Increase / (Decrease) in Short-Term Debt	285	(397)	825	713
Total	1,010	1,283	1,675	3,968

Source: 2014 Eversource Energy Form 10-K, page 67

Attachment H

Eversource Energy Projected Transmission Capital Expenditures

(Millions of Dollars)	**2015**	**2016**	**2017**	**2018**	**Total**
Eversource Energy Transmission Companies, Excluding NPT	$706	$ 659	$ 601	$ 480	$2,446
NPT[13]	34	309	620	466	1,429
Total Eversource Energy Transmission Segment	740	968	1,221	946	3,875

Source: 2014 Eversource Energy Form 10-K, page 36

[13] Project estimate has, subsequent to 10-K issuance, increased to $1.6 billion in total

Attachment I

Eversource Parent Credit Ratings and Outlook (as of September 30, 2015)

	S&P		Moody's		Fitch	
	rating	outlook	rating	outlook	rating	outlook
Corporate Credit Rating	A	stable	Baa1	stable	BBB+	stable

Attachment J

Hydro-Québec Credit Ratings and Outlook

	S&P		Moody's		Fitch	
	rating	outlook	rating	outlook	rating	outlook
Corporate Credit Rating	No Rating*		Aa2	stable	AA-	negative
Senior Unsecured Debt	A+	n/a**	Aa2	stable	AA-	negative

*Hydro-Québec's parent, the Province of Québec, has an issuer rating of A+ (stable) from S&P.
**S&P has not assigned a ratings outlook to Hydro-Québec's Senior Unsecured Debt.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF JERRY FORTIER

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name, title, and business address.

A. My name is Jerry Fortier. I am a Project Director at Eversource Energy ("Eversource"), currently assigned to the Northern Pass Transmission Project ("Northern Pass" or the "Project") being developed by Northern Pass Transmission LLC, an Eversource company ("NPT" or the "Company"). My business address is 56 Prospect Street, Hartford, Connecticut, 06103.

Q. Briefly summarize your educational background and work experience.

A. I hold an Associate's degree in Electrical Engineering from the Wentworth Institute of Technology in Boston, Massachusetts, a Bachelor's of Arts degree in Organizational Management from Ashford University in Clinton, Iowa and a Master's Certification in Project Management from George Washington University in Washington, D.C. I have directed and managed numerous other transmission line and substation projects for Eversource.

I was previously the project manager of the Greater Springfield Reliability Project (GSRP), the Interstate Reliability Project (Interstate), and the Central Connecticut Reliability Project (CCRP), which are three of the four major projects that are part of the New England East-West Solution. GSRP designed to address specific weaknesses in the transmission system around the Springfield, Massachusetts area and provide businesses and residents in the Greater Springfield area with improved access to competitively priced power. Interstate is designed to address weaknesses in the east/west and west/east transmission of power across Connecticut, Rhode Island, and Massachusetts. In 2013, the long-term reliability of the bulk power system in the Greater Hartford and Central Connecticut area was studied by ISO-New England. This study, called the Greater Hartford / Central Connecticut Study (GHCC), included a more comprehensive geographic area than the original scope of the proposed Central Connecticut Reliability Project to address flow-through and load-supply issues under certain dispatch patterns, contingency conditions, and transfer conditions. Attachment A is my resume, which includes a list of other projects I have managed.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is your role in the Project?

A. I am a Project Director, currently assigned responsibility for the overall design and construction of NPT.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide an overview of the Project, summarize the construction plans, including plans to give hiring priority to local New Hampshire workers, explain post-construction operations and to describe the Applicants' technical and managerial capability to construct and operate the Project.

Key Project Elements

Q. Please provide an overview of the proposed Project.

A. NPT proposes to construct a high voltage direct current ("HVDC") electric transmission line with a 1,090 MW transfer capability running from the international border between New Hampshire and Canada to Franklin, New Hampshire, where it will connect to a new station that will convert the energy from HVDC to alternating current ("AC"). From this station, a new 345 kV AC line will extend approximately 34 miles in order to interconnect with the existing transmission system at the existing substation located in Deerfield, New Hampshire. The Project will also require upgrades at the existing Deerfield substation and the Scobie Pond substation located in Londonderry, each of which is owned and operated by Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH"), a wholly-owned subsidiary of Eversource.

The northern HVDC converter terminal will be constructed by Hydro Québec at its Des Cantons Substation in the Province of Québec, Canada; it will be connected to an HVDC line that will run southward in Québec for approximately 47 miles, where it will cross the U.S. and Canadian border into Pittsburg, New Hampshire. The New Hampshire segment of the HVDC line will continue southward for approximately 158.3 miles to the southern HVDC converter terminal. As part of the Project, the line will consist of three underground cable segments totaling approximately 60.5 miles.

NPT will lease approximately 99.5 miles of existing electric transmission right-of-way ("ROW") from PSNH in two segments. From Pittsburg, the line will extend southerly on land or in ROW belonging to entities other than PSNH for approximately 40 miles (approximately 8 miles of this segment would be installed underground in public roads). After reaching Dummer, the Project will travel overhead in ROWs owned by PSNH between Dummer and Bethlehem over a distance of approximately 40.5 miles (the "Northern Segment"). From Bethlehem, for a distance of approximately 52 miles through the White Mountain region and down to Bridgewater, Northern Pass will be located primarily underground in public roads. Thereafter, the Project will continue overhead in PSNH's ROWs from Bridgewater to a HVDC/AC converter station to be constructed by NPT in Franklin, New Hampshire. Once converted, Northern Pass will continue as a 345 kV AC line from Franklin along approximately 34 miles of ROWs owned by PSNH to an existing PSNH substation in Deerfield, New Hampshire (together with the Bridgewater to Franklin corridor, the "Southern Segment"). For additional information regarding the land rights associated with the Project, please see section (b)(6) of the Application. The Project map sheets can also be found in Appendix 1.

Once the Project is commissioned, and ready for commercial operation, ISO-NE will assume operational control pursuant to the terms of a FERC-approved Transmission Operating Agreement between NPT LLC and ISO-NE. The Project will enable the transmission of 1,090 MW of power between Québec and New England. Its objective is to provide clean, renewable, competitively-priced electricity for consumers in New Hampshire and the rest of New England.

Q. What are the key physical features of the Project?

A. The key components of the Project, described below, are the HVDC line, the converter terminal and the 345 kV AC line. Other components of the Project that are required to support the interconnection to the regional transmission system are included in the Project Description, which is located in section (h)(1) of the Application.

The heart of the Project is the construction of the +/- 320 kV DC transmission line from the Québec border to Franklin NH. The HVDC line will be approximately 158.3 miles in length with 97.8 miles of overhead construction and approximately 60.5 miles of underground construction.

The overhead portions of the HVDC line will consist of a 32 mile section where new rights have been secured to locate the line. Twenty-four miles of the 32 mile section are within a working forest that is already frequently cleared. The remaining 65.8 miles of overhead will be installed in existing PSNH ROW that already has existing transmission and distribution lines. For the area where the HVDC line will be located within an existing ROW, where necessary, portions of the existing transmission and distribution lines will be relocated to allow room for the HVDC line construction.

The underground cables will be installed in three sections with a total Project length of 60.5 miles. The three areas are 1) a 0.7 mile segment in the towns of Pittsburg and Clarksville in the vicinity of the Route 3 bridge crossing of the Connecticut River, 2) a 7.5 mile segment in the towns of Clarksville and Stewartstown and 3) a 52.3 mile segment starting in the Town of Bethlehem at Route 302 and ending at the intersection of the transmission ROW and Route 3 in Bridgewater. The 52.3 mile segment would be constructed within Routes 302, 18, 116, 112 and 3. At the six locations (one at each end of the cable segment) where the overhead line transitions between the overhead line and cable, a transition station will be installed. The transition station will resemble a small substation and will be approximately 75' by 130'. Equipment in the transition station will include a terminal structure, surge arresters, instrument transformers, cable terminators communications equipment and a small control enclosure.

The converter station is located in Franklin, New Hampshire. The site was selected for three reasons. First, NPT was able to locate, and purchase from a willing landowner, a previously disturbed parcel that is large enough to accommodate the converter terminal. In addition, the use of this site facilitates the potential use and incorporation of the 345 kV by PSNH into a reliability project should ISO-NE determine that the AC line, together with other system improvements, would provide transmission system reliability benefits in the future. Finally, the site is located close to the existing ROW.

The conversion of energy from HVDC to AC will be done at a Converter Terminal that has as its core operation feature a Voltage Source Converter ("VSC"). The converter terminal footprint is approximately 10 acres and will be located within a 118 acre parcel in Franklin, NH. The main components of the VSC include:

- A DC area where the line enters the terminal. Equipment in this area includes disconnect switches, circuit breakers, capacitors, reactors and instrument transformers.
- The conversion from HVDC to AC takes place in a valve hall. This is a building that is approximately 235' by 180'. The main electrical component that transforms the energy between AC and DC is the insulated gate bi-polar transistor ("IGBT"). An IGBT is an electronic device that essentially builds an AC voltage from the HVDC voltage. In addition to the IGBTs,

HVDC reactors are located in the valve hall. A control room and unmanned office space will be located adjacent to the valve hall.

- The AC portion of the Converter Terminal includes the converter transformers, reactors, filters, capacitors, instrument transformers, disconnect switches and circuit breakers. The entire Converter Terminal will be located within a security fence.

Q. Please describe the steps being taken to allow NPT to utilize the existing PSNH transmission corridor.

A. Concurrently with the filing of the Application, NPT will submit to the New Hampshire Public Utilities Commission ("PUC") a Petition to Commence Business as a Public Utility in the State of New Hampshire. In addition, both PSNH and NPT will seek approval by the PUC of a lease that will allow NPT to use existing PSNH ROW.

Q. Please describe the ROW and any widening that will be required to construct the Project.

A. The transmission corridor in the new portion of the North Section where there is no preexisting transmission ROW, will be 120 feet wide. The line was redesigned to reduce the portion of the ROW that will be cleared. As described previously, much of this new corridor is a working forest and subject to routine timber harvesting. The 120 foot width was selected because it will accommodate not only the operation of the transmission line, but also construction, maintenance and repair activities. It is designed to accommodate both steady state and extreme weather conditions, based on both NESC design requirements and good utility practice.

As previously described, for the Central and South Sections and a portion of the North Section, Northern Pass intends to use existing transmission ROW under its lease with PSNH. The width of the existing ROW varies from 150 feet to 392.5 feet.

Q. Explain what upgrade work will be done at the Deerfield substation and why.

A. As discussed above, certain upgrades to the AC system are required to support the Project's interconnection with the regional electric grid. Additional work is necessary at the Deerfield substation in accordance with the requirements identified by the ISO-NE as part of its I.3.9 process.

Initially, the ISO-NE I.3.9 studies analyzed the impact of a new 1,200 MW transmission project and identified that the two 345 kV lines between Deerfield and Scobie Pond needed to be thermally uprated to ensure minimum clearance criteria are not violated. This involves replacement of certain structures along the path to allow the line to transmit a greater level of power.

Since the initial I.3.9 studies, the Project has altered its projected power flow from 1,200 MW to 1,090 MW. The Project is currently undergoing a new I.3.9 study, which is expected to provide substantially similar results.

The Northern Pass 345 kV AC line will terminate at the existing Deerfield Substation where the power will then flow to other New Hampshire substations and the New England electrical system. At Deerfield Substation, portions of the substation will be reconfigured to accommodate the Project. The work involves relocating certain 345 kV line terminals and adding 345 kV line positions to the substation. In addition to the line terminal work, an existing 345 kV line, the 391 line, that presently goes by the substation will be looped into and out of the Deerfield Substation (two line terminal positions will be added). The 345 kV line work and terminal additions will be constructed within the existing substation fenced area.

In a separate new substation area adjacent to the existing substation, a static VAR (volt-ampere reactive) compensator ("SVC") and 345 kV capacitor banks will be installed. These devices, which were identified by the ISO-NE during its initial I.3.9 study, provide system voltage support during abnormal system events.

For the Deerfield upgrade, the equipment additions will include breakers, the SVC and transformer, capacitor banks, switches and bus, instrument transformers and arresters.

Q. Is work planned for any other substation locations?

A. Yes, a 345 kV capacitor bank addition is planned for an expansion of the Scobie Pond Substation along with the installation of 345 kV breakers in the existing substation bus.

Q. Explain why some existing lines need to be rebuilt and relocated.

A. Relocating some of the existing 115 kV transmission lines and 34.5 kV distribution lines is necessary to make room for the Project facilities. This allows NPT to lower structure heights to reduce potential visual impacts and to satisfy electrical code requirements. NPT has sought to utilize existing transmission ROW to the maximum extent feasible in order to minimize environmental and other impacts of the Project. NPT will bear the costs of all relocations and rebuilding of the PSNH lines.

In order to maximize the use of existing ROW and to reduce structure heights to reduce visual impacts in the HVDC portion of the line, NPT will relocate approximately 39.5 miles of existing 115 kV lines and 11.7 miles of 34.5 kV lines. For the 345 kV AC portion of the Project, approximately 22.8 miles of existing 115 kV lines and 6.5 miles of 34.5 kV lines must be relocated.

In addition, to address specific visual impact concerns expressed by officials and residents in Concord, NPT agreed to modify its design to reduce structure heights for the 345 kV AC line in some areas. Specifically, six additional miles of 115 kV line will be relocated to allow use of H-frame structures. The H-frame has a standard design height of 80 feet, which is the lowest height of the AC structure design alternatives.

Underground Construction

Q. What technology is associated with constructing an underground transmission line of this magnitude?

A. Underground cables will be installed using a combination of construction techniques that include direct burial of the cable in trenches, installation of the cable in conduit or in a duct bank constructed in trenches or through the use of trenchless technology. The trenchless technology will include jack and bore and directional boring. The depth of the direct buried cable will be approximately four feet below grade; the depth of the conduit or duct bank will vary based upon its configuration and will have at least 30 inches of cover over the duct bank; the depth of the jack and bore will be approximately 25 to 30 feet below grade; and the depth of the directional boring sections will be approximately 65 feet below grade at its maximum depth. The exact depth of the trenchless conduit installation, duct bank or direct buried cable may be adjusted based upon the final civil design. After the cable sections are installed, multiple segments of the line will be joined together in splice pits at locations along the route.

Project Construction

Q. Describe the process for selecting contractors that will be involved in the construction of the Project and what their respective roles will be.

A. The construction of the Project will be managed and constructed by several specialty contractors. The contractors that will be chosen will have years of experience in managing and constructing high voltage transmission lines and substation facilities throughout the United States and here in New England. For the Project, NPT will choose contractors with the experience and capabilities necessary for the size of this Project and the types of work that they will perform. The major categories of work necessary to complete the Project include engineering and design services, project management and control services, construction management, converter terminal and underground cable supply, and transmission line and substation construction services.

Each contractor chosen to work on this Project will be evaluated and selected based upon experience and previous performance on projects of similar size and scope in their respective fields and will include the review of each contractors safety and environmental record for comparison with industry standards. The procurement process will be managed by NPT's procurement group and will include standard utility practices including shortlisting qualified bidders, web-based bidding process, detailed bid evaluations based on technical and commercial criteria and contract negotiation and award.

Q. Describe the qualifications and role of the Owner's Engineer that will be involved in this Project.

A. It is expected that NPT will hire an Owner's Engineer or equivalent to assist it with the management of the construction process. The preferred Owner's Engineer will be a full-service engineering, architecture, construction, environmental and consulting solutions firm and will have a multi-disciplined staff of resources including engineers, architects, construction professionals, planners, estimators, economists, technicians and scientists, representing virtually all design disciplines. The Owner's Engineer will also be NPT's representative for engineering and design services, project management and controls services, and construction management and will be responsible for monitoring, coordinating and reporting to the Project. Reports will include the quality and compliance of the work that the construction contractors and vendors perform on this Project. The Owner's Engineer will provide services including design, permitting, construction management, schedule, cost, construction coordination, materials management, safety oversight, environmental compliance oversight, communications, and project closeout.

Q. Describe the qualifications and role of the overhead line Construction Contractor that will be involved in this Project.

A. The construction contractor chosen will demonstrate the ability to manage a project of this size and will have had recent successful experience in the construction of high voltage switching stations and substations, underground or overhead transmission lines and HVDC converter terminals as appropriate. The contractor will have a demonstrated ability to construct the work within the allotted time frames and have the ability to supply adequate labor. The preferred contractor for this Project will have the resources available to deliver the technical skill and physical capacity to respond safely, quickly and cost effectively and have an established track record of success with the ability to draw on field employees that are members of the International Brotherhood of Electrical Workers ("IBEW") and work closely with the National Electrical Contractors Association ("NECA"). This strong IBEW/NECA connection ensures trained, highly productive and safety-oriented personnel.

Q. Describe the qualifications and role of the Converter Terminal and Underground Cable supply vendor that will be involved in this Project.

A. The converter terminal, SVC and underground cable systems that are being proposed for this Project are unique in design and can only be manufactured by specialty companies. Worldwide, there are only a handful of vendors that can provide such equipment. Northern Pass has issued a request for proposal ("RFP") for the supply of the converter terminal, SVC and cable system. This RFP is underway and thus a final supplier has not yet been selected. Each of the companies participating in this RFP has vast experience in the manufacturing and installation of converter terminal and cable systems worldwide and in North America. It is expected that the vendor of choice will be selected in the near future and will immediately be integrated in the existing design teams of the converter terminal and cable systems. This contract will be for the supply and installation oversight of the converter, SVC and cable equipment.

Q. Describe how the companies described above will work together.

A. The construction of Northern Pass will be a collaborative effort of NPT, the construction contractor and the Owner's Engineer. Each brings its unique skill sets to the table to create a strong and dynamic team. The converter terminal and underground cable supply vendor will provide equipment and construction services specific to the converter and underground cable.

NPT, as owner, will be responsible for all major management decisions. The Owner's Engineer and the construction contractor senior project managers will report directly to the lead Northern Pass Transmission Project Director. This reporting will include updates on cost, schedule, risk, compliance, issues and other matters as it relates to the construction process. Regular meetings (weekly and monthly) will be held to provide project updates.

Attachment B details the Construction Management Reporting Matrix and shows conceptually how the companies will integrate the distinct design and construction efforts.

Both the Owner's Engineer and the construction contractor will have direct lines of communication at all significant levels of operation (safety, community relations, environmental compliance, outage coordination, materials management, project controls and construction coordination). This direct communication allows for fast information exchange and processing and ensures that daily decisions are made in a timely manner. The Owner's Engineer will provide the coordination and reporting that ensures that the Project is meeting all standard and compliance requirements.

Q. Please provide a general description of a Project Labor Agreement ("PLA").

A. A PLA is a set of terms and provisions agreed to between a construction project owner and a union regarding how work will be performed on a project. The owner includes PLA specifications in its bid requirements when it solicits contractors for its project. A contractor who accepts a contract award accepts the provisions of the PLA, and will apply the terms and provisions of the agreement with union and nonunion personnel who are hired to work on the contracted job.

Q. Describe how Northern Pass Transmission expects to use a PLA?

A. Northern Pass is firmly committed to hiring local, New Hampshire workers first, and to developing strong working relationships with both large and small contractors who are either union or non-union. In addition, Northern Pass will be seeking contractors who have a track record of working safely and in an environmentally sensitive manner, and who are focused on competitive pricing and on-time service.

The PLA used for the Project was uniquely structured to promote local jobs to New Hampshire workers. That is the top priority. There are provisions to bring in non-union companies both where there are specialized skills or equipment not provided by tradesmen, and where there are simply not enough skilled craftsmen available to staff a job. Non-union companies can become signatories to the PLA.

The PLA specifically identifies non-union job opportunities that are not subject to the agreement, including logging, landscaping, land clearing, maintenance and warranty work on equipment, training, testing, and equipment installation.

Numerous “service vendors” providing such services as trash haulers, security, fuel delivery, and janitorial services, are also included in these non-union opportunities. Non-union job opportunities also include a number of “non-manual job categories” needed for project support. These include inspectors, timekeepers, clerical and administrative workers, guards, emergency medical technicians, quality assurance/quality control staff, and engineering, real estate, survey, technical, and supervisory personnel.

The major engineering, construction, and equipment suppliers will generally hire trade personnel and/or subcontractors directly. The PLA requires that contractors hire NH labor and/or NH subcontractors first to ensure that local suppliers and businesses will be utilized.

The contractors who will be bidding on the Project’s major contracts will need to propose specific, aggressive, and innovative staffing/hiring plans as part of their efforts to provide a winning bid.

As the Project construction start date draws closer, NPT will hold job fairs where Project contractors will meet with those interested in working on the Project. In addition, the IBEW, one of the major unions that will be working on the job, will be soliciting workers for its training and apprentice programs to ensure an adequate supply of labor for the Project in key skills areas.

Q. Please describe how NPT intends to address any violations of either state or federal requirements that were pre-existing on the land prior to the start of construction.

A. Any potential violations (e.g. environmental issues) will be identified and reported to the appropriate reporting agency. Wherever possible, these issues will be resolved prior to when construction activities commence. Additionally, notification protocols will be created to assess any potential violations that could be identified once construction activities commence.

Project Operations

Q. After the Project is constructed, how will the Project operate?

A. Following completion of the Project construction phase, ISO-NE will assume operational control over the transmission facility pursuant to the terms of a FERC-approved Transmission Operating Agreement ("TOA") between NPT and ISO-NE.

Section 6.1(a) of the Transmission Service Agreement ("TSA") contemplates that the management committee comprised of Hydro Renewable Energy and NPT personnel will review the terms and conditions of the TOA to facilitate alignment of all interested parties. Under the TOA, NPT expects that ISO-NE will assume operational authority over the Project and all transactions over the line will be scheduled in accordance with the applicable New England market rules. ISO-NE will also have final approval authority over planned line outages. Therefore, Northern Pass effectively will operate in the same manner as all other facilities within the integrated ISO-NE system.

Section 6.2 of the TSA requires NPT to maintain the Project in accordance with good utility practice and in compliance with all applicable regulatory requirements, including applicable North American Electric Reliability Corporation ("NERC") and Northeast Power Coordinating Counsel ("NPCC") reliability standards, and to comply with all applicable operating instructions and manufacturers' warranties.

Q. Please describe the maintenance and inspection activities associated with Project operations.

A. For the Project route where there are already transmission lines, many of the maintenance and inspection activities will be performed for the Project as the crews traverse the ROW. In these locations, NPT will pay its allocated share of the costs associated with such maintenance and inspection activities.

Where the Project is not located with existing transmission lines, maintenance and inspection activities will be paid for by NPT, and performed consistent with the Eversource Energy maintenance policies and procedures which are documented in the Eversource Energy Transmission Maintenance Program Manual ("TMPM"). The TMPM is based upon the following key attributes:

- Best practices for preventive maintenance;

- Assuring compliance with regulatory and power coordination authority standards and guidelines;
- Establishing maintenance practices that are practical and cost effective;
- Establishing maintenance practices that monitor equipment operating conditions and provide trend data; and
- Written descriptions of the maintenance program.

During operation, NPT and its contractors will follow all Eversource Energy company policies and procedures, including a well-established set of transmission procedures mandated for all Eversource Energy employees and contractors. Those policies and procedures include all OSHA regulations, all State and federal regulations and other guidance documents. In accordance with maintenance procedures, Eversource Energy inspects high voltage transmission lines (including Northern Pass) on the following basis:

- Aerial patrol of the line each year for inspection of structures and conductors;
- Foot patrol of the line each year to visually inspect the facilities;
- Thermographic inspection of the line two times per year;
- Patrol of lines after every interruption if the specific cause cannot be identified;
- Aerial patrol of lines each year for vegetation management inspection; and
- Three year vegetation maintenance within cleared areas, ten year side trimming and tree removal as required.

With regard to the stationary buildings, including maintenance for transition stations, converter terminal, underground sections, and the substations, NPT will undertake the following:

- Monitoring, testing and maintaining, civil, electrical, protection and communication equipment including visual inspection, sampling, trending, testing, maintenance and time based equipment replacement;
- Monitoring on-line key electrical devices to determine equipment status, load levels, and temperature and to identify any abnormal conditions; and
- Spare parts will also always be kept on site.

In addition to the TMPM, the Protection System Maintenance Program ("PSMP") provides the basis for performing maintenance on Protection System components across the three-state Eversource Energy system. The PSMP provides the basis to verify regulatory compliance for protective systems. The requirements of the Federal Energy Regulatory Commission ("FERC"), NERC, NPCC and ISO-NE form the basis for the PSMP.

Q. Please describe the vegetation maintenance work that will be required once the Project is in operation.

A. PSNH will be responsible for vegetation maintenance work and a cost sharing agreement will be developed in connection with this work. Maintenance activities in the ROW, depending on the natural features and accessibility of the ROW, can be carried out on foot, or by line truck, track mounted vehicle, all-terrain vehicle or snowmobile. Any of these activities can have an impact on the environment if not performed in a sensitive manner. All vegetation management and line maintenance activities associated with the Project's new lines will be performed in accordance with the New Hampshire Division of Forest and Lands Best Management Practice for Utility Maintenance. The Best Management Practice publication provides guidance for identifying appropriate means and methods for vegetation management and maintenance in or within the vicinity of jurisdictional wetlands. The company will provide a field manual summarizing the Best Management Practice to all contractors performing maintenance work in the ROW.

Q. Please describe the security measures associated with Project operations.

A. NPT also will implement security measures consistent with industry practices and Eversource Energy policies, including the use of security cameras at stations. With regard to the stationary buildings, transition stations, converter terminal, underground sections, and the substations, NPT will maintain the facilities in accordance with the TMPM, the PSMP and manufacturer recommendations. Maintenance activities for those facilities will include:

- Monitoring, testing and maintaining civil, electrical, protection and communication equipment including visual inspection, sampling, trending, testing, maintenance and time based equipment replacement;
- Monitoring on-line key electrical devices to determine equipment status, load levels, and temperature and to identify any abnormal conditions; and
- Maintaining an adequate supply of spare parts on site.

Q. Please describe how NPT will manage Project operations.

A. NPT will rely on Eversource Energy's transmission maintenance and work management department to support the operating and maintenance requirements of the new facilities associated with the Project. NPT will pay for the cost of these services. To the extent appropriate or required (including for emergency repair efforts resulting from storms or system events), Eversource Energy supplements its transmission maintenance and work management department with contractors having crews with the necessary skills and experience. The collective staff available to NPT will ensure that all maintenance and operational activities are performed in accordance the TMPM and PSMP.

Q. Describe all measures that will be employed to ensure the Project operates safely.

A. During Project operations, NPT and its contractors will follow all Eversource Energy policies and procedures, including a well-established set of transmission procedures which contractors are required to follow. These policies and procedures necessarily include all Occupational Safety and Health Administration ("OSHA") regulations, all State and federal regulations and other guidance documents. NPT will also adhere to the National Fire Protection Association ("NFPA") 850 Recommended Practices for Electric Generating Plants and High Voltage Direct Current Converter Stations.

Q. Describe what measures will be taken to ensure the security of the Project once constructed.

A. The Project will meet all requirements identified by the Federal Energy Regulatory Commission in CIP-014-1, the security Reliability Standards for critical Bulk Power System facilities. Features of the Eversource Energy security plan include the following:

- Inspection of the converter station, transition stations and substations in accordance with the Eversource maintenance procedures
- Inspection of transmission lines (foot patrols and aerial inspections) in accordance with Eversource maintenance procedures
- Security gates at converter station, transition stations and substations
- Transmission line ROW gates to restrict access to the ROW at certain locations. Perimeter fencing at all station facilities

- Security cameras – to be used at converter and substations
- Control House security system

Technical and Managerial Capability

Q. Please summarize why the Applicants have the technical and managerial capability to construct and operate the project.

A. As discussed in the pre-filed testimony of James A. Muntz, Eversource has extensive experience siting large transmission projects in New England. Eversource owns and operates approximately 4,270 miles of transmission lines in the Northeast and serves approximately 3.6 million electric and natural gas customers in the region. The Eversource Transmission Business is a procedure-driven organization that has been structured for the specific purpose of constructing, operating and maintaining transmission assets in the states of CT, MA and NH. Eversource Transmission utilizes procedures for all key functions including Project Management, Engineering, Maintenance and Operations, and Quality Control, to name a few. Eversource has a significant ongoing transmission capital construction program in New Hampshire, of which this project is only a small part. Over the past decade, Eversource has a proven track record of constructing many complex transmission projects.

Eversource and its contractors have an extensive staff of in-house siting, engineering, environmental, legal project management and construction professionals, skilled in the development of large transmission projects. Eversource has numerous relationships with many major engineering firms, environmental and other related consultants and contractors which we will rely on to execute projects in a safe, efficient and cost effective manner.

Based on the information contained in the Application, coupled with the relevant pre-filed testimony, the Applicants have the requisite technical and managerial capability to construct and operate the Project.

Q. Does this conclude your testimony?

A. Yes, it does.

Jerry P. Fortier *860-608-8076 (Home); 860-867-6652 (Cell)*
13 North Ledge Rock Road, Niantic, CT 06357

Summary

Transmission Director with over 32 years of experience leading, managing, and developing strategy for the successful outcome of major transmission capital projects governed within a regulated environment. Major strengths include strategic planning, project management, communication, problem resolution, team building, and people management. Foster collaborative relationships across organizations to provide the highest level of improvements to the essential transmission system within established budgets and schedules.

Professional Experience

Northeast Utilities Service Company, Berlin, CT

2001- 2014

Director - Transmission

<u>Current Assignment</u>

- The Northern Pass Transmission Project ($1.5B); siting/permitting, construction planning and construction execution of the project which includes

<u>Achievements:</u>

- NEEWS Program which includes the close-out documentation of the Greater Springfield Reliability Project ($718M); the construction planning and construction execution of the Interstate Reliability Project ($218M); and the strategic planning associated with the Greater Hartford Central Connecticut Reliability Project ($350M).
- GSRP includes 35 miles of new 345-kilovolt (kV) electric transmission line, 27 miles of upgraded 115-kV electric transmission lines, 3 major 345-kV Substation additions, 2 new 115-kV Switching Stations, and 8 minor Substation upgrades. The project was successfully placed in service in November, 2013 more than $40M under budget and slightly ahead of schedule.
- Middletown-Norwalk new 345-kV electric transmission line. The project included 45 miles of overhead and 24 miles of underground through eighteen municipalities, as well as 57 miles of reconstructed 115-kV line to facilitate the installation of the 345-kV on existing rights of way. The project was completed nearly a year ahead of schedule and significantly

Jerry P. Fortier • 860-608-8076 (h) 860-867-6652 (c) • jerry.fortier@sbcglobal.net

under budget. With three other NU transmission projects, won the 2008 Platts Global Energy Award for “Energy Construction Project of the Year.”

- Bethel-Norwalk 345-kV electric transmission line. This project provided an additional 600 megawatts of electricity to be delivered to southwest Connecticut and the region and was completed ahead of schedule and under budget. In addition, the project was honored by the Edison Electric Institute with it’s first-ever Edison Award Finalist Commendation in 2007 and by "Utility Automation & Engineering T& D Magazine" as its 2006 Project of the Year.
- Glenbrook Substation STATCOM in Stamford, CT. The STATCOM is a flexible AC transmission system which is used to control system voltage transients. The project successfully constructed and commissioned the first ever North American Alstom designed STATCOM. The project was completed ahead of schedule.

Responsibilities:

- Single point of responsibility for assigned capital improvement budgets, schedule and scope of work including regulatory compliance. Critical decision maker for responsible functional areas assigned to the project.
- Facilitate weekly schedule planning and review meetings.
- Project reporting to inside and outside stakeholders.
- Program management oversight.
- Procurement and contract management oversight.
- Commission planning with independent system operators CONVEX and ISO-NE on complex transmission equipment such as; flexible AC transmission equipment, gas insulated substation, shunt reactor and XLPE cable systems.

Northeast Nuclear Energy Company, Millstone Nuclear Power Plant, Waterford, CT

1997-2001

Project Manager-Unit 2/3 Nuclear Power Station(s), Project Management Department

Achievements:

- Following a successful demonstration of a readiness for restart, worked as part of the management team that received authorization from the Nuclear Regulatory Commission (NRC) to restart the Unit Two Nuclear Power Station.
- Completed the separation of all power and emergency equipment between Unit 1 and 2; reconnection between Unit 2 and 3; coordinated the commissioning activities between all three units. Received approval from the NRC for a change in the Unit 2 and 3 design basis manuals. The project was completed ahead of schedule and under budget.
- Set a breaker-to-breaker world record for completing a generator rewind project in a refueling outage at the Unit 2 Nuclear Power Station.
- Developed an innovative approach for constructing and commissioning the Unit 2 feed-water system heater control system. This approach

Jerry P. Fortier • 860-608-8076 (h) 860-867-6652 (c) • jerry.fortier@sbcglobal.net

eliminated the need for costly production facility outages.

Responsibilities:

- Single point of responsibility for assigned capital improvement budgets, schedule and scope of work.
- Facilitated weekly schedule planning and review meetings.
- Project reporting to inside and outside stakeholders.

1996-1997

Outage Scheduling Manager-Unit 3 Nuclear Power Station, Outage Planning Department

Achievements:

- Following a successful demonstration of a readiness for restart, worked as part of the management team that received authorization from the Nuclear Regulatory Commission to restart the Unit Three Nuclear Power Station.
- Managed the development of a comprehensive schedule development and reporting process that included participation by all departments.
- Managed the development of key performance indicators for use by the senior management team.

Responsibilities:

- Managed the daily process used to develop daily and look ahead schedules used to coordinate work and operations activities at the production facility.
- Facilitated daily schedule reporting meetings.
- Developed the schedule reporting culture necessary for the effective planning and operation of the production facility.

1994-1996

Work Week Manager, Work Planning Department

Achievements:

- Developed six week planning and scheduling process used to manage work in all three nuclear power production facilities.
- Received the highest plant evaluation ranking of one from the Institute of Nuclear Power Operations.
- Outstanding safety achievement record.

Responsibilities:

- Development planning and oversight of all planned work activities throughout the three nuclear power production plants.
- Nuclear safety evaluation of scheduled work activities.
- Coordination with the “on-shift” Operations Shift Manager.

Jerry P. Fortier • 860-608-8076 (h) 860-867-6652 (c) • jerry.fortier@sbcglobal.net

1981-1994

Lead Test Coordinator, Generation Test Services

Achievements:

- Promoted to Lead Test Coordinator.
- Zero human error accomplishment.
- Outstanding safety achievement record.

Responsibilities:

- Oversight of preventive maintenance, troubleshooting and acceptance testing of power equipment and system control circuits.
- Oversight of construction planning, implementation and commissioning.
- Oversight of the development of department process procedures.

Education

Wentworth Institute of Technology, Boston, Massachusetts
Electrical Engineering Major, AS

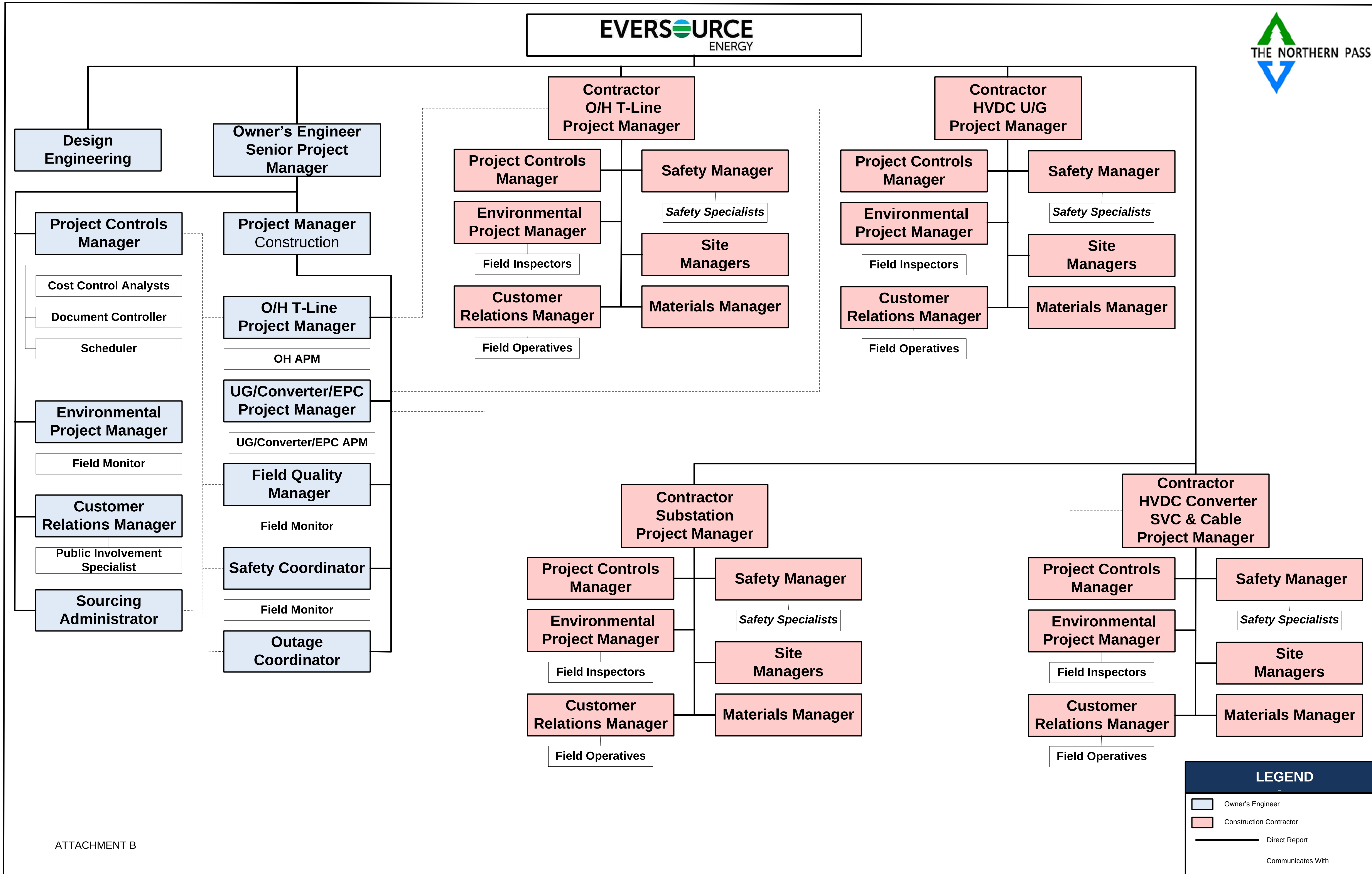
Ashford University, Clinton, Iowa
Organizational Management, BA

George Washington University, Washington, D.C.
Masters Certification in Project Management

Professional Training

2005 - Master's Certificate in Project Management - The George Washington School of Business

2002 - Associate's Certificate in Project Management - ESI International



ATTACHMENT B

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF SAMUEL JOHNSON

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name, title, and business address.

A. My name is Samuel Johnson. I work for Burns & McDonnell Engineering Company. I am a Senior Project Manager in charge of permitting. My current business address is 670 North Commercial Street, Manchester, New Hampshire 03101.

Q. Briefly summarize your educational background and work experience.

A. I attended the University of Toronto in Canada and graduated in 1991 with a Bachelor of Sciences Degree in Chemical Engineering.

For over the last nine years, I have worked at Burns & McDonnell on various major electric transmission development programs; planning and constructing high voltage transmission lines and substations. I have held numerous roles, ranging from Cost Control Manager to Assistant Program Manager to Finance Project Executive to my present position as the Lead Project Manager for the Northern Pass transmission project ("Northern Pass" or the "Project") proposed by Northern Pass Transmission, LLC ("NPT").

Prior to my time at Burns & McDonnell, I worked for two years at Select Energy as an Energy Analyst and prior to that at DTE Energy Group developing Natural Gas assets in the United States. Please see my resume, which is attached as Attachment A.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide information on the land rights required to construct Northern Pass, pre-filing public outreach conducted by the Applicants, and Project costs. As part of my discussion on public outreach, I provide information regarding the public outreach that was conducted from the inception of the Project until the Route Announcement in August 2015, and the public outreach that has been conducted and is currently ongoing after the new Route Announcement.

Q. What is your role in the Project?

A. I am the Northern Pass Lead Project Manager in charge of permitting for Burns & McDonnell Engineering Company ("BMcD"). BMcD has been hired by Eversource Energy ("Eversource"), as agent for NPT, to perform preliminary engineering design services, permit application development and Project support for the Northern Pass. My job is to manage the BMcD personnel working on the Project, coordinate with the NPT team, and to report to senior management on the status of the Project.

Land Rights

Q. Provide an overview of the land rights associated with this Project and explain how NPT will exercise control over the land where the Project will be constructed.

A. The Project will be constructed in areas where Northern Pass will have obtained the necessary regulatory approval from the NHSEC, NHPUC, USACE, and the NHDOT for use of public highways, State lands and waters, lease of PSNH rights-of-way ("ROW"), or has otherwise already secured the right to use land pursuant to leases with Bayroot LLC, and Renewable Properties, Inc. ("RPI"). The PSNH lease is for approximately 100 miles of PSNH ROW from Dummer to Bethlehem and from Bridgewater to Deerfield, and is subject to regulatory approval of the NHPUC in parallel with NHSEC siting process.

In Northern New Hampshire, the Project will be located on land or easements owned by RPI for which NPT has entered into an option agreement with RPI. The RPI lease includes the right to use a corridor with access rights through the towns of Pittsburg, Clarksville, and Stewartstown. NPT has also entered into an option agreement with RPI for the assignment of a lease with Bayroot LLC for approximately 24 miles to use the corridor for transmission line rights through Dixville, Millsfield, and Dummer.

The RPI lease also includes the necessary land rights needed to construct each transition station, the Converter Terminal, and the right to expand the existing PSNH easement in Pembroke to meet FAA requirements by keeping NPT's proposed structure heights at or below those existing transmission structures in that segment, and also for one property in Whitefield.

The six transition stations and associated lines will be located immediately adjacent to the transmission corridor. The Converter Terminal and associated lines are located outside the existing transmission corridor.

Lastly, NPT will use approximately 60 miles of public highways and municipal roads to locate almost all of the underground line (some portions of the underground line are located on the transition station properties included in the RPI lease). This application includes NPT's requests for NHDOT and the NHSEC's approval of the use of such public highways pursuant to RSA 231:160. Please refer to Appendix 9 for more detailed information on those requests.

PSNH has the existing fee interests and easement rights to support expansions of the Deerfield and Scobie Pond substations, and the easement rights to support modification of 10 existing transmission structures. All of the costs associated with the construction and maintenance of these PSNH facilities, including the value of property used, will be included in a form Interconnection Agreement required by ISO-NE.

Together, these established and requested rights support the full development of the Project over its total 192 mile length, and the development of the ancillary projects needed to support its interconnection into the regional transmission system.

Q. Please explain any additional land rights related to construction.

A. NPT or its contractors will have temporary easements or licenses during the construction process to accommodate construction activities (e.g., access and lay down areas) along some portions of the proposed route outside existing easement areas. See Section (d)(2) and (g)(8) (regarding the Applicants' request to delegate authority to NHDES to approve additional accessways and lay down areas). For the portions of the route where there are already transmission lines, operations, maintenance and repair activities will not change substantially from what occurs today and will be fully consistent with what those easements currently allow.

Project Public Outreach

Q. Describe the framework for the Project public outreach.

A. From its inception, the Project has made it a priority to reach out to key stakeholders, public officials, business leaders, municipal officials, the general public and landowners along the route. We have opened dialogues with these groups to describe the status of the Project, explain the permitting and construction process and to solicit constructive feedback on the route and other Project initiatives. The Project has a dedicated communications team that performs this outreach; their sole responsibility is to meet with these groups along the Project route, explain various aspects of the Project and provide a means of communication with the Project management team and its experts. All interactions are captured in the Project database and forwarded onto Project team members as necessary.

As noted above, the Project communications team maintains a Project database. The communications team works to ensure that interactions with the public are appropriately documented into the Project database, and that information is provided to Project management and other team members as necessary. The purpose of this database is three-fold:

- To provide a means where all communications can be stored for Project use;
- To assign a "ball-in-court" (BIC) owner for future relations with the landowner or member of the public as a consistent contact; and
- To outline overall questions and concerns, sorted by specific issue and/or by town, which is provided to the Project team.

The database has several functional benefits to a Project of this magnitude. Public interactions and comments are located in this module, which allows for reporting and organization of data. The reports produced are used on a daily basis by the communications team, Project management, and other team members as needed.

Data captured by the Project is obtained from a wide variety of sources and venues, including:

- Hot Line – direct calls to the project 800 number
- Direct Contact – in person meetings with company/business personnel or with non-abutters
- E-Mail – e-mails sent directly to Project personnel
- E-Newsletter – newsletters that were sent
- Field – encounters that occurred un-expectantly while performing field work
- Letter – mailings received directly at the project offices
- Letter-Government – letters sent to government officials (state, DOE, etc.) that NPT was cc'd on
- Meeting – scheduled meeting between landowner & Project personnel at the abutter's property or at a mutually agreeable location
- Meeting-Outreach – scheduled open houses
- Meeting-Public – company or municipal meetings / presentations
- Eversource (formerly PSNH) Customer Service

- Telephone – direct call to Project personnel
- info@northernpass.us – emails received from public and/or form filled out from website

Once a contact is received, it is entered into the project database within 24 hours (or within one business day), and assigned a "Ball-in-Court" (BIC) owner for response, if one is required. Phone calls received on the hotline are responded to within 24 hours, while all other types of contact are responded to within two weeks. It is the responsibility of the person assigned the BIC to make sure that these timeframes are met.

Q. Please describe the outreach that was conducted specifically for landowners along the Project route from the period of 2010 to July 2015.

A. Outreach to landowners, businesses, and others along the ROW has always been a priority for the Applicants since its inception. In the Pre-Route Announcement Phase (the original Project route announcement and development period from 2010 to 2013), Project representatives met with property owners at their request. Newsletters and other various forms of "Project Updates" were sent out periodically. Contacts with the public were documented and entered into the Public Contacts module in Contract Manager.

In June 2013, the Project publically announced a significant route change, and outreach efforts reflected this. A state-wide mailer was sent to every registered voter in New Hampshire, informing them of the new route announcement and potential changes in their area. This mailer sparked hundreds of calls and emails into the Project hotline and email forums, which lasted until the end of 2013. Additionally, Project representatives hand-delivered packets of updated information to the municipal offices of each town along the Project route the day of the announcement. Lastly, as part of the route announcement, the Project held a series of 15 Open Houses in communities along the Project route from August through December 2013. After the route was announced, from January 2014 to July 2015, the largest and most-extensive form of landowner outreach was organized and implemented. The goal of this landowner outreach initiative was to meet with all property owners and residents who are closest to the ROW. To perform this task in an organized manner, the total number of parcels located along the ROW was divided into four phases.

First, an introduction letter was sent to the parcel owner(s) at the address on file. The letter was addressed to every owner of the parcel that was listed on the tax card. Once the letters were sent, extensive background researched was conducted on each parcel by the communications team. Once the research was completed, the Project team placed a call to the landowner(s) if a phone number could be found.

If a site visit was scheduled, two Project Outreach Specialists would meet with the landowner(s) at a mutually agreeable date and time. At the meeting, the Specialists would give an update of the Project, including status of the permitting process, provide a general timeline of the Project, and address any questions or concerns. All landowner concerns and questions were entered in the Project's database. If any follow up was required from the meeting, one of the Specialists would respond in a timely manner, after speaking with the appropriate Project team members.

If a contact number could not be found, or if the landowner did not return a message left by the Project representatives, a closing letter was sent to the landowner(s), outlining that the Project attempted to contact them and schedule a site visit. The letter also provided the contact information for the Project in case the landowner(s) wanted to schedule a meeting at a future date. If the landowner(s) declined a meeting or scheduled a meeting, no closing letter was sent.

In all, a total of 129 landowner site visits occurred because of this effort.

During the period of June 2013 to July 2015, the Project conducted numerous outreach efforts in the municipalities along the route. The Project's communication team strived to communicate with town and city leaders to inform them of the Project and its potential impacts to their constituents. For a list of municipal contacts, please see Appendix 42. The majority of these municipal contacts were informational sessions where NPT provided significant Project updates. See Appendix 42.

Q. Please describe the open houses that occurred in 2013.

A. From August to December 2013, NPT held a series of Open Houses within communities along the proposed Project route. These Open Houses were designed to provide the public the opportunity to engage in dialogue with experts about different aspects of the Project, from construction, environmental, engineering, economic benefits, and many others. Landowners were also given the opportunity to view an interactive map of the route near and/or on their property. This allowed landowners to view where the ROW is in relation to their home, and provided an opportunity to visualize how the structures are currently designed and where they are located. This aspect of the Open House was the most attended.

A total of 15 Open Houses occurred, as follows:

1. Millsfield/Dixville – August 5, 2013
2. Dummer/Stark – August 13, 2013
3. Stewartstown/Clarksville – August 14, 2013
4. Pittsburg – August 20, 2013
5. Northumberland – August 21, 2013
6. Concord/Canterbury – September 4, 2013
7. Bethlehem/Dalton/Lancaster/Whitefield – September 10, 2013
8. Easton/Sugar Hill/Lincoln – September 11, 2013
9. Campton/Thornton/Woodstock – September 17, 2013
10. Bristol/Bridgewater/Ashland/Holderness/New Hampton – September 18, 2013
11. Deerfield – October 8, 2013
12. Franklin/Hill/Northfield – October 10, 2013
13. Pembroke/Allenstown – October 16, 2013
14. Sugar Hill – October 23, 2013
15. Dummer – December 5, 2013

A total of 833 members of the public attended these Open Houses, with 101 written comments received. As a result of these Open Houses, several landowner meetings were scheduled.

Q. Please summarize the outreach that was conducted along the Project route from the period prior to the new Route Announcement.

A. Prior to August 18, 2015, the Project received approximately 3,600 contacts and comments and recorded them in the Project database. Comments received from the public are grouped into categories such as Encroachments, Firewood, Jobs, Project Info, Project Support, etc. By using the Project database the Project communications team is able to analyze data and provide metrics detailing discussion topics. A summary of landowner contacts by town can be found in Appendix 42.

Q. Please describe the outreach that was conducted post Route Announcement until the filing of the application.

A. A revised Project route and the Forward NH initiative were announced on August 18, 2015. Communications regarding this new route were extensive and included outreach to elected officials, key stakeholders, municipalities, business leaders, and abutting landowners. The Project personally delivered packages describing the route and the Forward NH initiative to each municipality on the route and sent letters to all new, existing and former landowners. Because this new route involved 52 miles of new underground construction, the Project made contact with almost 1,000 new landowners and businesses. Offers for individual site visits were extended to all these new parties.

As The Project has done from the inception, it updated the Northern Pass website (www.northernpass.us) to add the most current Project information. Details regarding the route, general construction practices, the Forward NH initiative and other Project information can be found there.

As a part of the SEC filing, pre-application Public Information Sessions ("PIS") were held in each County that the Project runs through (Coos, Grafton, Belknap, Merrimack and Rockingham). Prior to and during the formal PIS, Project personnel were available to the public to provide detailed Project information to individuals in an open house style forum. These Public Information Sessions were recorded by a stenographer and included a presentation regarding the overall Project with an emphasis on the communities in the county where the PIS was held. A video of the overall project plan and benefits was also shown. A copy of the video can be found at Volume III of the Application.

The PIS also included a question and answer session moderated by a retired State Superior Court judge. Lastly, all members of the public had an opportunity to provide comments on the Project. A copy of the transcript from each PIS and the written comments is attached at Volume III of the Application.

Also following the new Route Announcement, NPT continued to conduct extensive public outreach to municipalities along the Project route and to abutting land owners. A list of the post-route announcement public outreach is included in Appendix 42.

Q. Please describe any additional Project outreach that has happened.

A. All members of the public can inquire about the status of the Project. As such, the Project has been involved with a variety of outreach efforts other than what is outlined above. This includes, but is not limited to, presentations at Rotary or Kiwanis Clubs, meetings with Chambers of Commerce and other municipal organizations (that are not directly affiliated with the City or Town), presentation of booths at Expos, and classroom presentations at local colleges. These types of outreach are generally performed on a "per-request basis", but there have been times when the Media Relations team has actively sought out presentation opportunities to communities along the proposed Project route.

Additionally, the Project is active on three social media platforms: Facebook, Twitter and YouTube. On Facebook, the Project posts information about the project and regional energy news about once a day. On Twitter, the Project sends out tweets a minimum of a few days a week to multiple tweets a day. On YouTube, the Project has posted informational videos aimed at sharing information with the general public.

Q. Please summarize the overall Project contacts.

A. In the seven years Northern Pass has been a public project, there have been over 3,700 comments received into the Project database (through October 9, 2015). Comments received from the public are grouped into categories such as encroachments, firewood, jobs, Project information, Project support, etc. By using the Project database the Project communications team is able to analyze data and provide metrics detailing discussion topics. Summary information of landowner contacts can be found in Appendix 42.

Of the comments received, approximately 1,730 (about 46 percent) were from people who are either outside the Project area or outside of New Hampshire entirely. About 6 percent (approximately 220) of the comments were from people living in communities along previous versions of the route. Approximately 1,800 (about 48 percent) of the total comments received came from individuals living in other communities. Of all communications to the Project there have been approximately 980 (about 26 percent) comments or requests from route abutters.

Those who contacted the Project typically requested general information. The four most commonly addressed topics were requests for Project information, jobs, general comments and real estate. Direct abutters to the route had similar top issues, with some variation among towns.

To a lesser extent there were requests for information regarding advanced notification, design, EMF, property values, and potential visual impacts.

Q. Please describe the public outreach that NPT will conduct post-application filing.

A. Conducting outreach is an important component for NPT. Project representatives are constantly available to meet with landowners, businesses, and municipalities to discuss the Project and address their concerns and questions. The Project email and hotline are available to anyone at any time, and representatives will address any comments in a timely manner.

As the Project continues to move forward into the SEC review process, there will be more opportunities for the public to provide comments. The Project will make every effort to ensure landowners and members of the general public know when future SEC meetings will be taking place.

NPT will also hold at least one PIS in each county where the facility will be located in accordance with RSA 162-H:10, I-a within 45 days after the acceptance of the application for a certificate by the Committee.

Q. Please describe your plan for interacting with local officials and residents during the construction process and addressing any concerns they may have.

A. One of the most important aspects for the successful construction of a project with the magnitude of NPT, with its size and the number of affected communities and landowners, is an open and proactive public involvement communications program, with team members dedicated solely to the mission of working with the public to explain the status and progress of the Project and to resolve landowner and municipal issues if they occur. From the start of construction to the completion of restoration, open lines of communications will be established and maintained to support a robust exchange of comments and concerns, and the resolution of any claims of damages filed during the work.

The NPT communication team is comprised of staff members who have been involved with the Project from nearly its inception, allowing for historic knowledge of community and landowner concerns to be passed down, through record-keeping and first-hand understanding, to the contractors performing the work within the corridors and substations.

A public involvement manager, supplied by the Owner's Engineer, will lead the communications team throughout the permitting and the construction phases.

The primary function of the communications team will be to meet with the public, maintain the communications processes and tools used to interact with the community, and to document concerns, claims and others issues in the Project database. Since its announcement, the Project has documented extensive contacts with the public in the database, which allows for immediate reporting and access to the needs and concerns expressed by the municipalities and landowners along the corridor. The Project has documented all issues that were raised have been to provide the best possible outcome during construction. From access to properties, to concerns about pets, to requests for buffering and recreational access, all known requests and concerns are monitored regularly and documented to help resolve issues without construction delay.

Each landowner is assigned a unique parcel identification number, which allows the team to specifically track issues, contacts and construction progress in the vicinity of their property. This parcel identification number carries through construction, and drives the Project database.

The Project database information is displayed in the Owner's Engineer geospatial solution which provides a visual representation of the Project construction zone, construction progress, and the issues expressed by the abutting landowners. The tool allows field personnel to be able to immediately review the issues that the landowner may have expressed previously in a given area and allows field staff to know specific requirements of abutting stakeholders prior to commencing work in a particular area.

The Project communications tools will be:

- The website: www.northernpass.us. The website will be routinely and regularly updated of construction status by community.
- The hotline, 1-800-286-7305, which will have all calls returned within 24 hours or the next business day.
- An email portal (info@northernpass.us), which will also have all contacts returned within 24 hours or the next business day.
- Project Facebook and Twitter accounts.

Along with direct field visits from staff, the communications tools give direct and immediate access by the public to the Project team to answer questions and concerns about construction status and progress.

Additional tools which will be used to alert the public to the progress of construction:

- Direct mailing to all landowners, municipalities, counties, and legislators notifying them of the start of construction no more than 60 days prior to commencement of the construction;
- Door hangers (placed through a “knock and talk” process with the abutting landowners) detailing the facets of construction, and timeframe for activities;
- Media advertisements in local newspapers, sportsmen and trade publications, regional and state-wide magazines, radio and television advising of the start of construction, and major events (helicopter stringing, etc.);
- Specific advertising will be tailored during specific timeframes of construction, such as hunting season and winter, to promote safety amongst winter sports enthusiasts such as skiers and snowmobilers;
- Municipal briefings and conference calls will be offered:
- Preconstruction briefings to each municipality. Meetings generally will occur 60 days prior to construction detailing the work within each community, the assignment of a team member as a liaison and an explain the tools for communicating with the Project;
- Weekly progress meetings held in a community by field staff (in person at the community offices with administrative staff);
- Conference calls to be held monthly (or otherwise requested) by county to advise of Project progress and major issues/concerns;
- A weekly e-mail transmittal to communities and concerned landowners about specific areas of the work (substations, etc.);
- State regulatory and legislative briefings on a monthly basis either by telephone conference call, e-mail or face-to-face; and

- Project field cards provided to all contractor employees to hand out in case of face-to-face interface with the public, giving the appropriate hotline, e-mail or website contact information.

Finally, residential outreach will occur through dedicated communication team field supervisors and contractor public involvement specialists:

- Contractors will be required to provide qualified personnel to notify the public and initiate claims response processes;
- Contractor staff will be trained by Project staff for the appropriate actions within the field;
- All of the above-stated tools will be applied to communicate with the public;
- Field staff will be available at the job site during all working hours, and if necessary at a neighbor's convenience, to initiate an immediate response to concerns;
- Lines of communications, such as public involvement contacts and Project database reporting, will be made available to the contractor daily to avoid abutter issues;
- Public involvement field staff will regularly attend tailboard meetings to keep an open dialogue with construction crews; and
- Public involvement representatives will regularly review a commitment report with field staff throughout the construction process.

Q. How will the Project communicate with and work with local communities and businesses prior to construction?

A. The Project will meet with local officials, business owners, and residents prior to the start of construction within each community to establish protocols and plans to avoid and mitigate disruptions to the extent practicable. For example, some of the items that may be included in such agreements relate to hours of construction, use of roads, and traffic management issues, etc.

Managing traffic during the Project construction is necessary to minimize traffic delays, maintain motorist and worker safety, complete roadwork in a timely manner, and maintain access for businesses and residents. Traffic considerations and control will follow the

"Guidelines for Implementation of the Work Zone Safety and Mobility Policy NHDOT Policy #601.0. A" for the development of a Traffic Management Plan. The Project will engage with the NHDOT and the municipalities along the Project route to establish protocols for work hours and seasonal restrictions where possible. Please see Lynn Farrington's testimony for further details regarding the specifics of traffic control.

<u>Costs</u>

Q. Please describe the cost estimates associated with the Project.

A. The cost estimates for the Project have been developed over many years as the Project has evolved. Our costs are based on engineering estimates (unit pricing) and limited information provided by construction and equipment supply vendors. Escalation, contingency, and allowance for funds used during construction ("AFUDC") are included in the total program costs. The overall Project cost is currently estimated to be in the $1.6 billion range. Costs will continue to be refined as the construction procurement process matures.

Q. What costs are associated with constructing segments of the line underground?

A. Underground construction has unique issues associated with it compared to overhead construction. There are higher costs associated with every aspect of the Project, including the installation of the cable trench, facility replacement, material costs, design redundancy, operations and maintenance issues, repairs that require specialty contractors, and labor-intensive work to locate faults.

The original Project configuration used a 1,200 MW mass impregnated cable technology that was significantly higher in cost and was approximately five to ten times more expensive than overhead lines. Compared to overhead construction, costs are approximately three times more with the new cable technology. This multiple is a direct reflection of the cost of the cable and the type of cable system required for the operation of the system.

Q. Does this conclude your testimony?

A. Yes, it does.

SAMUEL JOHNSON

Lead Project Manager

Mr. Johnson serves Burns & McDonnell as a program manager and regional office finance manager for the New England region. He has experience in project management, cost controls management, business development, gas marketing and gas management. Mr. Johnson's responsibilities have included technical, financial and commercial analysis, customer relations, environmental permitting, developing and integrating gas supply and electric outtake plans and various marketing initiatives. He is skilled in communicating and working with external and internal customers at senior levels.

EDUCATION

- B.S. in Chemical Engineering, University of Toronto, 1991

10 YEARS WITH BURNS & MCDONNELL

24 YEARS OF EXPERIENCE

A brief summary of his experience follows.

The Northern Pass Transmission Project | Northeast Utilities
Manchester, NH | 2012-Present

Program Manager. Mr. Johnson serves as the program manager for this $1.5 billion project. His responsibilities include:

- Project coordination and overall program management
- Project planning
- Executive reporting
- Internal/external planning and budgeting
- Project budgets, including the management of project contingency
- Summary level management of scheduling, overall project cash flow, budget, and change management
- Program contracting strategy

Burns & McDonnell New England Office
Wallingford, CT | 2005-Present

Regional Finance Manager. Mr. Johnson serves as regional finance manager for the New England region and is currently overseeing $9 billion worth of transmission line work. His responsibilities overseeing the region's projects include:

- Internal/external planning and budgeting
- Project budgets, including the management of project contingency
- Summary level management of scheduling, overall project cash flow and budget
- Executive reporting
- Invoice management / Accounts receivables

The Maine Power Reliability Program | Central Maine Power
New Gloucester, ME | 2008-2013

Finance Project Executive / Assistant Program Manager. Mr. Johnson served as the finance project executive and assistant program manager for this $1.5 billion project. His responsibilities included:

SAMUEL JOHNSON
(continued)

- Project coordination and overall program management
- Materials management
- Safety management
- Executive reporting
- Internal/external planning and budgeting
- Project budgets, including the management of project contingency
- Summary level management of scheduling, overall project cash flow, budget, and change management
- Program contracting strategy

The Middletown | Norwalk Transmission Line and Substation Project | Northeast Utilities

Southwestern Connecticut | 2005-2008

Cost Controls Manager. Mr. Johnson served as cost controls manager for the $1.4 billion project. His responsibilities included:

- Internal/external planning and budgeting
- Cash flow management
- Contract invoicing and change management
- Database management and information flow
- Project budgets, including the management of project contingency
- Generating and maintaining monthly cash flows for construction,
- Maintaining procurement and engineering services
- Negotiating contract deliverables and schedule of values for invoicing and contract management purposes
- Coordinating contractor invoices for approvals and payment management change management issues developing contract change orders
- Assisting in internal and external audits
- Analyzing trend expenditures to assist project and construction managers to maintain tight budget control
- Coordinating and reporting with client to provide seamless transitions from project accounting software to client's corporate database

*Select Energy

Berlin, Connecticut

Energy Analyst. Mr. Johnson's responsibilities included:

- Supporting the Daily Wholesale Gas Operations Group; including the NYMEX daily/monthly gas supply, gas nominations, scheduling and accounting reconciliation
- Implementing the integration of Retail Office, customer management software, into the Wholesale/Retail Gas Operations Group
- Internal/external planning and budgeting
- Daily and term trading book management
- Database management and information flow

SAMUEL JOHNSON

(continued)

*DTE Energy Group, Inc. (Detroit Edison)/MCN Energy Group, Inc. (MichCon), Hartford, Connecticut

Mr. Johnson's responsibilities included:

- Developing and implementing the northeast/mid-Atlantic marketing strategy
- Maximizing the value of DTE's key assets and providing corporate insight through interfacing with pipeline, LDC and end-use customers.
- Project development and management
- Budget preparation
- Internal planning
- Development of business and financial plans
- Contract negotiations
- Pipeline capacity and equity marketing

*Connecticut Natural Gas Corporation
Hartford, Connecticut

Energy Management Engineer. Mr. Johnson served as an energy management engineer and assisted in development of Key Accounts Group customers, including customer energy optimization from analysis of gas and electricity usage.

*Anchor Engineering Services, Inc.,
Glastonbury, Connecticut

Environmental Engineer. Mr. Johnson served as an environmental engineer and was responsible for designing and developing water treatment facilities for slaughterhouse effluent, landfill leachate and condensate including sitting and environmental permitting. Organized, managed, and performed quarterly monitoring and reporting for solid waste, industrial, and storm-water management clients.

*IB Grombach and Co. AG
Zurich, Switzerland

Project Coordinator. Mr. Johnson served as a project coordinator on a Water Treatment Plant Rehabilitation Project. He was responsible for analyzing water treatment plants to assess current physical and chemical status of treatment processes, leading to design and determination of rehabilitation needs; project updates and presentations to government ministers.

*Dow Europe AG, Horgen
Switzerland

Project Engineer. Mr. Johnson served as a project engineer and developed new latex adhesive products and testing methods.

**denotes experience prior to joining Burns & McDonnell*

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF DERRICK BRADSTREET

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Personal Background and Qualifications

Q. Please state your name, title, and business address.

A. My name is Derrick A. Bradstreet, P.E. I am a Project Manager for Burns & McDonnell Engineering Inc. My current business address is 9400 Ward Parkway, Kansas City MO 64114.

Q. Briefly summarize your educational background and work experience.

A. I am a Professional Engineer in the states of Kansas, Tennessee, New Hampshire and Utah with a Bachelor Degree in Electrical Engineering from Kansas State University. I graduated in 2004 with an emphasis in Power Systems.

I have more than ten years of professional experience directly related to high voltage transmission and distribution projects. My previous work has been for many different utility and developer clients across the United States. I am a member of the Institute of Electrical Engineers and CIGRE (an international council concentrated on large power systems).

I spent the first 8 years of my career as an electrical engineer in the Overhead Transmission Department at Burns & McDonnell. In this assignment, I was responsible for performing various tasks associated with the detailed design of high-voltage transmission lines. Major tasks consisted of: transmission line design and structure spotting using the PLS-CADD suite of software; conductor selection studies; insulation coordination studies; impedance calculations; interconnection studies; insulator and hardware design; grounding design; electric and magnetic field studies; interference studies; lightning performance studies; preparation of project cost estimates; preparation of procurement and construction specifications; preparation of Bill of Materials; and preparation of Issued for Construction drawing packages.

Approximately five years into my assignment in the Overhead Transmission Department, I began working in Project Management. My responsibilities included preparing cost estimates and schedules for various project tasks as well as becoming more familiar with the contracts and managing sub-consultants. After 8 years in a role as an electrical engineer in the Overhead Transmission Department I was assigned as a Project Manager concentrating on transmission line projects. A copy of my resume is included as Attachment A.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is your role in the Project?

A. I am the lead design engineer and am principally responsible for the overhead design of the Northern Pass transmission project ("Northern Pass" or the "Project") as proposed by Northern Pass Transmission LLC ("NPT"). I also am responsible for overseeing the design of the high voltage direct current ("HVDC") converter terminal and other associated facilities.

Q. What is the purpose of your testimony?

A. I describe the engineering design of the high voltage alternating current ("AC") and high voltage direct current ("HVDC") overhead transmission lines, AC substations, overhead/underground transition stations, and HVDC converter terminal. I also provide information showing that the design of the Project's aerial crossings of locally-maintained highways will not interfere with the safe, free, and convenient use by the public of those highways.

General Design of the Project

Q. Please describe the overhead design process and the major factors that were considered.

A. Project design for an overhead transmission line usually begins with a design criteria document that outlines the requirements for the Project. This document includes various parameters, such as vertical and horizontal clearance values, conductor requirements, insulation requirements, structural loading requirement and foundation loading requirements. Often, some studies must be completed to finalize the design requirements, unless there are standards from historical experience available. For Northern Pass, the Project team referenced the standard design parameters and historical experience of Eversource Energy ("Eversource") on the design and construction of AC transmission lines. The Project team applied Burns and McDonnell ("BMcD") standards and its experience to the design parameters for the HVDC line.

As with the design of the AC line, the main reference for developing the clearance requirements of a HVDC line is the National Electrical Safety Code ("NESC"), which sets forth the minimum requirements for transmission lines in the United States. This code includes methods for developing the required clearance for safe operation of a transmission line based on the voltage of the line. Generally, the higher the voltage of the line, the larger the clearances are between each conductor, between a conductor and the ground, and between conductor and the edge of the ROW. NPT has reviewed the required values in the NESC and has included a clearance margin beyond the minimum requirements, similar to the margin Eversource uses for their high-voltage transmission line designs across its service territories. A design margin is commonly added to the NESC minimums to account for changes required during construction. The design margin, however, is not of such a value that it would significantly impact the Project design.

The NESC also sets forth structural loading design requirements for transmission structures. Minimum loading values listed in the NESC are required for all electrical transmission structures. From PSNH's experience in New Hampshire, additional structural design criteria are employed. For example, PSNH's standard design includes an extreme ice case for structures that goes beyond the NESC ice loading requirements.

Once a design basis document is prepared, the corridors planned for the Project are reviewed to determine the available options to configure the proposed transmission line subject to any constraints. Constraints for existing transmission corridors are primarily related to terrain features, limited corridor width and existing transmission facilities. These constraints might require a different structure configuration for the Project that may not be the most efficient configuration, or necessitate the relocation of an existing line in the corridor to make additional space for the Project, or a combination of both. For example, there are areas where the Project can only use one structure configuration due to the available space in the existing right-of-way, namely, a vertical configuration.

The design team balances multiple considerations when creating a final proposed design. The major factors that typically drive overhead transmission design are environmental impact, visibility, and cost. As an example of such balancing, a horizontal structure configuration (where the energized conductors are located horizontally adjacent to each other) is typically preferred for reduced visibility and cost since this configuration would result in the lowest typical structure heights. Vertical structure configurations, on the other hand, place energized conductors in a vertically stacked orientation and are typically taller and higher in cost. The AC circuits that have three energized phases also utilize a Delta configuration, which places two phases on one side of the structure centerline stacked on top of each other, similar to a vertical configuration, but places the third phase on the opposite side of the structure centerline spaced roughly mid-way vertically between the other two phases. This provides some height reduction compared to the vertical configuration and provides ROW width reduction compared to the horizontal configuration. Please see Appendix 1 for examples of structure designs.

Environmental impacts on the ground for different structure configurations are similar for comparable construction. For example, a lattice horizontal HVDC tangent structure would have similar foundation requirements as a lattice vertical HVDC tangent structure. Corridor constraints may require that a less efficient structure configuration be used in some scenarios. In general, shorter less visible structures require a wider area in the corridor than taller structures. Additionally, relocating existing lines to provide additional space may create additional impacts.

The operating voltage and frequency of each transmission line is considered when developing the physical parameters of the supporting structures. Voltage level controls the clearances necessary and insulation levels that are necessary to connect to a supporting structure.

For both the AC and HVDC lines, the insulation requirements were defined based on the operating requirements of the Project, which are designed to meet an anticipated environmental contamination requirement (dust, industry, salt, ashes and other airborne particles that can degrade the insulation) and also meet the requirements for an overvoltage that the line may see during operation.

Conductor size (including conductor bundling requirements) must be defined for the line depending on how much current each conductor will be required to carry during the operation of the line. The conductor size for the HVDC line was determined to enhance multiple aspects of the line, including reducing electrical losses, limiting conductor sag and reducing electrical line effects.

Additionally, the design of the conductor size and bundle count must electrically operate as intended during all operations. For example, Northern Pass is designed to minimize electrical effects, such as corona discharge, which can be connected to radio interference and audible noise associated with transmission lines.

Conductor size and bundling of the 345 kV HVAC line is based on the Eversource standard that has been successfully operated throughout its system. Additionally, conductor size for relocated 115 kV lines and distribution lines are based off either replacing in-kind or in some cases reviewing clearance requirements to adjacent circuits.

Each transmission line that the Project plans to construct or modify must have defined structure parameters, which are driven by conductor size, shield wire/optical ground wire

("OPGW") requirements, clearance requirements and insulation requirements. For each voltage classification these requirements are provided in the design basis document.

Q. How is the initial transmission line design determined?

A. Overhead transmission design was determined by using the PLS-CADD suite of software. After reviewing the route for configuration requirements, a set of project cross-sections was developed to document what needs to be modeled in PLS-CADD, a 3D modelling software. For this Project, existing conditions surveys were performed using LIDAR technology, which is a common method of obtaining high resolution 3D survey information for linear projects. The PLS-CADD model interprets the 3D survey and checks clearances of the proposed design and the surrounding area to verify the design meets the Project requirements.

Transmission line alignments were also created in the PLS-CADD software to create an understanding of the ground terrain for a planned line segment. With an understanding of the ground terrain and the planned structure configuration, the proposed structures were placed along the alignment. Typically, the fewer the number of structures that are used for a particular segment of the line, the more efficient the design is and the less environmentally impactful the design would be. However, the Project also considers visibility as part of the design effort. The final design, therefore, reflects a balanced approach—each of the relevant criteria and constraints are balanced with one another to achieve a final result. Moreover, during the initial design process and before visual impact experts are engaged to provide feedback on the design, the design team reviews the height of the proposed structures. In some cases, the design can be modified to reduce the height associated with the relevant design constraints.

The transmission line is designed to meet a calculated maximum sag condition. Conductor sag, which is defined by the NESC as "the distance measured vertically from a conductor to the straight line joining its two points of support," increases with the distance between supporting structures, which requires taller structures or increased tension to maintain the electrical clearance above ground. Conductor sag can be limited by increasing the maximum tension of the conductor. As part of the design criteria of the Project, however, the maximum tension limit for the conductor must be defined. These tension limits are based on balancing the cost of structures that support high tension conductors and the need to meet industry practices to limit vibrations, which become more prevalent as tensions increase. These wind induced vibrations can damage the conductor if they are not considered in the initial design of the line.

For high-voltage transmission lines, the maximum sag is typically controlled by the maximum temperature that the conductor is designed to achieve for the particular transmission line. As electrical transmission lines move more power, more electrons flow from one end of the transmission line to the other using the conductors, which in turn causes the conductors to heat up. The more electrons that a conductor moves, the higher the temperature of the conductor will become, and as the temperature of conductor increases, the greater amount of sag. In some cases, the maximum sag for a span may occur when there is a significant amount of ice on the conductor. The final design must conform to all applicable design parameters to address all foreseen conditions.

Q. Aside from the major factors you described above, what other considerations went into the overhead design?

A. Environmental information collected from field surveys is considered and incorporated into the PLS-CADD model. The environmental field surveys are performed by various environmental and construction personnel, who suggest modifications based on impacts and constructability before finalizing the structure placements. This step is very important to the finalization of the proposed design because individual structure placements can be reviewed and shifted to minimize the environmental impacts. These shifts must also consider the visibility, cost impact and any other constraint for that particular section of the line.

After the environmental and construction comments were incorporated into the design, the data was provided to various experts for their review and comment. For example, for Northern Pass's visual impact and historic resources experts reviewed the Project data and suggested design modifications in certain areas. In addition, modifications were made based on public input.

Also, as part of the design of any transmission line, Federal Aviation Administration ("FAA") requirements are reviewed so that the Project is aware of controlling FAA. For Northern Pass, the Project team reviewed the current FAA requirements along the route and incorporated design changes to ensure that the Project complies with FAA requirements.

Q. What type of structures will the Project use and how they were chosen?

A. The HVDC structures are primarily planned to be lattice steel construction. Lattice steel structures are generally lighter in steel weight and provide a wider base four-leg foundation. This wider base with the loads from the structures spread over four foundation locations for each structure allow for the use of four smaller foundation areas for one structure as opposed to one large foundation. Lattice structures can be transported in bundles of angular steel members. These bundles are generally smaller and lighter than tubular steel poles sections. For the remote areas of the Project the smaller and lighter bundles will be beneficial for getting materials to the site for construction because the transport of these materials is easier to accomplish.

Some areas of the HVDC line will utilize tubular steel monopole construction primarily to reduce the area required at ground level for the construction of the transmission line. For example, these structures are used in areas where a gas pipeline shares the existing transmission corridor; the single foundation for a monopole as opposed to the four separated foundations of a lattice provides additional separation between these facilities. In other areas, the Project will use tubular steel monopoles to reduce potential visual impacts.

From the Franklin HVDC converter terminal to the Deerfield Substation, the 345 kV AC line will use multiple structure types. A significant portion of the 345 kV line will be tubular steel H-Frame structures. This configuration provides a shorter structure configuration and provides two smaller supporting foundations. Other areas of the 345 kV line are proposed to be vertical lattice or monopole steel structures. These lattice structure configurations are similar to the HVDC structures and items previously noted for the HVDC structures would apply here as well.

For areas of the Project where the existing 115 kV structures may need to be relocated, the Project will use tubular steel structures. Some of these structures will be a vertical configuration where the energized conductors are vertically stacked on the structure. Others locations will utilize a delta configuration where two energized conductors are located on one side of the structure and a third is placed vertically between those two, but on the other side of the structure. The delta configuration takes up a little more ROW width, but allows for shorter structures to be installed.

Relocated distribution structures will primarily consist of standard distribution configurations where all energized conductors attach to a cross arm located at the top of a wood pole. This construction will be in line with PSNH distribution standard structures.

Q. Please describe the design issues associated with building the Project in a transmission corridor that contains an existing gas pipeline.

A. Designing a transmission line adjacent to an existing gas pipeline first must consider proximity to each other. The structures must be aligned and placed in the ROW with adequate spacing to provide safe distances for construction and maintenance activities on both the transmission line and the gas pipeline. Additionally, gas pipelines require pumping stations, valves and other equipment to support their operation. Structure locations and alignment of the conductors must take this equipment into consideration to avoid conflicts during operations.

Design of the access roads and construction plan must be coordinated with the pipeline. Access road crossings of the pipeline must be analyzed to determine maximum vehicle weight and axle loads so the pipeline is not damaged.

Q. How did the decision to change cable technology affect the design of the Project?

A. The decision to increase the amount of undergrounding for the Project required a change in technology for the HVDC segment of the Project, from mass impregnated cable to cross-linked polyethylene ("XLPE") cable. This resulted in a change from a ±300 kV, 1,200 MW transmission line to a ±320 kV, 1,090 MW transmission line, and in turn, required certain structure changes. Insulation requirements also needed to be reviewed for the increased voltage and were increased accordingly. Design clearances were revised, which resulted in further revisions to the structure configuration and ROW usage. Structure configurations had to be adjusted to take into account the larger insulation distances and greater clearance required for the increase in voltage. Additionally, circuit alignments had to be reviewed to determine if additional ROW space was required between either an adjacent circuit of the edge of ROW for the increased voltage and structure configuration changes. The change in cable technology had no impact on the AC segment of the Project.

As part of the technology change, the metallic return conductor was eliminated, which accommodated significant change in structure configurations and a general reduction in structure heights of approximately five to ten feet. The change in operating voltage or power delivery did not affect the relocation of the 345 kV or 115 kV transmission lines.

The design of the converter terminal also changed in response to the change in cable technology. At Franklin, the converter site will see a significant decrease in physical size due to the technology change from Line Commutated Converter ("LCC") to Voltage Source Converter ("VSC"). Due to the nature of the converter technology, LCC converters require capacitors and filters to provide reactive compensation and remove electrical harmonics (signals in the electrical voltage and current) that are generated from the conversion of HVDC to AC power. VSC technology converts using different technology that typically does not require reactive compensation or generate harmonics large enough to require significant filtering. This factor and the reduction in the equipment necessary to allow the LCC design to function as required by ISO-NE has reduced the footprint from approximately 30 acres to approximately 10 acres.

Q. Please explain the site selection process.

A. The selection of the preferred route was the product of an evaluation of the potential environmental, historical and cultural resource impacts of a wide variety of alternative routes. Since the inception of the Project in 2009, many route alternatives were considered, most of which were determined to be infeasible. At the outset, the objective was to identify routes that began at the border between Canada and Pittsburgh, New Hampshire, and extended to the converter terminal location in Franklin, New Hampshire and continued to the Deerfield Substation while avoiding or minimizing impacts to both human and natural resources.

Route segments were laid out within the Project area to create hundreds of potential route variations, avoiding known constraints, to the extent possible, and taking advantage of opportunities to follow existing linear facilities such as transmission line corridors and roads where the Project could share existing ROW. The potential routes consisted of individual segments that could be combined to form a continuous path between endpoints. This step included consideration of multiple alternatives through each section of the project area. A first level review of these initial alternatives resulted in the elimination or modification of some alternatives because of potential impacts to human or natural resources, or engineering challenges such as steep slopes.

NPT then conducted a second level review in which it evaluated environmental and other resources that would be impacted by the remaining route alternatives. This evaluation of the routes included a systematic comparison of the alternatives based on criteria that represented the potential unreasonable adverse effects on resources along the route segments based on the types of resources present. The quantitative data were totaled for all of the potential routes. These data were used in evaluating the remaining alternatives to identify the routes with the least overall social and environmental impact.

The segment alternatives were divided into three geographic sections for the analysis:

- The north section, consisted of 46 segments which can be combined into 528 possible routes and are located between the Canadian border and Whitefield Substation, in Whitefield, New Hampshire, utilizing both existing and new ROW;
- The central section, which consisted of six segments and four possible routes and includes both a route that traverses the White Mountain National Forest (WMNF) on existing ROW, and a route that goes around the WMNF on new ROW; and
- The south section, which consisted of 37 segments and 32 possible routes that are located from the Franklin southern terminal location to the existing Deerfield Substation utilizing both existing and new ROW.

NPT then reviewed the results of the analysis and selected a preferred route and certain alternative route segments for the proposed transmission facility. At the time, the preferred route represented NPT's best judgment in selecting a technically feasible, economical route with the fewest impacts on environmental and other resources. The current proposed route was developed using similar impact analyses that took into account the availability of land from willing sellers and public roads.

Other Major Parts of the Facility

Q. Please provide a general description of the converter terminal.

A. The conversion from HVDC to AC will occur at a HVDC converter terminal located in Franklin, New Hampshire, on a 118-acre former campground site. The southern HVDC converter terminal will occupy approximately 10 acres of that site. This parcel was chosen based on its size to limit potential off-site effects, including any potential visual or auditory impacts. The actual terminal will be sited on a section of the property that is 400 feet away from the property boundary, which will limit off-site impacts. The site of the new HVDC converter terminal was chosen because the area has previously been disturbed. By siting the

HVDC converter terminal on an already disturbed area, the Project minimizes its overall environmental impacts, including, impacts to wetlands, rivers, streams, and historic properties that might be caused if an undeveloped site were used. Additionally, the site could be used in connection with future projects to meet the power needs of the region.

The HVDC converter terminal will be designed for a continuous HVDC to AC transfer rating of 1,090 MW and will use voltage source converter ("VSC") HVDC converter technology. The HVDC converter terminal will be configured as a symmetrical monopole system. The HVDC converter terminal will contain a valve hall, converter transformers, a cooling plant, HVDC filters, a HVDC switchyard, AC filters and AC and HVDC termination structures for the overhead lines.

The terminal will include an electrical enclosure for the IGBT's (valves) that will also contain control, protection and monitoring equipment. It will include oil-filled power transformers with a primary voltage of 345 kV AC. The ratings of the transformer connection to the valve hall will be determined by the HVDC equipment vendor based on the 1,090 MW transfer rating of the station. The transformers will be located outdoors.

The terminal will also contain high voltage AC filters consisting of capacitors, reactors and resistors. The AC filters will be designed to prevent the injection of harmonic currents into the AC transmission system. AC filters will be air insulated and located outdoors.

This terminal will include a 320 kV HVDC switchyard that will be the termination point of the HVDC line. The HVDC switchyard will be air insulated and located outdoors. Additionally, the terminal will include HVDC filters consisting of capacitors, reactors and resistors. The HVDC filters will be designed to prevent the injection of harmonic currents into the HVDC transmission system. The HVDC filters will be air insulated and located outdoors.

Q. Please describe the design of the HVDC converter terminal.

A. A detailed design of the HVDC converter terminal will be developed by the manufacturer selected to install the terminal. A specification has been developed by the Project and as detailed design is advanced the Project will work with the selected manufacturer to formalize requirements. Design of the HVDC converter terminal is based on various Institute of Electrical and Electronics Engineers ("IEEE"), International Electrotechnical Commission ("IEC"), and International Council on Large Electric Systems ("CIGRE") standards. The Project will review and approve the design performed by the selected manufacturer to make sure the requirements are met.

The converter site will include terminal structures, bus work, breakers, switches, converter transformers, reactors, capacitors, a building to enclose converter equipment, instrument transformers and protection and control equipment. Transport of this equipment to the construction site requires access to well developed and maintained roadways. The availability of such roadways at the converter terminal is another reason for its selection.

The specification for the converter manufacturer provides baseline audible noise levels for the HVDC converter terminal site and specifies that the sound produced by operation of all equipment at the facility shall not exceed 30 dbA at any existing occupied residential receptor property when measured within the boundary of the receptor property.

Q. Please describe how the Deerfield Substation is related to the Project and the design of upgrades that are necessary at the substation.

A. The existing PSNH Deerfield Substation will become the Project's interconnection point with the New England electrical system. After the Project delivers power to the Deerfield Substation, it is distributed on the regional grid throughout New Hampshire and New England. Currently, Deerfield is a 345 / 115 kV substation with three 345 kV transmission line connections. NPT will construct a 345 kV AC line from the Franklin HVDC converter terminal to the Deerfield substation.

As described in Bradley Bentley's pre-filed testimony, as part of the ISO-NE I.3.9 approval process it is expected that the Project will be required to bring the existing 391 line (a 345 kV line that currently passes by the Deerfield Substation running between Buxton, ME and Londonderry, NH) in and out of the Deerfield Substation, which will split the existing line into two separate lines. With these additional connections to the 345 kV station, there will be a need to construct two additional substation bays, which will provide the Project the required three new line positions. This will require an additional substation bus, terminal structures, breakers, switches, instrument transformers and protection and control equipment. The bay additions described above will occur within the existing Deerfield Substation fence.

It is also expected that substation upgrades at the Deerfield Substation will be required that cannot be constructed within the existing substation fence. A mechanically switched 345 kV capacitor bank will connect to the existing substation bus via a short overhead transmission span.

Also, a static var compensator ("SVC") is required that will connect to one of the new positions in the existing 345 kV yard via a short overhead transmission line. The switched capacitor bank and the SVC will be located in a separate fenced area on the Deerfield substation parcel. Both pieces of equipment are required for system stability during various contingencies on the system. Placement of the smaller fenced-in yard is situated to minimize wetland impacts directly adjacent to the existing 345 kV fence line. The work inside the new fenced area will include substation bus, terminal structures, a transformer, breakers, switches instrument transformers, a control building and protection and control equipment.

Q. Please describe what upgrades may be necessary at the Scobie Pond Substation.

A. It is expected that the existing PSNH Scobie Pond substation will also require upgrades. A mechanically switched 345 kV capacitor bank will be connected to the existing Scobie Pond 345 kV yard requiring a small expansion of the existing fence. A new 345 kV bay will be constructed which will allow the line position for the connection to the 345 kV capacitor bank. This will require additional substation bus, terminal structure, breakers, switches, instrument transformers and protection and control equipment.

Q. Please describe the facilities needed for the transition between overhead segments and underground segments.

A. At locations where the Project will transition between overhead to and underground, there will be what is referred to as a transition station. This is a small fenced-in area, approximately 75 feet by 130 feet, that includes equipment to connect and monitor the transition from overhead to underground. Within this area is equipment that terminates the overhead transmission line and connects the line down to where it transitions to the underground cable riser. The equipment that is interconnected to the overhead/underground jumper includes surge arrestors and current monitoring equipment. A small enclosure is planned to house the protection and control equipment. If a fault were to occur on the underground cable segment of the Project the operations of the HVDC converter terminals would be different than if a fault occurred on the overhead line segment. The equipment located in the transition station allows the HVDC system to identify where a fault occurs and take the appropriate action for restarting operation. See Proposed Transition Station Designs that are included in Appendix 1.

Q. What upgrades will be required to existing AC transmission facilities in order to meet the Project goals?

A. As noted above, it is expected that an existing 345 kV transmission line will need to be connected to the Deerfield Substation and that an SVC will need to be connected to the 345 kV bus there. Additionally, Deerfield and Scobie Pond require mechanically switched capacitor banks to connect to the existing 345 kV bus.

In addition to the substation upgrades, an increase in the maximum power transfer capability to the 391 line between Deerfield and Scobie Pond and the 373 line between Deerfield and Scobie Pond is expected. This increase in maximum power transfer requires modifications of 10 structures (8 on the 373 line and 2 on the 391line) to increase ground clearances. Additionally, compression hardware that attaches the energized conductor to the structure or splices sections of conductor together will need to be enhanced to accommodate a higher operating temperature range. This will require additional hardware to be installed on the existing compression hardware at tension structures and on existing full-tension splice hardware along the existing conductor.

<u>Public Highway Crossings</u>

Q. What is the basis for your design of the aerial crossings of public highways?

A. The New Hampshire Department of Transportation ("DOT") adopted the *Utility Accommodation Manual* ("UAM") to guide its process for licensing utilities within highway and railroad corridors. Municipalities generally do not have similar guidance. For purposes of NPT's request to cross local roads, the UAM is generally followed because it sets forth the most substantive and stringent design criteria and requirements available in New Hampshire.

Q. Please describe the aerial public highway crossings.

A. Construction of the Northern Pass requires 187 aerial crossings, of which 181 are at locations where transmission lines already exist. Northern Pass proposes to relocate the existing transmission line within the present easement area in order to accommodate the Project. The proposed relocation of the existing line, as well as the installation of the new transmission line are well above the minimum height clearance standards set forth in the UAM.

Of the 187 aerial crossings, 121 are across locally maintained public highways. The aerial spans will vary somewhat between 24 feet and 79 feet above the surface of the highways which far exceeds the minimum 18' clearance above highways required in UAM Section XIII, C,

1. The overhead lines and supporting structures will be located so as to pose no hazard to highway users.

Specific information regarding each crossing including location and height above the highway surface are found in Appendix 9, which includes:

1. A list of Aerial Crossing Locations.
2. Aerial Crossing Design Plans.

A traffic control plan consistent with the Manual on Uniform Traffic Control Devices (MUTCD) and access permits (a.k.a. Drive Permits) will be provided for review and approval in advance of construction.

Q. Does this conclude your testimony?

A. Yes, it does.

DERRICK A. BRADSTREET, PE

Mr. Bradstreet is a project manager and senior electrical engineer in the Transmission & Distribution Division. His responsibilities are in transmission line and substation design. He has experience in both large programs and individual projects which provides a vast background in the permitting, design, procurement and construction of high voltage transmission.

EDUCATION

- BS, Electrical Engineering

REGISTRATIONS

- Professional Engineer/Electrical (KS,NH,TN,UT)

11 YEARS WITH BURNS & MCDONNELL

11 YEARS OF EXPERIENCE

Sewaren-Metuchen 230-kV Conversion | Public Service Electric & Gas Company

Woodbridge, New Jersey | 2014- Present

Project manager for the overhead transmission work associated with the Sewaren-Metuchen 230-kV Conversion projects. Overhead scope includes the design of a double circuit 345-kV transmission line that will connect three existing PSE&G substations. This project includes working through development of design standards and cost savings measures for the initial 345-kV design on the PSE&G system.

Northern Pass Project | Northeast Utilities

Manchester, New Hampshire | 2009-Present

Project manager for the estimated $1.4 billion Northern Pass Project. This includes approximately 153 miles of HVDC transmission and approximately 34 miles of 345-kV transmission. Responsibilities include oversight of all project design, preparation of HVDC client standards, coordination with client engineering staff and siting/permitting team, and quality control review.

System Impedance Calculations | Nashville Electric Service

Nashville, Tennessee | 2012-2013

Engineering manager responsible for the preparation of line impedance modeling for the majority of the NES system. These calculations include 60+ 161-kV and 69-kV circuits totaling over 200 miles in length.

Conceptual Studies | PJM Interconnection, L.L.C.

Norristown, Pennsylvania | 2010-2011

Transmission engineer on the conceptual study team for multiple potential projects being reviewed for consideration in the PJM territory. Responsibilities included engineering review of potential transmission line routes, cost estimates and engineering details for a formal report.

Southern Cross | Pattern Energy

Houston, Texas | 2010-Present

Project manager for the overhead transmission portion of the Southern Cross Project. Responsibilities include oversight of all design activities, preliminary engineering for ±500-kV HVDC, 500-kV AC and 345-kV AC transmission lines, cost estimating and preliminary scheduling associated with the project.

DERRICK A. BRADSTREET, PE

(continued)

New England East West Solution | Northeast Utilities

Berlin, Connecticut | 2005-2009

Project engineer on the design team performing design studies, detailed design, and construction observation for 48 right-of-way miles of new 345-kV and rebuild 115-kV transmission line.

Middletown-Norwalk 345-kV Project | Northeast Utilities

Berlin, Connecticut | 2007-2009

Lead engineer on the 38-mile Interstate Reliability Project 345-kV transmission line. Responsibilities include permitting and siting, evaluating route alternatives, project estimating, client interface, evaluating bids and coordinating subcontractor work. Design responsibilities include design of transmission structures, preliminary engineering and quality review.

Eckles Rd. 161-kV Line | Electric Power Cooperative

Missouri City, Missouri | 2005 – 2006

Project engineer on the design team performing design studies, detailed design, and construction observation for the upgrade of 6 miles of 161-kV transmission line. Variety of responsibilities including PLS-CADD design and support during construction.

Kendall to Cagnon 345-kV Line | Lower Colorado River Authority

San Antonio, Texas | 2005

Project engineer performing a variety of services for the utility, relating to design of a double-circuit 345-kV transmission line. Responsibilities include lightning protection analysis, EMF calculations, insulation coordination, and pre-energization RI/TVI study.

San Miguel to Lobo 345-kV Project | South Texas Electric Cooperative

San Miguel, Texas | 2005 – 2006

Project engineer on the design team performing design studies and detailed design for 45 miles of 345-kV transmission line.

Line 453 69-kV Line Study | Hoosier Energy

Indiana | 2005

Performed analysis on a section of 69-kV transmission line with poor performance. Analysis conducted using PLS-CADD software to determine areas in the line with reliability issues.

GCMW 345-kV Project | American Transmission Company

Wisconsin | 2004-2005

Project engineer for a design team performing preliminary design and studies in support of the ATC Application for Certificate of Public Convenience and Necessity of two 345-kV transmission lines. Responsibilities included development of several tubular steel structure families, conductor evaluation, structure spotting of nearly 300 miles of primary and secondary routes, detailed construction cost estimates, and EMF calculations for each different configuration along all routes.

DERRICK A. BRADSTREET, PE

(continued)

CBEC Grimes Project | MidAmerican Energy Company

Iowa | 2004

Assisted senior engineer in providing recommended electrical characteristics and a lightning study for standard 69-kV, 161-kV and 345-kV structures used within the MEC system.

Cogen II Study | Archer Daniels Midland

Decatur, Illinois | 2004

Project engineer for a 34.5-kV transmission line at the cogeneration plant in Decatur, Illinois. Responsibilities included performing lightning protection study on existing structures and providing a solution to decrease the occurrence of flashover.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF NATHAN SCOTT

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualification and Purpose of Testimony</u>

Q. Please state your name, title, and business address.

A. My name is Nathan Scott. I am a Senior Transmission Engineer for Burns & McDonnell Engineering, Inc. My current business address is 9400 Ward Parkway, Kansas City, Missouri 64114.

Q. Briefly summarize your educational background and work experience.

A. I hold a Bachelor's of Science in Mechanical Engineering from Iowa State University. I also hold a Bachelor's degree in Physics with a minor in Mathematics from Central College in Pella, Iowa. I am a certified professional engineer in the State of Washington and have over ten years of experience specializing in the design of underground transmission lines and underground distribution lines.

I am a member of the Institute of Electrical and Electronics Engineers ("IEEE"), and the Insulated Conductors Committee ("ICC").

For the past two years at Burns & McDonnell ("BMcD"), I have worked on numerous projects as an underground transmission engineer. I have been involved in all aspects of project design, from project inception through construction support and inspection. This includes underground studies and evaluation reports, development of design criteria, routing and siting, cost estimating, cable sizing and ampacity studies, preparation of contract documents including plan, profiles, details, civil and electrical specifications and bid package preparation. I have also performed construction inspections for both civil installation and cable and accessories installation. Please see Attachment A for my resume.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is your role in the Project?

A. I am the underground project manager and lead engineer responsible for the electrical design of the three underground segments of the high-voltage direct current ("HVDC") transmission line associated with the Northern Pass Transmission Project ("Northern Pass" or the "Project") as proposed by Northern Pass Transmission LLC ("NPT" or the "Applicant").

Q. What is the purpose of your testimony?

A. I provide information about the underground design for the Project.

Underground Design

Q. Identify the specific portions of the project that will be sited underground.

A. The Project proposes to construct three separate segments of the transmission line underground. These three segments are (1) the Route 3 Crossing from Pittsburg to Clarksville for approximately 0.7 miles, (2) the Northern Alignment (NRTH) from Clarksville to Stewartstown for approximately 7.5 miles, and (3) the Bethlehem to Bridgewater Alignment (BB) for approximately 52.3 miles. Additional details on each alignment are provided in response to a question later on in this testimony.

Q. Describe the design factors that went into each of three segments.

A. The main factors that were considered when designing the underground segments were constructability, identification of trenchless installation locations, and identifying the preliminary locations of splice pits.

The first step of design consisted of a site visit to the segments of the Project that may be installed underground. As a part of the site visit, the Project team identified and recorded the location of obstacles that would limit the feasibility of open cut trenching techniques. This included bridge crossings, stream and river crossings, and large culvert crossings. Geotagged photos were taken at these locations, and certain reference points were created in Google Earth for further analysis during the desktop design. For many of the potential underground routes Google Earth imagery was available to supplement those taken during field investigations. In some instances, additional field verified information was obtained, such as culvert measurements (invert, size and type). In some locations a remote sensing survey (LIDAR) was also obtained and converted into a basemap to be used during desktop design. In locations where LIDAR survey was not obtained, georeferenced aerial imagery was used to create a basemap.

The second step of the design process involved desktop design. During desktop design, the Project team compiled the information obtained from the site visit(s) to give a reasonable idea of the various constructability techniques that would be required for the different portions of the routes. An analysis of constructability involves determining how the end installation (cables installed inside of conduits and associated splicing locations) will be constructed. This coincides with the size of construction equipment and the available right-of-way and road alignment. Constructability also takes into account potential impacts to existing infrastructure, such as, trees, underground utilities, overhead utilities, and private or public property. Part of the constructability analysis accounted for the restoration of grade and maintenance of existing drainage during construction. Where there were no known obstacles present, open cut trenches were assumed as the feasible installation technique to be utilized. Open cut trenching includes installation from construction equipment including excavators, loaders, backhoes, and dump trucks at grade near the trench. A duct system, which is the combination of the PVC ducts, thermally approved backfill and/or concrete cap, buried at a designed depth so that traffic loads are fully distributed in the soil and are not, therefore, a concern.

At locations where obstacles were identified, trenchless installation techniques were assumed as the feasible alternative to install the duct bank and cable system. Some natural features and road improvements call for the use of trenchless technology (horizontal boring or horizontal directional drilling) for installing the underground conduits and cable. The Project team analyzed the results of site visits, field investigation, and the environmental review to determine the potential trenchless installation locations. Trenchless crossing techniques each have their own constraints related to them, specifically; horizontal directional drills (HDD) require a longer straight distance available for installation than a horizontal bore (HB). Based upon the geometry of the road near a design constraint (river, stream, culvert, etc.) requiring the trenchless crossing, as well as the anticipated depth of the crossing, either an HDD or an HB trenchless installation technique was assumed for each such location, as described in the following paragraph. Additional field investigation and design will be required during the detailed design phase to verify the types of trenchless installation techniques that will be used. It is also possible that during the detailed design phase, alternatives to the trenchless installation may present itself at any given location.

Q. Please describe the trenchless construction techniques considered when developing the design of the Project.

A. The two main trenchless techniques considered for this project are HDD or HB. The exact type of HB to be used depends specifically on the location of the bore, and can be one of a number of varying techniques, such as: Auger Boring, Jacking and Boring, Pipe Ramming, Micro Tunneling, or a variation of the these techniques. Both HDD's and HB's have installation criteria that dictate which technique is feasible for a specific crossing.

HDD's consist of drilling equipment located at grade that can drill for long distances, ranging from approximately two hundred and fifty feet to two thousand five hundred feet for this project. HDD's are installed in an entrance and exit arc of a radius that is dictated by the equipment being used and the materials being installed. The arc is located between the at-grade entrance location and the at-grade exit location, however, straight portions of installation, or horizontal bends can be utilized as well to get the desired geometry for the bore, again, the exact radii and slope angle that may be used are dictated by the equipment being used and the materials being installed.

HB's consist of digging a large jacking pit and a smaller receiving pit to bore directly between. The geotechnical qualities of the soils can impact the type of trenchless installation technology used. Both types of trenchless installation require either a large footprint for a long period of time for equipment or a large footprint for the excavated jacking and receiving pits, therefore, open cut trenching installation is typically the preferred installation technique. A maximum trenchless installation excavation pit was assumed as twenty feet wide by twenty feed deep by sixty feet long. These dimensions may vary depending upon the type of equipment to be used during construction as well as the depth of the obstruction being crossed. The vertical separation below existing obstruction was assumed to be ten feet. This vertical separation may be reduced during detailed design, which would affect the overall depth of installation required. HDD's will also require additional physical footprint for at-grade auxiliary equipment. The exact dimensions required for this equipment will vary depending upon the location of installation, but will be optimized to reduce the impact to traffic or vegetation.

During detailed design, alternatives to trenchless installation of the cable and conduit system utilizing other techniques will be analyzed further to try and reduce the number of trenchless installations to the extent possible. A major assumption used during the preparation of the preliminary design drawings was that all existing culverts must be kept in place and may not be re-built as a part of this project. As further information is gathered to support a detailed design, certain locations may present themselves as being viable for replacement of the culvert as a part of this Project.

Q. What other factors did you take into consideration in the underground design?

A. After determination of the route centerline and the locations where trenchless installation was assumed, splice locations were identified. The number of splice locations are minimized to reduce the overall impact to shipment of cable reels as well as the construction duration. The fewer number of splices required to construct the Project, the less overall impact to traffic and the general public. Although the desired splice location is determined primarily by the distance from one splice location to another, there are also additional constraints that impact the splice pit locations. Constraints, such as, a direct line of sight from a residence, locations of driveways and intersecting roads, roadway widths, and existing underground and overhead utilities were considered when selecting the proposed splice pit locations.

Q. Please describe the how the open cut trench installation will be backfilled and any special considerations that were taken into account.

A. The current design consists of open cut trench installation of conduits inside of a thermally approved sand mixture. A concrete cap will be placed above the sand mixture to provide mechanical protection. Above the concrete cap, native soils excavated from the trench shall be used as a backfill if they meet aggregate size requirements and predetermined thermal design requirements. In the event that there is not enough suitable native material available for use as backfill, a thermally design low strength fluidized thermal backfill shall be used.

The Project location presents specific obstacles to construction, primarily availability of materials as well as the cost to procure them. For this reason, the Project anticipates that the concrete cap will be precast segments that are brought to the site and lowered into the trench. The thermally approved sand mixture and fluidized thermal backfill shall be procured from batch plants as near to the site of construction as possible. These backfill materials shall be transported in concrete mixer trucks. Native soils excavated from grade shall be kept either near the current trenching activities, or at a nearby staging location and transported back and forth to the trench.

<u>Project Details</u>

Q. Please describe each underground segment of the Project in detail.

A. The preliminary underground design plan and profiles are included in the NHDOT applications and attached in Appendix 9. These drawings show the location and depth of the cable system. The drawings also show the proposed location of trenchless construction. The three underground segments of the Project are described in more detail below.

Route 3 River Crossing from Pittsburg to Clarksville

The Route 3 Crossing is approximately 0.7 miles long. The installation of the Project through this segment consists primarily of open cut trenching installation with one HDD trenchless installation under Route 3 across the Connecticut River. There will be one splice location and two transition stations along the route. It will be constructed along Route 3 and Beecher Falls Road, in Pittsburg and Clarksville.

Northern Alignment (NRTH) from Clarksville to Stewartstown

The NRTH is approximately 7.5 miles long. The proposed installation consists primarily of open cut trenching installation with seven trenchless installations under streams and culverts. Although assumptions on the type and length of trenchless installations have been made as a part of preliminary design, the determination of the specific trenchless methods that will be used will depend upon the length of the trenchless installation, geometry of the roadway, and geotechnical soil properties. Geotechnical and soil information that will be gathered during detailed engineering and the trenchless installation method will be analyzed for the selection of the best solution. There are twenty-three proposed splice locations and two proposed transition stations along the NRTH. The NRTH will be constructed along Route 145, Old County Road, North Hill Road, and Bear Rock Road and is located within Clarksville and Stewartstown.

Bethlehem to Bridgewater (BB)

The Bethlehem to Bridgewater alignment (BB) has an overall length of approximately 52.3 miles. The proposed installation consists of open cut trenching installation with 43 identified trenchless installation locations across streams and culverts. There are 134 proposed splice locations and two proposed transition stations. Although assumptions on the type and length of trenchless installations have been made as a part of the preliminary design, the determination of the specific trenchless methods that will be used will depend upon the length of the trenchless installation, geometry of the roadway, and geotechnical soil properties. Geotechnical and soil information will be gathered during detailed engineering will be analyzed to select the best solution. Starting in Bethlehem and traveling south through, Sugar Hill, Franconia, Easton, Woodstock, Thornton, Campton, Plymouth and ending in Bridgewater, the BB will be constructed along Highway 302, Route 18, Route 116, Route 112, Route 3.

The location of the underground segments were developed from a combination of desktop review, utilizing Google Earth, and GIS maps and field review consisting of driving the routes and identifying any constraints observable from the roadway. Major design considerations were taken into account during the preliminary design to find the optimum location in the road for the proposed underground installation, especially splicing locations and trenchless installation locations. In general, the underground segments are designed to avoid conflicts with existing overhead utilities. The segments are also designed to minimize impacts on wetlands and other resources.

Q. Please describe the underground transmission cables that will be used.

A. The underground cables are made up of several layers of concentric materials, including:

- Copper conductor – carries the power in the cable
- Conductor shield – provides smooth interface between conductor and insulation
- Insulation – cross-linked polyethylene (XLPE) – provides the protection of the voltage to ground
- Insulation shield – provides smooth interface between insulation and metallic screen
- Metallic screen – carries fault current to ground and provides moisture protection
- Outer jacket – provides mechanical and moisture protection for the cable

The underground cables are installed in polyvinyl chloride (PVC) conduits. The design accounts for two – 8 inch PVC conduits for the two power cables to be installed, and three – 3 inch PVC conduits for communications and grounding purposes.

Q. Do backfill materials impact cable installation or performance?

A. From a design standpoint, the materials placed in a trench must meet certain requirements to be suitable for use as a backfill. This includes both the mechanical properties of the material, as well as the thermal characteristics of the material. If a backfill material does not meet the designed for thermal resistivity requirements, the result on the cable system may be a reduction in the amount of heat that can be dissipated, resulting on a hot spot on the cable system that could potentially impact the overall circuit rating of the system. See Appendix 9 for a representation of open cut trenching installation of conduits.

Q. Please describe how the placement of transition structures will affect the design of the underground segments.

A. Overhead to underground transitions stations will be installed to allow for the transition of the overhead conductor to the underground location. The transition station will resemble a small switching station. It will have an area approximately 75 feet by 130 feet, and it will be enclosed by a perimeter security fence to limit access to those qualified to be present within the fence. The equipment at each transition station will include a line terminal structure, surge arresters, instrument transformers, cable terminators, communications equipment, and a small control building.

The placement of the transition structure is vital to the orientation and approach of the underground cable and overhead line and is selected to maintain the proper alignment for both the overhead and underground installations as well as limit environmental impacts.

The location of the transition structures must accommodate the installation of the cable system. Physical obstacles, such as steep grade changes, existing utilities, structural foundations, etc. are taken into consideration for routing the cables to the termination point. For this Project, the proposed transition station locations accommodate cable alignments coming off of the road right of way to the cable termination points. See Appendix 1 for the proposed plan and profile designs for the transition stations.

Q. How does the Project change from the 1,200 to 1,090 MW affect the underground design?

A. The 1,200 MW cable system consists of a different cable technology than the 1,090 MW cable system. The 1,200 MW cable system would consist of two mass impregnated insulated cables per high voltage direct current (“HVDC”) pole as well as two metallic return cables. The 1,200 MW system would have six ducts for power cables; two for the ‘+’ pole, two for the ‘-‘pole and two for the metallic returns.

The 1,090 MW cable system consists of one XLPE insulated cable per pole. The 1,090 MW system would have two ducts for power cables: one for the ‘+’ pole, one for the ‘-‘pole and zero metallic returns.

The reduced number of power cables for the 1,090 MW cable system results in a smaller physical footprint required for installation, both horizontally and vertically. This applies to both open cut trenched installation and trenchless installation.

Due to the total number of cables required for the 1,200 MW cable system, two splice pits would have been required at each splicing location. For the 1,090 MW cable system, only one splice pit is required at each splicing location.

Splicing is also different. The duration required to splice one set of mass impregnated insulated cables for the 1,200 MW cable system is approximately one month per splice location. The duration required to splice one set of cross-linked polyethylene cables is approximately one week per splice location. The significant difference in duration is largely due to the insulation materials of the cables. The mass-impregnated insulation is paper insulation that has been impregnated with oil prior to installation. The splicing process is entirely by hand. For the XLPE cables, pre-molded joints can be utilized to remove a majority of the work that would otherwise have to be done by hand.

Q. What factors were considered to ensure that the underground segments of the Project are designed in a safe manner?

A. Safety is a key element of the underground design. One safety consideration during design is the presence of existing utility infrastructure, typically from below-grade water, sewer, gas and electric lines. NPT will identify and locate the existing underground utilities to the extent possible in the Project area. Where practical, the Project will be designed to avoid the existing utilities that are collocated in the road ROW. The contractor will support and protect the existing utilities during the construction of the Project. The contractor will coordinate construction of the Project with the existing utility owners and immediately contact the utility owner in the event an unidentified utility is encountered during the construction of the Project. For the majority of the Project, there is no existing underground infrastructure.

Overhead utilities can also impact underground excavation. For the most part, the Project considered existing overhead utilities and avoided impacts to them to the extent practicable. The preliminary design of the Project was located so as to be on the opposite side of the road as existing overhead utilities wherever practicable. Although design is done to minimize impacts to existing overhead utilities, as design progresses, it will become evident where relocation of the existing overhead distribution or other existing utilities may be required. These locations will most likely be at trenchless installation locations or at splice pit/vault locations. In the rare event, relocation of existing utilities is necessary, NPT will coordinate with the utility owners/operators to avoid and minimize impacts to the customers being served by those utilities.

Q. Does this conclude your testimony?

A. Yes, it does.

NATHAN D. SCOTT, PE

Underground Project Engineer / Underground Project Manager

Mr. Scott is a senior transmission line design engineer with over 10 years of engineering experience.

EDUCATION

- BA, Physics
- BS, Mechanical Engineering

REGISTRATIONS

- Professional Engineer/Mechanical (Washington)
- Member of IEEE
- Member of ICC

2 YEARS WITH BURNS & MCDONNELL

10 YEARS OF EXPERIENCE

Northern Pass 300-kV HVDC Underground Project | Northeast Utilities
Pittsburg, NH | Current

Engineer for the preliminary route analysis of three segments of a total of 62-miles of 300-kV DC underground transmission line through rural areas. Primary responsibilities include site evaluation, route analysis, feasibility studies, preparation of preliminary plan and profile drawings and associated specifications. Additional responsibilities include support for public involvement activities including attending Open Houses.

Station 23 115-kV Transmission Line | Rochester Gas & Electric
Rochester, NY | Current

Engineer and Project Manager for the design of a 115-kV XLPE underground transmission line with both open air and GIS terminations. Primary responsibilities include scope definition and project estimating, design and review of the following; construction drawings and specifications, ampacity calculations, cable pulling tensions, as well as construction sequencing and the development of outage durations associated with construction tasks.

Southwest Ring Road 138-kV & 240-kV | AltaLink
Calgary, Alberta, Canada | Current

Engineer and Project Manager for the design of 138-kV XLPE and 240-kV XLPE underground transmission lines installed within the same trench. Primary responsibilities include scope definition and project estimating, design and review of the following; construction drawings and specifications, ampacity calculations, cable pulling tensions, as well as construction sequencing and the development of outage durations associated with construction tasks.

Bello – Guayabal – Ancon Sur 220-kV Underground Project | EPM
Medellin, Columbia | Current

Engineer and Project Manager for the design of two 220-kV XLPE underground transmission lines installed within the same trench. Primary responsibilities include scope definition, design and review of the following; construction drawings and specifications, ampacity calculations, cable pulling tensions.

Underground Transmission Initiative | Public Service Electric & Gas
New Jersey | Current

Provides engineering review for the design of new installation and re-conductor of HPFF circuits.

NATHAN D. SCOTT, PE

(continued)

Alaskan Way Viaduct and Seawall Replacement Project* | Washington State DOT / Seattle City Light

Washington | 2006 - 2013

Lead Design Engineer for this project. As a lead design engineer he was responsible for a wide range of duties. He ran and participated in numerous coordination meetings between different City, State and Private entities. He was responsible for route analysis, feasibility and selection. He performed all aspects of design engineering work ranging from centerline identification, below grade analysis for utility conflicts, cable technology analysis and selection, circuit rating and cable sizing, cost estimating, and preparation of contract documents including Plans and Profiles, Details, Specifications, Engineering Calculations and Estimates. Mr. Scott also assisted with construction management duties including RFI and submittal reviews as well as attending coordination meetings with the Contractor and inspection duties. He worked on the relocation of five underground 13.8kV network feeders, the relocation of two overhead 26kV radial feeders underground with two cables per phase for each circuit, and the relocation of two underground 115kV transmission circuits, all through an urban corridor.

Central Waterfront Project* | Seattle City Light / Seattle DOT

Washington | 2010 - 2013

Lead Design Engineer for this project. As a lead design engineer he was responsible for a wide range of duties. He ran and participated in numerous coordination meetings between different City, State and Private entities. He was responsible for route analysis, feasibility and selection. He performed all aspects of design engineering work ranging from centerline identification, below grade analysis for utility conflicts, cable technology analysis and selection, circuit rating and cable sizing, cost estimating, and preparation of contract documents including Plans and Profiles, Details, Specifications, Engineering Calculations and Estimates. Mr. Scott also assisted with construction management duties including RFI and submittal reviews as well as attending coordination meetings with the Contractor and inspection duties. He worked on the relocation of two overhead 115kV transmission circuits underground through an urban corridor.

IRIS Project* | Bill and Melinda Gates Foundation

Washington | 2011 - 2012

Lead Design Engineer for this project. As a lead design engineer he was responsible for a wide range of duties. He ran and participated in numerous coordination meetings between different City, State and Private entities. He was responsible for route analysis, feasibility and selection. He performed all aspects of design engineering work ranging from centerline identification, below grade analysis for utility conflicts, cable technology analysis and selection, circuit rating and cable sizing, cost estimating, and preparation of contract documents including Plans and Profiles, Details, Specifications, Engineering Calculations and Estimates. Mr. Scott also assisted with construction management duties including RFI and submittal reviews as well as attending coordination meetings with the Contractor and special inspection duties. He worked on the relocation of one overhead 115kV transmission circuit underground and three overhead 26kV radial feeders underground with an end build out of two cables per phase per circuit, all through an urban corridor.

Bainbridge Island 115kV Feasibility Study* | Puget Sound Energy

Washington | 2012

Lead Design Engineer for this project. As a lead design engineer he was responsible for a wide range of duties. He ran and participated in coordination meetings with Puget Sound Energy. He was responsible for route analysis, feasibility and recommended alternative. He performed various aspects of design engineering work ranging from centerline identification, cable technology analysis, circuit rating and cable sizing, cost estimating, and preparation of report documents.

NATHAN D. SCOTT, PE
(continued)

Denny Substation 230kV Feasibility Study* | Seattle City Light
Washington | 2012 – 2013

Lead Design Engineer for this project. As a lead design engineer he was responsible for a wide range of duties. He ran and participated in coordination meetings with various city entities. He was responsible for route analysis, feasibility and recommended alternative. He performed various aspects of design engineering work ranging from centerline identification, cable technology analysis, circuit rating and cable sizing, cost estimating, and preparation of report documents.

**denotes experience prior to joining Burns & McDonnell*

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF JOHN KAYSER

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name, title, and business address.

A. My name is John Kayser. I am a Project Manager in the Transmission and Distribution division at Burns & McDonnell. My business address is Burns & McDonnell, 27 Pearl Street, Portland, ME.

Q. Briefly summarize your educational background and work experience.

A. I am a Professional Engineer in the states of Florida, Iowa and Maine. I am also a Project Management Professional (PMP) registered with the Project Management Institute. I graduated from Iowa State University with a Bachelor's of Science degree in Electrical Engineering in May 1992.

I have more than twenty-three years of professional experience in design and construction projects with more than sixteen years of experience in the transmission and distribution utility industry including substantial experience in the construction of large transmission and distribution projects. I am a member of the Society of American Military Engineers, the Project Management Institute and the Institute of Electrical and Electronics Engineers.

I have been in my current position as Project Manager since 2009. Prior to that I was employed by Alliant Energy from 1999 to 2009 where I held several positions in Delivery System Planning and Project Management. From 1997 to 1999 I was employed by All County Electric in Marion, IA as an Electrical Engineer and Project Manager. From 1992-1997 I was a member of the United States Air Force where I served in several engineering, management and leadership positions. I am also currently a member of the Maine Air National Guard where I serve as the commander of the 101st Civil Engineer Squadron.

Please see Attachment A for my resume.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is your role in the Project?

A. I am a Construction Project Manager. I am working on planning for management and oversight of the construction for the Northern Pass Transmission Project ("Northern Pass" or the "Project") proposed by Northern Pass Transmission LLC ("NPT").

Q. What is the purpose of your testimony?

A. I provide an overview of the construction management activities that will be implemented for the Project including a summary of the management processes and techniques that will be used. I also explain the processes used to plan, implement, monitor and communicate the construction activities of this Project, and closely coordinate those activities with, the engineering, permitting, real estate and community relations stakeholders. I will describe the major construction activities, how the construction will occur at multiple locations simultaneously, and how the Project will ensure compliance with the Certificate and other permitting requirements. I will explain how the management team will protect the safety of the public and workers and maintain communications with the local officials and residents of the communities affected during construction and discuss certain traffic considerations during construction.

Project Management Procedures and General Project Construction Activities

Q. Please provide a general overview of how the construction of the Project will be managed.

A. The construction of the Project will be managed consistent with other large-scale Eversource Energy projects that have recently been completed. The Project Manager of Construction ("PMC") will be responsible for the direct oversight and management of the field inspectors, safety specialists, outage coordinator, which are further described below, and for the oversight and coordination with the contractors' construction management teams.

As is typical with projects of this size, there will be field inspectors reporting directly to the PMC who will have the responsibility to audit the various construction contractors. For example, there will be field inspectors with relevant qualifications and experience specific to each of the following construction types: high-voltage direct current ("HVDC") Overhead Transmission, HVDC Underground Transmission, Alternating Current ("AC") Overhead Transmission, HVDC Converter Terminal, HVDC Overhead / Underground ("OH/UG") Transition Stations and Existing AC Transmission and Modifications and Existing Substations Modifications. The Project Management staff and organization hierarchy is illustrated in the Construction Management Reporting Matrix. See Attachment B of Jerry Fortier's Testimony for a sample of such a plan.

In addition to the experienced staffing and organization hierarchy, management processes such as a Project Execution Plan ("PEP"), Construction Phasing Plan ("CPP"), Compliance Plan ("CP") and Construction Schedule will be used. The PEP will be developed specifically for this Project and is essential to assist the Project Management Team ("PMT") and the contracted parties with the efficient and successful execution of the Project in a manner consistent with the Project's regulatory and permit obligations, cost, schedule, quality, and performance objectives.

As part of the PEP, a CPP will be developed and implemented. The CPP is a critical element in the overall planning process and describes detailed plans for construction and system outage planning. It will be developed in close cooperation between the PMT, contractors, and NPT staff. The detailed plans are expected to be revised and updated as the Project proceeds to account for further discussions with Electric System Control Center and ISO-NE, potential scheduling conflicts with other projects in the Northeast area, and specific maintenance projects on the Eversource system.

A Quality Assurance/Quality Control ("QA/QC") Plan will also be established and implemented as part of the PEP. This plan covers the QA/QC requirements for the Project including field operation procedures such as construction monitoring, communications, maintenance of construction records, materials receiving, right-of-way ("ROW") inspections, and specific inspections during and after work completion. Also included are QA/QC processes for detailed engineering and design activities including periodic reviews of design documents, procurement QA/QC processes, and procurement source inspection criteria.

The CP is prepared by each Contractor and reviewed and approved by the PMT, field construction personnel, and Project Environmental Monitors ("EMs"). It includes site specific information such as construction drawings, graphics and excerpts from site-or resource-specific plans. A CP summarizes the environmental features and environmental and other regulatory/siting requirements relevant to construction activities at a particular construction location or a ROW segment and provides for the review of the work activities/sequence of work to be performed by the Contractor at the site. The CP details the procedures that the Contractor will implement to comply with the specified requirements during the performance of specific construction tasks and will be submitted to and approved by NPT or NPT's representative in advance of the site work. In accordance with NHDES permit conditions, a pre-construction kick-off meeting will be held for all personnel involved in inspecting and monitoring the project. Further, the approved CP must be reviewed in the field by construction personnel immediately prior to commencing work at the specified site.

Field Inspectors ("FI") will report to the PMC and are responsible for making periodic work site visits and for providing the field observations and monitoring of the construction contractor's operations and compliance with the Project requirements. The FIs record pertinent construction information in reports, attend weekly construction status update meetings, monitor the contractor's quality control process, monitor testing and inspection activities, attend and participate in outage coordination planning and weekly construction status meetings.

Safety Specialists ("SS") will report to the PMC and are responsible for providing the field observations and monitoring of the construction contractor's operations and compliance with the Project Health and Safety Plan ("HASP"). Safety Specialist is responsible for making routine work site visits and observing and reviewing the contractor's safety plans. The SS is responsible for recording pertinent safety information in daily reports, attending weekly construction status update meetings and monitoring the contractor's compliance with the HASP.

Q. Please elaborate on the training programs and any related oversight associated with the Project.

A. All PMT field staff must complete a 30 hour OSHA Construction Safety & Health course prior to their field assignment. NPT's Engineer employees are required to maintain a First Aid and CPR certification and must complete a Driver Safety Course. The Transmission and Distribution Project staff is also required to take a 10 hour OSHA Electric Utility Safety class. Each of the projects has a site specific Project Orientation that is required for all individuals working on the Project. The orientation is typically 3 hours in length and covers safety, environmental awareness, security, and community relations.

Internally, NPT's engineering contractor will have the expertise to provide their employees with specific job safety training. Some examples of training include OSHA 10 and 30 Hour, construction outreach, confined space, fall protection, trenching/excavation, lockout/tagout, hazard communication, respiratory protection and rigging. In many cases training programs are developed in collaboration with the utilities to incorporate their standard procedures, such as substation access. Updates are provided if there are major changes or modifications to the OSHA Construction standards.

The Project team will provide additional training to the contractors, specific to environmental issues. It is expected that training programs will be similar to what is typically provided on other large scale transmission projects. For example, pre-construction training consists of Level I training for Project Orientation (referenced above), and Level II environmental training all personnel having a supervisory position. In addition to these two trainings, environmental refresher training is provided each spring, to coincide with mud season. The environmental refresher training covers the basics of erosion and sediment control and emphasizes environmental awareness and accountability; making good decisions; and properly communicating any environmental problems encountered. Environmental alerts and updates are provided to all contractors on a regular basis to facilitate communication and discussion of problems encountered by the Project.

Q. Please describe how the construction schedule and construction plan is developed.

A. The construction schedule for the Project is developed by establishing key milestones and in-service dates. An iterative process is then used to further develop the schedule. A construction plan for the Project is developed by incorporating the vast experience from similar projects and the varied expertise of the Project team to establish activity durations and the logical path to meet the milestones established for this Project.

Consideration is given to the aspects and risks that will be encountered including; time of year restrictions for both environmental and transmission system requirements, public relations and real estate agreements, long lead material procurements and the Certificate requirements. Using this information, a summary level schedule will be developed placing each activity in a progression to achieve the final in-service dates. The summary level schedule will be included in all contractor agreements with the requirement that the contractor(s) responsible for the construction of the major construction groups must develop, implement and update (regularly) a detailed construction schedule. This schedule is typically used for tracking completed work and forecasting future work activities and confirming key milestones will be met. The schedule includes major work categories such as foundations, cable trench and conduits, structural steel, poles, conductor and will factor in major Project milestones. These categories are likely to be segregated by line section, line number, town, voltage group and/or area of a station.

The Project is not complete and ready for energization until all components have been completed, such as the HVDC Overhead Transmission, HVDC Underground Transmission, AC Overhead Transmission, Converter Station, HVDC OH/UG Transition Stations, Existing AC Transmission Modifications and Existing Substations Modifications.

The construction plan for the Project is developed using the summary schedule to form the basis of the construction services and material supply of the substations and transmission lines. A construction planning team will be involved in the further refinement of the construction sequencing including final commissioning of the stations and transmission lines. With a scope as complex and large as Northern Pass, there are numerous constraints within the transmission system which require consideration. The factors that are considered in the development of a construction plan are transmission and distribution line outage constraints, seasonal constraints, maintaining system reliability and constructability. The construction planning team includes members from the Project team, representatives from Eversource Energy system planning, system operations and engineering, project managers, outage coordinator and the contractor(s) management team.

The team will collaborate to produce detailed sequence diagrams for the Project. These diagrams provide a step-by-step visual representation of the sequencing of construction activities required to construct and energize each substation and line section.

NPT will construct new overhead transmission lines within new ROW and existing ROW corridors. Where existing transmission lines along the ROW will need to be relocated, outages of the system will be necessary and will require coordination with ISO-NE. This will be handled by an Outage Coordination Team. These outages should not result in any actual customer outages.

Once the construction sequencing is developed, the Project team will implement the outage schedule process. The outage schedule process is used to confirm that all new or modified transmission and station facilities are sequenced into service in accordance with ISO-NE Operational procedures and with minimal disruption to the transmission grid and no interruption of service to the distribution customers.

Q. Since construction will occur in more than one location simultaneously, describe how this affects Project management.

A. The Project scope is divided into seven major construction types: HVDC Overhead Transmission, HVDC Underground Transmission, AC Overhead Transmission, Converter Station, HVDC OH/UG Transition Stations, Existing AC Transmission Modifications and Existing Substations Modifications.

Separating the work into construction types and specific activities will allow multiple crews and contractors to work at various locations throughout the Project at the same time. For example, a tree clearing crew could be working in Pittsburg at the same time a structure setting crew is working in New Hampton, while a site development crew could be working in Franklin at the converter location. The work locations will be scheduled and managed to provide for the most efficiency while maintaining compliance with the requirements of the Certificate.

To support the construction activities, the PMT includes project managers, assistant project managers, construction manager, environmental manager, and community relations manager. The Project manager and assistant Project manager are assigned to specific regions or aspects of the Project. In addition, the field staff responsible for oversight and monitoring the work includes construction field inspectors, environmental inspectors, safety specialists and community relations operatives.

Each major construction work location will have an assigned hierarchy of project management and field support staff responsible for the oversight and management of that work and contractor activities. The staff assignments will be determined accordingly by the qualifications and experience relevant to the type of work involved.

Q. Please describe how construction will be planned and managed for the work areas in proximity to existing features, such as, utilities, railroads, highways and sensitive environmental areas.

A. With a Project of this size and magnitude, there will be numerous major construction activities and undertakings due to the large area and varied geography. The construction of the Project will include locations where it will be necessary to cross or work adjacent to rivers, highways, railroads, gas pipelines or other utilities. Each of these locations will be planned and coordinated with the agencies having jurisdiction to comply with the requirements. NPT will plan and perform the work in compliance with applicable permits, plans, specifications, codes and regulations. The work will be planned and performed by qualified contractors with experience in the required work, using appropriate procedures, equipment and personnel with the necessary technical expertise. The PMT will monitor the construction activities, provide oversight, coordinate inspections, and audits throughout the construction process.

Sensitive environmental resources, including rare plants, wildlife and cultural areas are present throughout the Project work areas. Compliance plans will be created for each work area and will include the measures to avoid, minimize, and mitigate as necessary to meet the requirements of the Certificate. See e.g., DEIS, Appendix H, Applicant-Proposed Impact Avoidance and Minimization Measures.

As discussed in the pre-filed testimony of Lynn Farrington, the overhead and underground work locations within, adjacent to or crossing a highway or public road, traffic control plans will be developed to comply with New Hampshire Department of Transportation ("NHDOT") requirements. In locations where the overhead transmission line will cross over/under other energized transmission or distribution lines, the contractor will develop and implement a plan to maintain minimum approach distances to other energized lines and coordinate with the utility to set up protection of the lines. For the overhead transmission line work the construction contractor will be required to develop safety work plans specific to the location which will utilize guard structures or equipment specific to prevent low sagging wires from interfering with highway and other utilities during construction activities. In areas where the relocation of existing transmission and distribution lines is necessary, pre-outage work will be performed to the extent possible to minimize outage durations and coordinated with ISO-NE and the utilities to perform within the required outage windows. Outages will be planned and coordinated per the procedures referenced above. The PMT will plan the relocation of distribution lines to minimize the length of any required customer outages.

Similar to highway crossings, the Project will be constructed in locations where it will be necessary to cross or work adjacent to a railroad. Each of these locations will be planned and coordinated with the agencies having jurisdiction to comply with the requirements for flagging and construction activities. The construction contractor will be required to develop safety work plans specific to this location which will utilize guard structures or equipment specific to prevent low sagging wires from interfering with the railroad during construction activities.

For work locations adjacent to or crossing gas pipelines, the PMT will coordinate with the utility owner to determine the location of pipelines and requirements and protocols for construction near pipelines. The methods and protocols will include requirements for communications with the utility, locating the pipeline, excavating near pipelines and construction of access roads to cross the underground pipeline. In addition, to eliminate the risk of damaging the gas pipeline, the construction contractor will be required to locate the gas pipeline at each location where structure foundations will be installed in the vicinity of the pipeline. The contractor will be required to meet the utility owner's requirements for excavation and construction in the vicinity of the pipeline.

Distribution lines are the lower-voltage power lines that bring electricity to customers' homes. Sometimes, these lines are located in transmission ROW. During construction, the relocation of existing lines is carefully coordinated with the installation of new lines to allow workers to safely perform construction while customers continue to receive electrical power with no loss of service. Where relocations are required, new distribution poles and wires are first installed in an alternate section of the ROW. Once complete, the existing distribution line is de-energized so that the new section of line can be cut-in. The cut-in of the newly constructed line may require an outage. The work will be done to minimize the outage duration and will be coordinated with the affected customers to minimize impact. The de-energized portions of the lines are then removed so that transmission line construction can continue.

Planned transmission outages will be required in locations where existing 115 kV transmission lines need to be relocated to facilitate the construction of the new 320 kV HVDC and 345 kV AC lines. The relocated 115 kV lines are constructed parallel to the existing line while the existing lines remain in service. Construction is completed to the extent possible and in coordination with ISO-NE and the utility; a planned transmission outage will be taken to cut-in the new section of line. This planned outage will not cause any loss of service to the distribution customers.

In the locations where the work zone crosses the White Mountain National Forest and the Appalachian Trail, the PMT will notify and coordinate with the responsible entities to plan and manage temporary trail relocations, barricades and signage for the work areas during construction activities. On site traffic control personnel will be used during active construction periods in that location.

For the work locations in urban areas, the management team will notify and coordinate with the nearby businesses, municipalities and residential areas affected to develop and implement traffic control plans including the consideration of nighttime work to minimize traffic impacts. Other work will include the construction of the overhead transmission line near the Concord Airport. The PMT will notify and coordinate with the Federal Aviation Administration (FAA) and Concord Airport operations for design and construction plans to meet the requirements.

For the work locations in active farmlands the PMT will notify and coordinate with the owners to avoid impacts to the crops during growing seasons. Where practicable, the work may be scheduled to avoid the growing seasons, locate access roads and work pads to avoid or minimize disturbance and establish methods for soil preservation.

Q. Please describe the blasting procedures associated with construction.

A. It is anticipated that blasting will be required for overhead, underground and substation construction of the Project. The Project specifications will require that only experienced, licensed blasting contractors will be allowed to perform work on the Project and will comply with all applicable federal, state and municipal regulations, the Certificate, permits, Project engineering specifications and OSHA requirements.

Prior to commencement of work, Project specific blasting plans are submitted by the contractor to the management team for review. In a typical blasting plan, the contractor will demonstrate how the operations will comply with requirements. This generally includes pre- and post-blast surveys, well testing (if needed), vibration monitoring (seismographs), Activity Hazard Analysis, Pre-Task Analysis and notification procedures. In addition, the plans generally provide information about physical site perimeter control measures, safety control measures, warning signs and sounds, and site control plans for essential workers.

The typical notifications that are provided include:

- 30 days prior, abutting neighbors with residences, structures or water wells within 500 feet will be notified of blasting activities;
- The contractor or blasting agent will go door-to-door with an invitation to conduct pre-blast testing 14 days prior to activities;

- The contractor, blasting agent and public involvement team members will meet with the abutting neighbors to provide pre-blast appointment;
- Water wells within a five hundred foot radius of the blast location will be tested using the State of New Hampshire, Department of Environmental Services, Water Testing Guide, to establish a pre-blasting baseline;
- Structures and residences will be videotaped to established pre-blast baseline;
- Abutting neighbors can be notified the day of blasting via telephone call or email;
- Abutting neighbors can follow up with concerns through the Project hotline or website portal; and
- Post-blast testing will be offered upon request by the abutting neighbor.

Q. How will the Project comply with all of the requirements of the Certificate when implementing the construction plan, including, the conditions set under each State and federal permit?

A. The PMT has a proven track record of executing a construction plan to comply with all conditions set under the permits obtained for this Project.

In order to ensure quality and consistency across all aspects of the Project, contractual agreements with all contractors and sub tier contractors will include a copy of the Certificate and require full compliance with the Certificate as part of the agreement. NPT's engineering contractor responsible for management and construction oversight will provide environmental and safety orientation to all staff that will be performing field work on the Project. The PMT employs a proactive management strategy for the implementation of the environmental compliance program. Rather than simply inspecting for issues after they have occurred and reactively responding, the PMT continues to develop strategies to avoid and minimize occurrence of issues in the first place. These strategies focus on how to train contractors and subcontractors so that they work with the PMT staff to reduce or alleviate the probability of non-compliance/violation incidents occurring.

In preparation for construction, the PMT will follow a Project Sourcing Plan to develop contractual agreements with the contractors. These contracts will include flow down clauses which assign the terms and conditions and Certificate requirements to the contractors. The contractor will be required to develop and submit Compliance Plans. These documents summarize the environmental features and other regulatory and siting requirements relevant to construction activities at a particular construction location or a ROW segment, review the work activities and sequence of work to be performed by the contractor at the site; and detail the procedures that the contractor will implement to comply with the specified requirements during the performance of specific construction tasks. This compliance tool is reviewed and approved by the PMT, as well as by field construction personnel, including Project environmental inspectors.

The construction contractor will be required to provide QA/QC processes and staff, along with dedicated environmental and safety staff to confirm compliance with the Certificate. Each contractor is responsible for managing its own staff and compliance with the Certificate and is also responsible for monitoring and enforcing its disciplinary procedures. Furthermore, the PMT will provide field oversight and monitoring of the construction contractor's practices to confirm compliance with the Certificate. The PMT will confirm that the construction specifications accurately incorporate or reference directly all relevant environmental certificate, permit, and approval conditions and plans to be implemented during construction and that Project environmental requirements were reviewed with the contractors. The PMT provides an environmental manager, with expertise in the certificate conditions and is available to respond to questions that may arise during the course of construction activities.

Pre-construction walk-overs are performed with supervisory contractor's staff responsible for environmental compliance, appropriate PMT members, such as the environmental inspector, and the construction field inspector, prior to construction of that portion of the Project. The walk-over is intended to identify any new conditions that have not been previously identified during environmental and construability review. The purpose of the walk-over is to visit all sites that may have site-specific compliance issues and discuss with the Contractor's staff their proposed strategy for addressing the issues while the PMT personnel and third-party inspectors are in the field and can view the information first-hand on-site. This confirms the Contractor's personnel have a clear understanding of what the expectations and requirements are for all certificate conditions and permits. Furthermore, the PMT will have an opportunity to confirm they are in agreement with the Contractor's solutions for addressing issues before activities potentially resulting in non-conformances or notice of violations are initiated. Any potential violations identified during the walk down (encroachments, environmental issues, etc.) will be identified and reported to the appropriate reporting agency. Wherever practicable, these issues will be resolved prior to when construction activities commence.

In the event of a non-compliance incident the contractor or field inspector will assess the issue and determine the incident type, (e.g., safety, environmental, system interruption or quality) and will determine if an immediate stop work is necessary. Pre-established communications protocols will be implemented between the PMT and the construction contractor to notify and address the incident. Depending upon how critical the issue is, the PMT will send the appropriate staff to the location to begin an investigation. The contractor will also be required to perform its own investigation and provide a root cause analysis of the incident. Verbal instruction may be used at the discretion of the designated construction manager for conditions or practices which are less than serious and are not likely to cause an accident or incident.

Q. Describe specifically how the Project team will ensure compliance with all environmental permits and requirements.

A. The Project recognizes that maintaining compliance with regulatory requirements is one of the keys to the success in any project. The Company's core values of environmental stewardship and integrity aligns with team's proactive approach to compliance management. Prior to construction, NPT will review all permits and supporting documentation to develop a plan to communicate regulatory requirements, establish roles and responsibilities, lines of communication, means to monitor compliance and implement and document corrective actions.

The plan will provide a process through which potential environmental issues and changes to the Project, identified before and during construction, can be resolved quickly and efficiently and do not result in any significant adverse environmental effects. The objective of the plan is for there to be no environmental notices of violation issued to the Project. To accomplish this, NPT must be in compliance with permit conditions until Project completion and final stabilization, and must protect environmental features in the Project area.

As described previously, NPT will require all personnel to attend pre-construction environmental training commensurate with their level of responsibility. Additionally, all environmental and supervisory personnel will be provided with an environmental compliance manual containing all state and federal permits and supporting documentation needed to comply with the permits.

The Project's environmental compliance team will work proactively with site managers/superintendents, contractor personnel, and environmental inspectors to facilitate compliance with the permit(s). The Project's environmental compliance team will perform the following:

- Providing training to all personnel, as needed, by the level of responsibility of the individual;
- Providing all permits to contractor/subcontractors as well as any changes or modifications to the permit conditions;
- Overseeing work and coordinating with contractor's field personnel to verify personnel are complying with permit conditions;
- Reporting non-conformance issues to key personnel, as appropriate
- Coordinating inspections, as needed;
- Escorting regulatory agents during any agency field inspections;
- Cooperating with contractor/subcontractors to identify potential non-conformance issues and mitigate any non-conformance;
- Developing and conveying corrective action plans/reports, as needed;
- Managing potential changes to permit conditions;
- Issuing non-conformance notices to contractor/subcontractor during environmental compliance inspections/audits when necessary;
- Periodically auditing the contractors' records to validate they are maintaining appropriate environmental records (e.g., NPDES inspection reports).

A proactive process of risk identification, mitigation planning, and implementation will be developed by NPT. The plan will provide guidance in situations where the project team is required to react to risk events. A risk event is defined as a non-conformance or a potential non-conformance with permit conditions. Corrective action(s) will be coordinated with the contractor, superintendent, environmental inspector and third party inspector and will be implemented as soon as practicable.

Q. Please describe the size and location of the construction laydown areas and temporary storage areas.

A. To support the construction of the Project, a combination of temporary storage areas/construction laydown yards, staging areas, and crane pads are necessary. Temporary storage areas/construction laydown yards are typically previously disturbed large paved or gravel surface lots 5 to 50 acres in size. These areas are used for the long term storage of construction materials such as structural steel, conductor and any other major type of equipment. Staging areas are much smaller in size and are used to stage construction material for the upcoming weeks. Typical staging areas are less than two acres in size. Crane pads are located at every structure location and will be used as a staging area for that structure's materials and for the location of the equipment that will be used to erect the structure. Crane pads are constructed utilizing the native material in the area, gravel or timber mats. For Northern Pass, the typical crane pad size will be 12,000 square feet (120' by 100').

The preferred locations for temporary storage and staging sites are in the general vicinity of the ROWs. Although the staging areas do not necessarily have to be adjacent to the transmission line ROWs, establishing these areas in proximity to construction sites improves construction efficiency and minimizes the potential for inconvenience or nuisance effects to the public (e.g., as a result of the movement of equipment, manpower, and supplies to and from the ROWs along public roads). Crane pads are located within the ROW, at individual transmission structure locations.

All construction laydown yards and temporary storage sites will fall under the permits for this Project and will be established and maintained in accordance with all permit conditions. NPT requests that the Committee delegate approval authority, to the extent any approval may be necessary, for all construction laydown yards and temporary storage areas to the New Hampshire Department of Environmental Services ("DES").

Q. Please describe the construction laydown areas and temporary storage areas in detail.

A. As mentioned above, temporary storage areas/construction laydown areas will be used on the Project for bulk material and equipment storage. The properties chosen for these locations will be previously developed sites (such as parking lots) or vacant land and will be evaluated for use as material storage or staging areas, taking into consideration parcel size requirements and location in relation to the Project route.

Each location will be evaluated for resource impact and how the site will be prepared for use as a material storage or staging area. Such site preparation work may include vegetation removal, grading, adding gravel, and installing crushed stone anti-tracking pads at vehicular access points from public roads

Storage areas will also be used for mobile construction offices, parking personal vehicles of construction crew members, parking construction vehicles and equipment, and performing minor maintenance on construction equipment. In addition, storage areas will function as staging areas. For example, components for new transmission line structures will be temporarily stored at these locations prior to delivery to structure sites. Transmission line materials or structures also may be assembled at storage areas prior to delivery to the ROW.

Storage areas for the proposed Project are typically selected based upon proximity to work locations along the ROWs. As the construction of the Project progresses, storage areas are typically moved to keep equipment and materials close to the locations where line construction work is being performed. Once a storage area is no longer used to support construction activities, it will be restored to pre-construction conditions, pursuant to the use agreement with the property owner.

The actual locations of the staging and storage sites have not been determined The contractors are responsible for finalizing the locations of staging and storage areas, and for making arrangements with property owners regarding the use of the properties. The development, use, and restoration of any staging sites will conform to conditions of the Project's permits and any other applicable federal, state, and local requirements.

Because there is adequate room at the converter terminal site, the materials procured for the construction of the converter terminal will be stored at the site itself. Adequate room for site storage is also available at the Deerfield Substation and Scobie Pond Substation.

Q. Please describe the staging areas in detail.

A. Staging areas, which are generally less than two acres in size, are typically used for temporarily stockpiling materials for transmission line construction (e.g., erosion and sedimentation control materials, poles and structure components, insulators and hardware, and construction equipment). In addition, staging areas may be used to temporarily stockpile materials removed from the ROW or used during the construction process, prior to off-site disposal. The number and proposed locations of staging areas required to support the construction effort are determined by the contractors.

Staging areas are required in proximity to the Project route and may be located on or off the ROW. PSNH-owned property that is presently used for utility purposes or otherwise cleared of vegetation will be used for staging areas to the extent practical. Locations along the ROW may also be used, provided sufficient easement rights exist.

As construction progresses, staging areas will be relocated to coincide with construction work. When a particular staging area is no longer required, the site is returned to its pre-construction condition, to the extent practical, as requested by the property owners.

Overhead Line Construction

Q. Please describe the plan to construct the overhead transmission line.

A. The overhead transmission lines will be constructed as described in Section (g)(8) of the Application. There will be construction in several areas of the Project occurring at the same time in order to meet the Project schedule. The PMT will develop a detailed construction plan and schedule in coordination with the overhead line contractor as described above

Q. Will helicopters be used during construction?

A. Helicopters will be used during the construction of the overhead transmission lines. Helicopters are typically used for pulling lead line for conductor stringing, placing workers on structures, moving minor materials and stringing blocks and for inspection of the lines. It is anticipated that there will be multiple helicopters working on the Project simultaneously during portions of the construction period.

Q. How will NPT clear vegetation to construct the Project?

A. To accommodate the construction and subsequent operation of the new Northern Pass Transmission lines, vegetation removal will be required. Vegetation along the ROWs may be removed where necessary to allow for construction, to provide and maintain access to structures and, as needed, along the ROWs, and to provide safe distances between the conductors and woody vegetation at all times. However, the amount of and type of vegetation clearing required would vary and would depend on factors such as the need to create additional ROW, existing width of the existing managed ROW, vegetation communities present (e.g., forested, herbaceous, scrub-shrub, open field), the type of the new transmission structures, configuration and spacing of the transmission line conductors, transmission line span lengths, and terrain.

As part of the construction of the new transmission lines, undesirable, tall-growing, woody species within the ROW areas proximate to the new lines will be removed. Desirable species would be preserved to the extent practical. In selected cases, certain desirable, low-growing trees may be kept on the ROW in specific locations and only trimmed to ensure adequate clearance from wires and structures, pursuant to Eversource Energy' Right-of-Way Vegetation Initial Clearance Standard for Transmission Lines. Generally, all tall-growing tree species would be removed from the managed portion of the ROWs and low-growing tree species and taller shrub species would be retained in the areas outside of the conductor zones (the area directly under the conductors extending outward from the outermost conductors).

Vegetation will be typically removed from the Project's construction workspace (including the areas to be managed in the vicinity of the new line) using mechanical methods. Where necessary, Northern Pass will encourage the selected vegetation clearing contractor to use low-impact tree clearing means and methods to remove forested vegetation. Low-impact tree clearing incorporates a variety of approaches, techniques, and equipment to minimize site disturbance and to protect wetlands, watercourses, soils, rare species and their habitats, and cultural resources.

During vegetation removal, timber mats or equivalent may be used to provide a stable base for clearing equipment across wetlands or within wetlands along the ROW. Such temporary support would minimize rutting in wetlands and would be removed after the clearing activities are completed. The locations where temporary support would be required would be determined in the field, based on site-specific conditions (e.g., soil saturation) present at the time of construction, and may not be the same as the permanent or temporary access roads illustrated on the Project Maps. See Appendix 1.

Appropriate erosion and sedimentation controls would be deployed as necessary. See erosion and soil control details in the Alteration of Terrain Permit Application, Appendix 6. Where removal of woody vegetation is required, vegetation will be cut flush with the ground surface to the extent possible. Where practical, trees would be felled parallel to and within the ROW to minimize the potential for damage to residual vegetation.

NPT will take particular care to retain lower growing vegetation along stream banks and within wetlands to the extent possible. In general, NPT may alter to some degree vegetation management activities in the following areas, provided that the construction and operation of the facilities remains in accordance with national transmission line vegetation management standards:

- Areas of visual sensitivity where vegetation removal may be limited for aesthetic purposes;
- Steep slopes and valleys spanned by transmission lines;
- Agricultural lands; and
- Residential areas where maintained landscapes do not interfere with the construction, maintenance, or operation of the transmission lines.

Q. Please describe the construction access points and roads.

A. Access roads are required during construction. “On-ROW access roads” will be used to move equipment and material between structure locations. In some areas, to avoid traversing along the ROW through sensitive environmental resources (i.e. wetlands and vernal pools) or rugged topography along the ROWs, access roads to the ROW may be developed across private property or across land owned by PSNH (“off-ROW access roads”).

Depending on site-specific conditions, grading may be required to develop or to improve access roads. Some access roads would be needed only during construction and thus would be used temporarily, whereas other access roads may be required permanently for the long-term operation and maintenance of the new transmission lines. For those roads that are temporary in nature, the access roads will be removed and the land will be restored to its original condition. For those roads that may be permanent in nature, NPT requests that the SEC delegate any required approvals for permanent access ways to NHDES, in accordance with the delegation request contained in (d)(2) and (g)(8) of the Application.

Typically, at points of intersection with public roads, the Project will install signs along the access roads that specify the roads are for construction purposes and are restricted from use by public vehicular traffic. In addition, where on-ROW access roads or off-ROW dirt roads intersect with public roads, rock aprons or equivalent are typically used to minimize tracking of dirt from the ROW onto the public road as a result of construction vehicle movements. Public roads in the vicinity of access roads may also be periodically swept to remove dirt that is tracked from construction activities.

Any access road improvements will be carried out in accordance with Project permits, conditions and approvals.

Q. Please describe the on-ROW Access Roads.

A. Contiguous access along the existing ROWs is generally not necessary for the construction of the proposed overhead transmission lines, although access is required to each proposed transmission structure location. Along most of the Proposed Route, the existing 115 kV lines (and other transmission and distribution lines) have been in service for more than 50 years and, as a result of the ongoing operation and maintenance activities along those transmission lines, some access roads are already established. Such existing access roads would be used for the construction of the new transmission lines wherever possible. The on-ROW access roads expected to be used for the proposed Project are illustrated on the Project Maps, see Appendix 1. NPT requests that the SEC delegate any required approvals of additional access ways to NHDES, in accordance with the delegation request contained in (d)(2) and (g)(8) of the Application.

However, most of the existing access roads would have to be improved, widened, or otherwise modified in order to be used safely and effectively during construction. For example, to safely support the heavy construction equipment (e.g., flat-bed trailers, cranes, and concrete trucks) required to install transmission line structure foundations and transmission line structures, access roads must be sufficiently wide, with a stable base and grades that typically must be 10% or less.

Access road improvements typically include clearing adjacent vegetation and widening roads as needed to provide a minimal travel surface approximately 12 to 16 feet wide (additional width would be needed at turning or passing locations). Access roads may be graveled. Where access roads traverse streams or wetlands, culverts and timber mats (or equivalent) may be used. Existing culvert crossings may also be improved. Erosion and sedimentation controls would be installed as necessary before the commencement of any improvements to or development of access roads.

For the section of the Project from Pittsburg to Dummer where no existing ROW exists today, new temporary access roads will be created. These roads will be created on property that is either leased by NPT or for which an access agreement with a landowner has been reached. As is noted above, the proposed access road construction would typically include clearing adjacent vegetation and widening roads as needed to provide a minimal travel surface approximately 12 to 16 feet wide (additional width would be needed at turning or passing locations).

Q. Please describe the off-ROW Access Roads.

A. Along portions of the northern section of the proposed route, terrain and environmental features (e.g., steep slopes, rock outcrops, large wetland complexes, rivers, lakes, etc.) make linear construction access along the ROW difficult or impractical. In such locations, to avoid or minimize adverse environmental effects while allowing safe access to the ROWs, NPT proposes to use off-ROW access roads as necessary. Such off-ROW access roads will entail the use of public roads or access roads across private property. These off-ROW access roads will be limited to only the areas where NPT leases or PSNH owns the property or where existing access agreements have been negotiated.

NPT performed an initial review of existing access roads leading to the transmission line ROW for the Project. Based on this initial review, an inventory of possible access roads was prepared. For the vast majority of the Project, it is expected access to the ROW will be obtained from the points where public roads intersect the ROW. The contractor will be allowed to propose additional on-ROW and off-ROW access ways during the construction phase of the Project with the review and approval of the Applicants. NPT requests that the SEC delegate any required approvals of additional access ways to NHDES, in accordance with the delegation request contained in (d)(2) and (g)(8) of the Application.

For all points where access to the ROW is from public roads, appropriate construction warning signs will be used for traffic control. As is mentioned above, where on-ROW access roads or off-ROW dirt roads intersect with public roads, rock aprons or equivalent are typically used to minimize tracking of dirt from the ROW onto the public road as a result of construction vehicle movements. Public roads in the vicinity of access roads may also be periodically swept to remove dirt that is tracked from construction activities.

Q. Please describe the crane pads in detail.

A. At each transmission line structure site along the ROW, a work area, called a “crane pad”, is required to stage structure components for final on-site assembly and to provide a safe, level work base for the construction equipment used to erect the structure. The size and configuration of a crane pad at a particular structure location would vary based on site-specific conditions; however, a typical pad averages about 120 feet by 100 feet. The exact locations and configurations of crane pads would be determined during final Project design, based on site-specific conditions (e.g., to avoid or minimize work in wetlands or other environmentally- or culturally-sensitive areas). Generally, however, at each structure site, the crane pad would be situated within the structure location envelope identified on the mile sheets. Please see Project Maps, Appendix 1, for their proposed locations.

A typical (upland) installation of a crane pad involves several steps, beginning with the removal of vegetation, if necessary. The crane pad site then would be graded to create a level work area and, if necessary, the upper three to six inches of topsoil (which is typically unsuitable to support the necessary construction activities) would be removed. The topsoil would be temporarily stockpiled within the ROW. A filter fabric layer then would be installed over the excavated area. A rock base, which allows drainage, then would be layered on top of the filter fabric. Additional layers of rock with dirt/rock fines are typically placed over this rock base. Finally, a roller is used to flatten and compact the pad. Crane pads often can be modified and contoured to the surrounding area to minimize impacts. In areas where crane pads must unavoidably be located in wetlands, layers of removable timber mats are typically used to construct the pads. Alternatively, a large rock base layer may be used to allow water to flow underneath the pad. Smaller rock is layered on top of larger rock, followed by the final layer of gravel intermixed with soil.

Upon completion of construction, crane pads would typically be removed. The rock base and fabric materials would be excavated and removed for off-site disposal. Timber mats, where used for crane support in wetlands, would similarly be removed. The topsoil layer would be re-spread over the crane pad site and the area would be returned to pre-construction grade, to the extent practical and consistent with Eversource Energy's ROW maintenance program.

Q. Please describe how the necessary upgrades for the existing AC transmission facilities will be constructed. Are there any special considerations associated with this portion of the construction phase?

A. Construction associated with the existing AC transmission facilities includes structure upgrades to reduce conductor sag limitations and replacement of the line's connecting hardware to achieve the required thermal rating for the 345 kV AC transmission line from Deerfield Substation to Scobie Pond Substation. There is no difference in the overhead transmission line construction and these upgrades, the work will progress in a linear sequence and will be performed in accordance with the CP.

Q. What construction access issues are associated with the border crossing from the Canada into the United States?

A. Construction access issues are not expected at the international border crossing. Coordination of the construction activities in the crossing area will be carefully managed. The last structure on each side of the border will be a dead end structure and by pre-arrangement, will be installed by the respective contractor constructing either the Canadian or United States portion of the transmission line. The final transmission line connection will be installed by one of the two construction contractors who will do the stringing to the opposite side of the border. Because construction activities will be near the border, the Project will meet with the Office of Homeland Security and Canadian Customs to establish construction notification protocols to ensure there are no issues with the work being done.

Substation, Converter Station and Transition Stations

Q. Please describe the construction activities that are necessary for the existing substations, the new converter terminal, and the transition stations and how they will tie into the construction schedule for the entire Project.

A. The construction activities for the existing substation, new converter terminal and transition structure locations are generally the same. Some work activities on a given site can overlap, but generally they occur sequentially. Work at multiple sites will occur simultaneously in order to meet the Project milestones for energization. In some cases existing lines may need to be re-located prior to the construction of the station.

The modifications to the existing substations, as described in the testimony of Mr. Derrick Bradstreet, will include connecting the new 345 kV AC line from the converter terminal in Franklin, New Hampshire to an existing terminal in the Deerfield Substation. In order to establish the new line position for the 345 kV line from the converter terminal, an existing 345kV line connection in the substation will be relocated. This will require the addition of terminal structures, 345 kV switches, breakers, bus work, instrument transformers and associated protection and control devices inside the existing Deerfield Substation. In addition, the 345 kV

AC line from Buxton, Maine to Londonderry, New Hampshire that presently passes by the Deerfield Substation will be split into two segments and terminated at Deerfield Substation. Terminating this line at Deerfield will require the construction of an additional 345 kV bay position, which will be done within the existing substation yard. A Static Var Compensator (SVC) and a building to house the SVC equipment and 345 kV capacitor banks will be installed adjacent to the existing PSNH substation in Deerfield, New Hampshire

At the Scobie Pond 345 kV Substation, located in Londonderry, New Hampshire 345 kV capacitor banks will be installed and constructed in an area adjacent to the existing substation yard.

The 345-kV Franklin substation will consist of the same apparatus as found in any conventional ac electrical substation. This apparatus includes capacitors, reactors, circuit breakers, disconnect switches, instrument transformers, surge arresters, bus-work, and the converter transformers and buildings to house the converter and protection and control equipment.

At locations where the Project will transition from an overhead line to an underground line there will be what is referred to as a transition station. A transition station is a small fenced in area that includes equipment to connect and monitor the transition from overhead to underground. The fenced area is approximately 75' by 130' in dimension. Within this area is a terminal structure that terminates the overhead transmission line with a connection down to substation equipment where it connects to the underground cable riser. The station equipment that is interconnected to the overhead/underground connection includes surge arrestors and current monitoring equipment. A small enclosure is planned to house the communication, protection and control equipment.

The work at each site will begin with the careful review of the Certificate requirements and following the public outreach notifications protocols and the activities described in the Project compliance plan. The contractor will perform survey, staking and protection of any sensitive areas, and contact Dig Safe for demarcation of existing utilities. Access to the work site will then be established and the required safety measures will be implemented to begin construction. Such measures may include; sanitary facilities, barricades, temporary fence, walkways, fire extinguishers and signage.

The work site is then cleared of any trees, shrubs and debris (if needed) and the temporary environmental erosion controls are installed. Environmental control measures will be monitored throughout the process until the site is restored and stabilized.

At this point the relocation of existing transmission or distribution lines will occur where necessary. The contractor will strip the topsoil, grade and prepare the site to the designed elevations, restore the disturbed areas and install the perimeter security fence. Next the contractor will excavate and install foundations, drainage systems and underground conduits within the perimeter fenced area. Station materials, structures and equipment will begin delivery to the site for installation. The materials and equipment will be stored at the work site until such time they will be installed. The installation will begin with erecting the buildings, steel support structures, installing buswork, electrical equipment and control cable. With the buildings erected, the SVC or HVDC Converter equipment and control equipment will be installed. Finally, the site is landscaped when required and restored and the transmission lines and station is complete.

Following the installation and prior to the energization an extensive electrical testing process begins to confirm that each piece of equipment and circuit is installed and operating in accordance with the specifications. As with the construction the energization is a sequential process that energizes the equipment and facilities in a logical order to coordinate with the equipment and system requirements to meet the Project milestones. Transmission line outages will be necessary and will require coordination with ISO-NE. The Project team will implement an outage and schedule process to confirm that all new or modified transmission and station facilities are sequenced into service in accordance with ISO-NE Operational procedures with no interruption of service to the distribution customers.

It is likely that the contractor will encounter bedrock during the construction at the stations. Blasting will likely be utilized to remove the rock in these locations. The blasting at the stations will be achieved through blast detonation in delayed series that will result in impacts or vibrations with the specifications provided. See Page 10.

Underground Construction

Q. Please describe the underground installations.

A. NPT proposes three distinct sections of underground installation within public highways. The proposed design employs a mix of trench and trenchless construction to address significant highway features, natural and historic resources, construction impacts, and terrain challenges.

The first and most northerly underground section, approximately 0.7 miles in length, passes underneath Old Canaan Road just north of the Connecticut River in the Town of Pittsburg. The transmission line will be placed below U.S. Route 3 to land in Clarksville on the southerly side of the Connecticut River, where it proceeds southeasterly after leaving the highway right of way. This section is within state maintained public highways.

The second underground section, approximately 7.5 miles in length, utilizes Route 145, Old County Road, North Hill Road and Bear Rock Road in Clarksville and Stewartstown. This route utilizes both state and locally maintained highways.

The third and longest underground section bypasses the White Mountain National Forest, travelling 52.3 miles from Bethlehem to Bridgewater along state-maintained public highways controlled by the DOT.

Concurrently with the Application for a Certificate of Site and Facility, NPT is filing the appropriate permit applications with the NHDOT for use of all of these public highways. With respect to the second section, the transmission line returns underground in Clarksville to follow the state maintained Route 145 corridor before traversing southerly along Old County Road/North Hill Road to the Bear Rock Road intersection. Remaining underground, the facility will follow Bear Rock Road east to a point near the intersection with Heath Road. A sample excavation permit reflecting typical NHDOT requirements is provided for application to the municipally maintained highways. Corresponding design plans are included in Appendix 9 and 10.

Q. Provide an overview of the process for constructing the underground portions of the line.

A. Similar to overhead transmission construction, the HVDC Underground Transmission line construction will generally progress in a linear approach. Installing underground transmission line is comparable to that of installing a water or sewer main. As discussed earlier, work at multiple sites will occur simultaneously in order to meet the Project milestones for energization.

The work at each site will begin with a careful review of the Certificate requirements and implementation of the public outreach notification protocols and activities described in the CP.

The contractor will perform survey, staking and protection of any sensitive areas, and contact Dig Safe for demarcation of existing utilities.

The contractor will develop and implement a work plan for each location. Typical plans include safe access for the crews, equipment and materials. In undeveloped locations, temporary access roads will be constructed. Appropriate traffic control plans including sign patterns, lane closures and barricades will be developed in accordance with the Certificate requirements.

The installation of the underground transmission line will follow the existing highway alignment to the extent possible and will include sections that are either under the roadway, in the roadway shoulder or in undeveloped areas of the road ROW. Where the installation is in paved road, the pavement will be saw cut on both sides of the trench to limit damage to the road. In undeveloped locations, temporary roads will be constructed for safe, efficient and environmentally compliant access to the work.

The trench will be excavated to the design depth, which generally has a minimum cover along and/or across the highway right-of-way of 30". The sidewalls are shored for support to allow safe worker access. Typically up to 750 feet of trench excavation will be open at a time to allow for efficient construction installation methods.

Conduits will be installed into spacers to maintain their position in the trench. The conduits will be either backfilled with a suitable granular material or a high slump concrete, then capped with a layer of concrete for protection against accidental dig-ins. Any temporary shoring will be removed as the trench is backfilled. After backfill, undeveloped areas will be restored and roadways will be restored and paved in accordance with NHDOT requirements. Typical pavement restoration is to patch the trench along the route as the duct bank is constructed and then return after the highway section is completed for any mill and overlay of the pavement as required.

Trenches terminate either at splice pits or an underground to overhead transition structure. The conduit systems will be “proofed” or tested by pulling a specified dimensional mandrel through the duct from splice location to splice location. After installation and testing of the duct bank, pits and transition structure system, the conductors will be pulled to the splice locations. Conductors will be spliced in the pits, or terminated at a transition structure. When an underground section is complete there will be a series of electrical tests performed on the cable before it is energized.

Q. Describe the approach for underground construction.

A. The underground transmission lines will be constructed as described in Section (g)(8) of the Application and in the pre-filed testimony of Jerry Fortier. There will be construction in several areas of the Project occurring at the same time in order to meet the Project schedule. The PMT will develop a detailed construction plan and schedule in coordination with the underground line contractor to ensure the Project is completed on schedule and in compliance with all permit, NHDOT and Certificate requirements.

Q. What additional requirements were considered when deciding to construct the Project underground in public roads?

A. The Project specifically considered NHDOT minimum standards required for constructing roadways. Once complete, the underground sections will considerably exceed NHDOT minimum standards for underground installations thereby avoiding future impacts on highway maintenance activities or improvements. NHDOT standards require maintaining a minimum depth of 18” below the pavement subgrade for roadway installations. While considerable variation occurs, NPT proposes a minimum of 30” of cover above the duct banks and 24” above the splice pits or vaults. At these depths, it is highly improbable that future highway activities would be impacted in any material way. In the unlikely event, greater depth is necessary to insure the minimum depth below subgrade is necessary, it will be provided. Restoring the gravel surface is readily achievable along the town maintained roadway segments.

Q. Were there any additional specific factors taken into consideration for the underground segments?

A. Once the proposed underground route leaves Rt. 145, it passes down Old County Road/North Hill Road to the intersection with the state maintained portion of Bear Rock Road. Old County/North Hill Roads are rural, gravel surface roads. Old County and North Hill Roads are maintained by the Towns of Clarksville and Stewartstown within their respective geographical boundaries. The designs for each segment within this section are found in Appendix 1.

Except for the portion lying between Creampoke and East Roads which is 49.5’ (3 Rods), the right of way is 66’ (4 Rods) for most of the length. However, this width belies the actual nature of these roads which are narrow, winding and bucolic. Because of the age of the layouts, determining the precise location of the easements is not possible.

Significant stretches of Old County/North Hill Road have little or no defined ditch lines beyond the travelled way. Where ditch lines exist, they are within a few feet of the travelled surface. Dense, mature tree growth is similarly close to the travelled way which in generally less than 18' wide. Fences, historic stone walls, landscaping and other property monuments, as well as existing overhead utility distribution lines run within ten feet of the travelled way. Several historic residences, barns and sheds, as well as two cemeteries line the length of the road. In several instances, historic properties are located on both sides of the road.

The extensive construction impacts necessary to install the proposed transmission line outside the disturbed roadway area would irretrievably change the character of these roads. Extensive mature tree clearing, disruption of old stone walls and fences would occur throughout the length of these roads dramatically altering the roads' rural feel and charm. Wetlands and water resources along the roads would be affected, both delaying and raising the cost of construction. On the other hand, the gravel surface of the roads provides an efficient medium to avoid these environmental and social impacts while minimizing construction time, as well as impacts on the public.

East of Guy Placey Road, Bear Rock Road maintenance is the responsibility of the Town of Stewartstown. While the roadway characteristics are similar to the state maintained portion, more residences are interspersed along the town maintained section. Many are close to the roadway. The locally maintained portion of Bear Rock Road has steep embankments on the south with extensive wetland and water resources. The northern side rises sharply and has several driveways, mature trees, fences and stonewalls. Several potentially historic buildings line the road on either side. Existing utilities continue along the road. Drainage ditches are within a few feet of the travelled surface.

Attempting to construct a utility of this nature outside the disturbed area of the roadway along Bear Rock Road is highly problematic and unwise. Construction beyond the disturbed area would invariably wreak havoc on these abutting properties, several of which have historic significance. Drainage structures will also be disrupted, requiring extensive redesign and expense. Utility poles and lines will need to be relocated. Locating the new transmission line in the roadway itself will greatly reduce impacts, construction time and inconvenience to the public.

Q. How are the conduits in trenches backfilled?

A. The conduits are backfilled with either thermal sand or concrete with a mix design approved by the engineer. Thermal sand is used when conduits are covered in the trench without concrete encasement. It is a flow-able material that does not leave any air pockets that can be detrimental to the successful operation of the cable system. Thermal sand is also used directly around the conduits to allow for future access to the conduits while reducing potential damage that civil excavation may have on the conduits. Once placed, the thermal sand may be removed via vacuum excavation. Typically the use of thermal sand as a backfill is accompanied by a concrete panel/cap directly above the conduits. The concrete cap acts as a mechanical protection against dig-ins from directly above the conduits, but does not provide protection from the sides. The alternative of thermally approved concrete encasing the conduits provides mechanical protection of the conduits from all sides. The low strength thermal concrete is typically specified as having a compressive strength of 300psi. This compressive strength rating is much lower than the 3000psi rating that a high strength thermal concrete would have. The low strength compressive rating is specified as such so that it may be dug through in the future as necessary, ideally without the use of a jackhammer. Typically a high strength thermal concrete would be used to encase the conduits while the low strength thermal concrete would be used to backfill to grade.

A red warning tape is buried above the concrete cap or high strength thermal concrete encasement to alert anyone that could potentially excavate over the transmission line that an electric line is buried there.

The selection of the specific backfill materials that will be used in the trench for the backfill and encasement layers will depend upon the availability of the materials and whether the native materials being excavated are suitable as a backfill substitute. Geotechnical and soil information will be gathered during detailed engineering and the encasement and backfill alternatives will be analyzed to select the best solution.

Q. Please describe how the cables are spliced.

A. There are different approaches to performing cable splicing. For this Project the cables will be joined / spliced in splice pits. The exact dimensions and type of pit are dependent upon the requirements of the cable manufacturer selected to supply and splice the cable. The design accounts for the final dimensions of the splice pit. Once the conduit system and splice pits have been installed, cables can be pulled into place.

To construct a splice pit, a large opening is excavated and shored and a solid level surface is formed at the bottom. A temporary splice enclosure large enough to enclose the conductor and allow for a technician to enter and perform the splicing operation is then placed on top of the pit. This structure provides a controlled environment in which to complete the splice work and maintain temperature, humidity and dust control. The splicing process entails the following: the cable ends are formed (forming is the process of removing the cable layers and getting the conductors ready to be spliced together), a pre-molded splice body is placed over one end of the cable, the conductor ends are joined by welding/mechanical means, the pre-molded splice body is moved in place over the conductor joint and sealed. The purpose of the pre-molded splice body is to replace the layers of the cable insulation that were removed during the splicing process.

Q. What precautions will the Project take to ensure that the underground segments are constructed in a safe manner?

A. Safety is a key element of constructability reviews. This includes an assessment of the work areas to determine if there is sufficient space to maintain traffic flow and provide for worker safety. Other factors include the review of the traffic density along the route, proximity to existing utilities, and maintaining access to essential facilities.

While performing routing activities for this Project, it was evident that for the proposed route alignments, there would be ample room available to perform the work safely. This is in large part due to the fact that the proposed alignments are within the road right-of-way on rural roadways. Please see the Pre-Filed testimony of Lynn Farrington for how traffic safety will be ensured.

In areas with narrow road widths in the Northern Alignments road closures may be necessary during construction hours to safely construct the Project. The road closures will likely be one to two weeks in duration during construction hours in each area. The PMT will work closely with municipal officials and all affected property owners in the locations of these road closures to minimize impacts.

The contractor will be required to develop a safety plan for all areas of construction and will be required to comply with the Project Health and Safety Plan.

Safety and Security During Construction

Q. How will safety of the public and the safety of the workers during the construction process be protected?

A. Safety is of the utmost importance to the Project team. To ensure that the Project protects the safety of the public and construction workers, as noted above, the Project will develop a HASP, which will be incorporated into each contractor agreement.

The contractors working on Northern Pass are required to comply with applicable regulations and standards (for example OSHA and Dig Safe). Typical daily activities of the Contractor will include conducting morning crew meetings to discuss activities and potential hazards (tailboards). Additionally, the contractor will perform and document site inspections, and equipment inspections. The contractors will be required to complete safety forms such as an Activity Hazard Analysis and a Pre-Task Analysis for all work activities daily.

In the event of an incident or near-miss occurrence, the contractor is required to submit an Incident Investigation Report detailing the specific information of the incident. Serious incidents resulting in an OSHA recordable injury will require: additional investigation, review and root cause analysis, and follow-up corrective measures, as deemed necessary, to prevent future occurrences.

The Project team will utilize qualified management and staff, with experience on similar projects to perform audits and oversight throughout the construction process. Training programs will be required for the field staff (see training question for more details). The Project team will use a Task Safety Observations (TSO) process to identify field safety trends occurring on the Project. This information will be communicated through Project wide safety bulletins, and formal notices to the contractors as a preventative measure In addition the Project team will hold weekly safety meetings to review and discuss the safety observations in the field.

In addition, contractors working on the Project are required to identify areas of fire opportunity during daily “tailboard” safety talks and their safety pre-planning and NPT employees in the field are required to carry fire extinguishers in Project vehicles to address small scale fires. Local fire jurisdictions, emergency management personnel and state officials are briefed prior to the commencement of the work and provided with details of that work. Local “safe zones” are identified in the case of fire or personal emergency. Evacuation plans will be developed in written form for each work location. Evacuation plans will indicate the nearest major road crossings as well as the nearest safe zone, hospital or appropriate care center.

Public safety will be protected during all aspects of the construction of the Project. Previous to the construction, the engineering, materials and equipment that will be used to construct this Project will meet the requirements of the Certificate, will be designed by professional engineers licensed in the State of New Hampshire and will comply with the codes and industry standards that apply. Traffic plans specific to the work locations will be developed and implemented to comply with the NHDOT requirements. All construction contracts for this Project will have strict requirements in regard to maintenance of construction equipment including daily inspections. Oversize equipment deliveries will comply with the NHDOT requirements. Work sites will have the proper signage to provide hazard warnings, location and emergency contact information. Pedestrian traffic will be protected from entering work zones by the use of temporary walkways, barricades, fencing or personnel to direct traffic. Public notification protocols will be used to notify local officials and residents of the upcoming work in their area.

Traffic Considerations During Construction

Q. Please explain how traffic control will be handled during construction.

A. Prior to construction, a Manual on Uniform Traffic Control Devices (MUTCD) compliant traffic management plan and traffic control plan will be provided for review and approval. Managing traffic during the Project construction is necessary to minimize traffic delays, maintain motorist and worker safety, complete roadwork in a timely manner, and maintain access for businesses and residents. Traffic considerations and control will follow the "Guidelines for Implementation of the Work Zone Safety and Mobility Policy NHDOT Policy #601.0. A" for the development of a Traffic Management Plan (TMP) and will consist of the following strategy components:

- Traffic Control Plan (TCP) - provides detailed signing, striping and device layout as required to guide and direct road users through a work zone.
- Transportation Operations (TO) – identification of strategies that will mitigate impacts of the work zone on the Transportation Network.

- Public Outreach (PO) – communication strategies will be used to inform affected road users, the general public, area businesses, and appropriate public entities about the Project schedule and expected impacts.

In addition to the strategies listed above, the TMP will also include contingency plans, incident management plans and detailed roles and responsibilities of key personnel. The TMP will also outline a set of coordinated strategies that describe how the work zone impacts will be managed. TMP development will begin during Project planning and evolve throughout the design process and construction phase. Although the final TMP is not completed until the final design phase, conducting certain impact analyses during early design phases will assist in the development of preferred alternatives. Work zone impacts will be considered during the evaluation and selection of design alternatives and when possible design alternatives that alleviate work zone impacts will be selected. Traffic will be maintained in accordance with the Manual on Uniform Traffic Control (MUTCD), latest version, during the performance of the work when appropriate. In addition, prior to construction, driveway access permits will be applied for as needed based on the means and methods adopted by the construction contractor.

Q. Does this conclude your testimony?

A. Yes, it does.

JOHN KAYSER, PE, PMP

Project Manager

Mr. Kayser presently serves Burns & McDonnell as a Project Manager. He is currently the Construction Project Manager on the Northern Pass Transmission project. He has over 16 years of experience in overhead transmission line design, transmission planning, construction and maintenance. He also has a background in facility power and lighting design and airfield lighting design and construction.

Mr. Kayser has managed 12.47 kV to 345 kV construction projects and has directed the efforts of planners, designers, estimators and construction forces to ensure projects are completed on time and within budget.

While at Alliant Energy, an investor owned electric and gas utility in the Midwest, Mr. Kayser managed the delivery system planning team and was responsible for planning and prioritization of the distribution, transmission and substation projects.

Mr. Kayser also has experience in design, estimation, construction management and project management of commercial and industrial facilities. As a project engineer in the Air Force he managed the design and construction of facilities in the United States and throughout the world.

EDUCATION

- BS, Electrical Engineering, Iowa State University, May 1992

REGISTRATIONS

- Professional Engineer, State of Florida #51988
- Professional Engineer, State of Iowa #14157
- Professional Engineer, State of Maine #12049
- PMI Project Management Professional
- OSHA 10-Hour Construction Training

6 YEARS WITH BURNS & MCDONNELL

20+ YEARS OF EXPERIENCE

A summary of his experience at Burns & McDonnell and prior to his hire in 2009 is provided below.

Northern Pass Transmission Project | Eversource Energy
Manchester, New Hampshire | 2015-Present

Construction Project Manager on the Northern Pass Transmission Project. He is responsible for overseeing schedule, budget, design, and construction for the $1.5 billion project. He is also accountable for coordinating the design, constructability and outage coordination for the converter station, substations, HVDC and HVAC transmission lines.

Maine Power Reliability Program | Central Maine Power
New Gloucester, Maine | 2015

Program Manager. Mr. Kayser served as the Program Manager on the $1.4 billion Maine Power Reliability Program. He provided leadership and directed the project personnel in a number of areas including project management, project controls, real estate, community relations, environmental siting and permitting, engineering, outage planning and construction. He was responsible for the full scope of project efforts including staffing the program management team, guiding the team through the development of policies and project strategies, completion of the project execution plan and managing the construction.

Maine Power Reliability Program | Central Maine Power
New Gloucester, Maine | 2014-2015

Assistant Program Manager on Maine Power Reliability Project he was responsible for the supervision of project managers, construction managers, and superintendents. Mr. Kayser managed initiatives in contract preparation and execution, quality assurance, construction management, commissioning and outage planning.

JOHN KAYSER, PE, PMP
(continued)

Maine Power Reliability Program | Central Maine Power
New Gloucester, Maine | 2009-2014

Project Manager Mr. Kayser was the project manager of transmission supporting program management of 450 miles of 115 kV and 345 kV overhead transmission lines. He was responsible for overseeing schedule, budget, design, and construction for the $1.4 billion project. He was also accountable for coordinating the design, constructability and outage coordination for the transmission lines.

*Alliant Energy
Cedar Rapids, Iowa | 1999-2009

Manager of Delivery System Planning Mr. Kayser was manager of delivery system planning responsible for the planning of the sub-transmission and distribution systems for Interstate Power and Light Company (IPL). He was responsible for the evaluation, approval, and prioritization of large projects valued at $54 million annually. He was also instrumental in the restoration efforts during the February 2007 ice storm and June 2008 floods that affected the IPL service territory.

*Alliant Energy
Cedar Rapids, Iowa | 1999-2009

Project Manager for transmission and distribution projects from 12.47 kV to 161 kV including a 10 mile 161 kV project. He managed the design, schedule, procurement and construction for more than 150 projects.

*Alliant Energy
Cedar Rapids, Iowa | 1999-2009

Delivery System Planner Mr. Kayser started his career at Alliant Energy as a delivery system planner. He was responsible for analysis of the transmission and distributions systems for an area consisting of over 67,000 customers and 440 MW of load.

*All County Electric
Marion, Iowa | 1997-1999

Electrical Engineer As an electrical engineer at All County Electric Mr. Kayser was responsible for design, cost estimating, and project management for three electrical contractors. He completed power, lighting and fire protection designs for several commercial and light industrial facilities including manufacturing facilities, hospitals, radio stations and daycare centers.

*United States Air Force
Hurlburt Field, Florida | 1992-1997

Engineering Officer Mr. Kayser held several positions as an engineering officer in the U.S. Air Force. He led a 95-person team in the planning and construction of a tent city to house over 5,000 people in Cairo, Egypt. He also designed several construction projects including a major upgrade to the airfield lighting Pope AFB, NC, replacement of PCB contaminated transformers at Griffiss AFB, NY, and design of an engineering facility for the 823rd RED HORSE Squadron.

**denotes experience prior to joining Burns & McDonnell*

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF LYNN FARRINGTON

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name, title, and business address.

A. My name is Lynn Farrington and I am a licensed professional engineer (NH License #14125, specializing in 'Civil-Highway,') working in the transportation field. I am also a licensed professional traffic operations engineer (Certificate #3416 awarded by the Transportation Professionals Certification Board). I am currently employed by Louis Berger at 482 Congress Street, Suite 401, Portland, Maine 04101.

Q. Briefly summarize your educational background and work experience.

A. I graduated with a B.S. in Civil Engineering from the University of Maine in 2006. I have worked in the transportation field as an engineering consultant for the past nine years.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is your role in the Project?

A. I am advising the Northern Pass Transmission Project ("Northern Pass" or the "Project") construction planning team in relation to mobility, safety and the maintenance and protection of traffic on roadways that may be temporarily affected by installation of the transmission line.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to demonstrate to the Committee that temporary traffic impacts due to installation of the transmission line are being considered and appropriately mitigated by the Applicant and offer the opinion that the Project will not have an unreasonable adverse impact on public safety during construction.

Q. Please describe other similar projects you have worked on.

A. The most recent traffic control planning and mitigation process I completed was for a bridge replacement on Veterans Memorial Parkway in East Providence, RI. In order for the bridge to be built quickly (within 2 months' time) the Rhode Island Department of Transportation approved a construction method that required closing the Parkway for the duration of the project, which resulted in the need for a detour route. Since this location is urban I utilized the roadway network to create both a primary and an alternative detour route. By having two signed routes for drivers the volume of vehicles on any one route was lessened.

Traffic signal timing and phasing along both detour routes was adjusted to better serve the change in traffic patterns.

As part of the bridge construction the local road, Warren Avenue, also needed to be closed under the bridge for short periods of time. This process required a total of three detour routes: one for the eastbound direction, one for the westbound direction and a pedestrian route. In these instances police details were assigned to intersections to keep traffic flowing.

A second, smaller scale traffic control plan that I recently completed was for the construction of a downtown roadway in Newport, RI. This full depth and overlay roadway repair was completed by shifting both lanes of traffic to the north while constructing to the south, and vice versa. This configuration pattern made up Phases 1 and 2 of the traffic control plans. The client had also requested brick crosswalks with granite curbing border throughout the downtown area. This construction required a four day period with no traffic driving over the brick for the mortar to dry. This was accomplished by detouring traffic in the westbound direction, shifting traffic in the eastbound direction and constructing the crosswalks in two stages.

Q. Please summarize the process you use to analyze traffic impacts during construction.

A. The first step to analyze traffic impacts during construction is to understand the construction methods and procedures required to install the transmission line within the public roadway right-of-way (ROW) limits. Construction space and time duration requirements are determined by the construction phasing team. The construction phasing team is made up of the client and construction specialists familiar with the type of construction necessary. Once the construction phasing plans are drafted, I begin an analysis and documentation of the impacts expected. If any extensive traffic impacts are noted during this first review, discussions with the construction phasing team are necessary to revise the plans. This process continues throughout the duration of the project.

The next step is to understand how traffic currently operates within the specific highway or roadway corridor. This is generally accomplished by analyzing the volume and movement of traffic on the roadway. Data relative to traffic flow is obtained through Automated Traffic Recorder (ATR) counts or Turning Movement Counts (TMCs) or both. ATR counts are completed using tubes laid across the roadway that record the number of vehicles passing by a given point in 15 minute increments. TMCs use either a person with a count board or video recordings to count the number of vehicles entering an intersection as well as the direction a vehicle turns to exit the intersection.

Once the current volumes are established I compare them to known capacities. For instance, Federal Highway states that a flagger can allow approximately 850 vehicles per hour to pass through a two-way one-lane construction area if the work zone is the longest allowable length (1,600’). If the demand under normal conditions is known to be 500 vehicles per hour the demand (500) is much lower than the capacity (850) and the construction condition proposed can likely go forward without more extensive analysis. This type of hourly comparison may be the only necessary step for some locations. Based on this procedure and findings I would create an hourly lane restriction chart if volumes approach or exceed capacity for the necessary work zone length.

Level of Service is a more detailed way of looking at traffic conditions. This is often necessary when considering traffic flow at signalized intersections or stop signs. Level of Service is directly related to the average delay a driver is expected to experience when traveling through an intersection or along a roadway. The letter grade scale ranges from A to F and can be established for two-lane roadways, highways and intersections. A level of service “A” is defined as free flowing with complete mobility. Level of Service “F” is a breakdown of flow with frequent slowing and or stopping. Level of Service “F” occurs when demand is higher than capacity. A level of service “D” is generally used as the design criteria for new intersection designs or expansions. Level of Service A through C is considered good and is often not obtainable in urban areas during peak hours.

Once the construction methods and existing condition volumes are determined a traffic control plan method is chosen. A “traffic control plan” is a layout of barrels, cones, signing and striping which guides drivers through a construction area. Guidance and 46 examples of commonly used traffic control plans are available in the Manual of Uniform Traffic Control Devices.

Possible traffic control measures that are commonly evaluated for construction scenarios include, but are not limited to:

1. Short term single lane closures on a two lane roadway utilizing a flagger;

2. Long term single lane closures on a two lane roadway utilizing a temporary signal;
3. Single or multiple lane closures on the highway;
4. Detour routes; and
5. Lane closures and/or turning movement restrictions at signalized intersections.

Q. Please describe the process you use to develop an approach to managing and mitigating traffic impacts during construction.

A. Based on the proposed traffic control plan chosen at each location additional analysis may be necessary to evaluate the temporary construction condition. This is not necessary for a two lane closure utilizing a flagger if the capacity of the roadway provided is sufficient for the expected demand.

Additional analysis is generally necessary when construction is within a signalized intersection, a detour route impacts heavily utilized intersections or demand exceeds capacity for a two-way one-lane flagging operation.

In these cases a computer software program will be employed to (1) measure the impacts of the temporary traffic control scenario without mitigation and (2) test proposed mitigation theories and measure the expected impacts of mitigation. The types of software I commonly use are Synchro/SimTraffic, Highway Capacity Software and VISSIM. The software chosen depends on the situation being analyzed. While the user interface may differ the equations and assumptions made within each software package are based on those presented in the Highway Capacity Manual.

When simulated traffic impacts forecast a failing Level of Service and changes to the construction phasing or durations will not alleviate the condition mitigation recommendations are created for consideration.

The final written product is a traffic management plan. The traffic management plan will include the traffic analysis and recommended mitigation for areas where a failing Level of Service due to the construction is expected, as well as:

1. Traffic control plans for each construction location within the roadway;
2. Intelligent Transportation Systems necessary to improve level of service;
3. Construction timing limitations;
4. Public outreach requirements;

5. Crash locations and safety considerations;

6. Roles and responsibilities to ensure the implementation of the traffic management plan throughout construction; and

7. Strategies to encourage work zone safety, efficient routes for emergency response vehicles, incident management and enforcement.

Q. Please describe how you will manage and mitigate traffic impacts during construction along each major project segment.

A. Mitigation recommendations may include:

1. Multiple detour routes;

2. Signal timing and phasing adjustments along detour routes; and

3. Public outreach campaigns.

Once in place, mitigation will be maintained by following the New Hampshire Department of Transportation ("NHDOT") Guidelines for Implementation of the Work Zone Safety and Mobility Policy #601.01 dated October 12, 2007.

Q. How will you ensure that the traffic management plan you developed is being followed at all times?

A. The Transportation Management Plan is a document requested by NHDOT (at the direction of the Traffic Control Committee) for projects with complex traffic control plans and/or projects that are expected to cause substantial impacts to traffic. The document is approved by NHDOT and included as a permitting requirement for construction to progress. The traffic management plan also designates work zone traffic control task leaders and responsibilities as well as options for inspection and monitoring requirements. If at any time quality control inspectors or Resident Engineers witness or are informed that the Transportation Management Plan is not being followed construction may be stopped until the situation is rectified. Alternative contingency plans may be submitted to NHDOT for approval if complications arise with specific requirements within the transportation management plan.

Q. How will you ensure that the traffic management components of the Certificate are being complied with at all times?

A. The traffic management components of the Certificate will be referred to in the Transportation Management Plan and, therefore, task leader responsibilities, inspection and monitoring requirements will refer to these specific requirements.

Q. Please describe the NHDOT permits that the Applicants are seeking that relate to construction.

A. The NHDOT permits and approvals expected to be necessary for the completion of this Project are:

1. Use and Occupancy Agreement executed by NHDOT. This permit allows the Contractor to install utilities within Limited Access State owned Right of Way (LAROW), including Turnpike property. Once completed the permit serves as permission for the approved elements to occupy an agreed upon area within the State LAROW.

2. An ***Excavation (Trench) Permit*** executed by NHDOT. This permit allows the Contractor to excavate earth and/or roadway within the State ROW to install project components. A key element of this permit is that any disturbed areas must be restored to their original standards of design.

3. A ***Turnpike Encroachment Permit*** Application executed by NHDOT, Bureau of Turnpikes. This permit controls and manages excavations within Limited Access Turnpike owned ROW (LAROW). It will allow the contractor to access the transmission line ROW across turnpike owned property.

4. An ***Application for Driveway Permit*** executed by NHDOT. If needed, this permit will be requested by the contractor to install a driveway from a NH State maintained highway to access the transmission line ROW.

5. Permission for Aerial Crossing granted by NHDOT. This permission is obtained by petitioning the Department as outlined in the Utility Accommodations Manual.

Q. How will the Applicants ensure compliance with all of the requirements of NHDOT permits and agreements when constructing the Project?

A. Each NHDOT permit and agreement issued has a series of conditions assigned that must be met by the Applicant. Upon issuance of the NHDOT permits and agreements and the SEC Certificate of Site and Facility the Project will move forward with selection of one or more Contractors to complete the work specified in the contract documents (which include design plans and specifications). All conditions of the NHDOT permits and agreements and the SEC Certificate of Site and Facility will be included in the contract documents to be executed by the selected Contractor(s).

Q. When do you expect to develop specific plans for managing and mitigating traffic impacts during construction for this Project?

A. Development of traffic mitigation concepts begins during the early stages of development when more alternatives for addressing work zone impacts are available.

Once mitigation techniques are proposed and agreed upon, corresponding traffic control plans and a Traffic Management Plan(s) are drafted. Traffic control plans show typical layouts of signing, cones and barrels to convey traffic safely through active work zones. As the design progresses the traffic control plans and Traffic Management Plan(s) are refined to address specific traffic concerns.

The final Traffic Control Plans and Traffic Management Plan(s) will be submitted with the final design plans to NHDOT for approval. The final version will:

1. Refine traffic control plan layouts;
2. Add location specific information;
3. Add names for key roles;
4. Address comments from the public;
5. Address comments from the construction phasing team;
6. Address comments from the NHDOT; and
7. Elaborate on the general strategies proposed.

Q. Please describe the process that you will use to manage and mitigate traffic impacts due to construction delivery vehicles.

A. In New England a number of alternate routes are generally available to reach any given location. Due to this intricate road system a strategic plan can be created to allow access to each construction location which utilizes the most appropriate roadway types for transport, time of day for transport and suitable routes for overheight and/or overweight deliveries. By creating a well thought through plan for deliveries and construction vehicles traveling to and from the loading zones traffic impacts can largely be avoided.

Q. In your opinion, will the Project have a negative effect on public safety with regard to public highways and local streets?

A. As described above, it is anticipated that the traffic management components of the Project will provide appropriate mitigation of the temporary impacts to traffic to ensure that there will be no unreasonable adverse effects on public safety along the public highways and local streets.

Q. Does this conclude your testimony?

A. Yes, it does.

Lynn Farrington PE, PTOE

TRANSPORTATION ENGINEER

Firm
Louis Berger

Education
BS, Civil Engineering

Registrations/Certifications
Professional Engineer (NH, ME, MA, RI, GA)
Professional Traffic Operations Engineer

Years of Experience 9
Years with Firm 3

Professional Summary
Ms. Farrington has a strong transportation engineering background with nine years of experience. Previous project experiences include intersection and roadway operational analysis using Synchro/Sim Traffic, HCS and VISSIM, roadway design, striping, signing, and safety analysis. Her areas of specialization include traffic signal phasing and timing, traffic impact evaluation, roadway and intersection design and 3D traffic modeling. Ms. Farrington also has experience with specifications, drafting, project and utility coordination, estimates and scheduling.

Selected Louis Berger Experience
Rhode Island Airport Corporation, Adaptive Signal System Design, Warwick, Rhode Island. Traffic engineer. Led a team consisting of representatives from the Airport Corporation, Rhode Island Department of Transportation and Federal Highway. Assisted with the grant application process and received funding for over $900,000. Worked with the diverse team of professionals to create a request for proposals and choose a qualified vendor. The design phase is now ending with construction expected to begin in September 2015. The schedule for this project has been accelerated to allow the option of using a general contractor already on site. Professional Services: 2014; Construction: 2015; Size: 1 Intersection; Cost: Unknown

MaineDOT, WIN 20205.00, Intersections of Route 35 & Route 5, Dayton, ME. Project Manager. The Maine Department of Transportation (MaineDOT) is proposing to improve the intersection of Route 5 (New County Road) and Route 35 (Clarks Mills Road) in the Town of Dayton, Maine by modifying the intersection from 2-way stop controlled to a roundabout configuration. The current intersection has five legs that intersect at very odd angles. The intersection is listed as a High Crash Location, with a current Crash Rate Factor (CRF) of 5.00 and one fatality in the last 3 years. The design was further complicated by a large number of oversized vehicles using the intersection. The project is currently in preliminary design. Louis Berger has created three different alternatives/layouts in the very tight corridor that were presented to MaineDOT. One alternative has been chosen and presented during a Public Hearing in January 2015. The project includes a complete reconstruction of the entire intersection including realigning four out of the five legs. Other parts of the project include drainage improvements, truck aprons and utility relocation. The project is currently scheduled to be constructed during the 2016 construction season using 80% federal funding.

Cranbury Road Area Bicycle and Pedestrian Mobility Alternatives Study, West Windsor Township, New Jersey. The Township, in response to the public demand, began a study to improve mobility options along a 2 mile stretch of Cranbury Road. The study area consists of two 11-foot travel lanes with limited shoulders. The study explored existing constraints, including utilities, right-of-way, and steep grades, and recommends alternatives to improve vehicular, pedestrian and bicycle safety, improve mobility, provide more access to local businesses and properties, and better accommodate alternate modes of travel. Specific duties included sidewalk, bicycle lane and trail alignment alternatives, impact analysis, option comparison and review of the final report.

Federated Companies, midtown Development Traffic Impact Study, Portland, ME. Traffic engineer. Served as the primary engineer and project coordinator for the traffic impact study and permit application stage of development planning. The proposed 'midtown' development in the Bayside neighborhood is consists of a multi-use complex consisting of 100,000 square feet of retail space, 775 residential units and 1,040 parking spaces. Traffic forecasting, analysis, mitigation recommendations, scoping meetings and permit application process was completed by Louis Berger. Mitigation recommendations were also proposed to account for the 337 AM trip ends and 503 PM trip ends forecasted to impact the downtown area.

Jamaica North-South Highway Company Ltd. (JNSHC), Treadways Toll Plaza, Jamaica. Traffic engineer. The Treadways toll plaza and a portion of the highway from Linstead to Moneague (19.2 kilometers) was previously designed and constructed by a French developer. More recently, China Harbor Engineering Company Limited (CHEC) has completed this section of highway and plans to open it to the public in August of 2014. Specific duties included a site visit to review the equipment installed, recommend upgrades necessary to operate the plaza, created a tolling specific Operations and Maintenance Manual (OMM) for the August 2014 opening date. The OMM covered tolling operations, tolling equipment and structure maintenance, toll building and systems maintenance, signing and striping.

SMRT Inc, Maine Correctional Center, Windham, ME. Traffic engineer. Served as the primary engineer and project coordinator for the traffic impact study stage of expansion and/or relocation planning. The proposed expansion and relocation options analyzed intended to increase capacity at the site from 654 inmates to 1,531 inmates. Traffic forecasting, analysis, mitigation recommendations, scoping meetings and mitigation recommendations were proposed within the full study.

Jamaica North-South Highway Company Ltd. (JNSHC), Jamaica North-South Highway, Jamaica. Traffic engineer. Served as the primary peer reviewer for the traffic analysis of all proposed interchanges along the corridor. Traffic forecasting, analysis, intersection and interchange layout was reviewed by Louis Berger and suggestions were made to improve the final product for the client. The overall project includes full roadway construction from the City of Kingston to Ocho Rios. Specific duties include review of the layout, signing, striping and traffic flows based on current design standards.

Private Client, Interstate 4 Managed Lanes Design, Orlando, FL. Traffic engineer. As the consultants to the financers of this design and construction team Louis Berger was routinely called upon to analyze proposed improvements to the original design using the VISSIM software. Based on proposed layouts the benefits to drivers was quantified in relationship to the additional cost of construction. Specific duties included traffic flow analysis, truck traffic analysis and VISSIM simulations.

New Jersey Transit, Pedestrian Pathway Design, Princeton Junction, New Jersey. Traffic engineer. The client envisioned a recreational bicycle and walking path adjacent to a proposed bus way between the towns of West Windsor and Princeton. While the existing right of way and slopes were sufficient for the planned bus way the concept design allowed the client to fully understand the impacts to adjacent lands due to excessive nearby grades. Specific duties included pathway design, drafting and preliminary impacts summary.

Robert Wood Johnson Hospital, Parking Garage, New Brunswick, New Jersey. Traffic engineer. The hospital's primary goal was to create adequate ingress and egress at a proposed parking garage while causing as few disruptions to traffic flow on nearby roadways as possible. Specific duties included Synchro/SimTraffic analysis of nearby signalized intersections prior to the construction of the garage and with anticipated volumes after construction. The analysis led to a number of signal timing and phasing changes that allowed traffic to flow more efficiently after construction than was previously anticipated.

Department of Conservation and Recreation, Nantasket Beach Traffic Analysis, Hull, Massachusetts. Traffic engineer. The client is currently considering major changes to roadway configurations and traffic flow in the beach front area as part of their Master Plan. Specific duties included interaction with the client, town and public, 3D traffic analysis of peak summer weekend conditions at nine intersections, and analysis of proposed changes including rerouting a major roadway to an adjacent intersection. Other considerations involved in the master plan drafting are the addition of a dedicated bike path, pavilion area, ingress/egress assessment at maintenance facilities, facilities utilization analysis of maintenance and office facilities, possible facility layout options, recommended phasing of construction and preliminary cost estimates.

Massachusetts Department of Transportation, Emergency Access Gates, Lexington, Massachusetts. Traffic engineer. Roadway design along Route 2/Crosby's Corner include creating a limited access roadway with frontage roads along the current Route 2 corridor and significant expansion at Crosby's Corner to increase capacity. Specific duties on this project were the research, design, specifications and cost estimate for two automated cantilever access gates within the limited access corridor. These gates are anticipated for use by emergency responders and were requested by the Lexington Fire Department to decrease response times. A technical memorandum discussing possible limitations of gate operations was created in conjunction with the design documents and cost information.

Massachusetts Department of Transportation, Traffic Signal Regulation Permit Applications, Route 99, Massachusetts. Traffic engineer. Signal design, timings and phasings at five (5) intersections throughout the Route 99 corridor were completed in the towns of Boston and Everett. The City of Everett has a specific preemption system used by emergency vehicles that needed to be adhered to. The City of Boston utilizes specific controllers and does not have a preemption standard. These differences served to be a challenge during construction, installation and final acceptance. Specific duties included resolving the preemption issues during construction acceptance and preparing the traffic signal regulation permit applications for all signals and submitting to the appropriate districts for approval.

MaineDOT, Ogunquit 19106.00, Route 1/Main Street, Ogunquit, Maine. Transportation engineer. Assisting in the design of the 2.3-mile roadway rehabilitation of Route 1 through Ogunquit, Maine. Project includes resurfacing, drainage improvements, utility relocation, sidewalk construction, and project coordination for one of the most popular summer vacation destinations in Maine. The project is currently in final design and has been garnering municipal and state support since the first public hearing in May 2012. Specific duties include a full sign inventory, proposed signing and striping layouts, quantity and estimate preparation, plan set preparation, and guardrail design. Professional Services: 2013; Construction: TBD; Size: 2.3 miles; Cost: TBD

Rhode Island Department of Transportation (RIDOT), I-195 Bridge Construction, Providence, Rhode Island. Traffic engineer. Simultaneous construction of bridges 471 and 472 over the mainline. Developed a feasible detour plan through the city of Providence during all phases of bridge construction. Specific duties were to optimize traffic signal phasing and timing data at intersections nearby and design all detour signing necessary. VISSIM analysis was used to create a preferred ramp alignment and lane closure plan for I-195. Professional Services: 2013; Construction: TBD; Size: 2 Bridges; Cost: TBD

Rhode Island Department of Transportation (RIDOT), I-195 Bridge Construction, Providence, Rhode Island. Traffic engineer. Construction of bridge 465 which accesses the Veteran's Memorial Parkway from I-195. Developed a feasible detour plan through the city of Providence during all phases of bridge construction. Included a full shut-down of Warren Avenue to both vehicles and pedestrians during off-peak hours. Specific duties were to optimize traffic signal phasing and timing data at intersections nearby and design all detour signing necessary.

Analysis was completed using Synchro/Sim Traffic software. Professional Services: 2013; Construction: TBD; Size: 1 Bridge; Cost: TBD

Town of Concord, Cambridge Turnpike Improvement Project, Concord, Massachusetts. Traffic engineer. The Town's primary goal is to alleviate the flooding while ensuring a context sensitive balance is struck amongst cultural, environmental, roadway users, and aesthetic concerns. Specific duties included intersection analysis and proposal of five design alternatives for the intersection of Lexington Road and the Cambridge Turnpike. Pedestrian crossings, striping, traffic calming, intersection sight distance, and signing were a focus throughout the project duration. Professional Services: 2012; Construction: TBD; Size: 1.33 miles; Cost: TBD

City of Newport, Broadway Streetscape Improvements, Washington Square to Bliss Road, Newport, Rhode Island. Traffic engineer. Reconstruction of approximately 2,100 linear feet of roadway and associated pedestrian facilities for the purpose of achieving traffic calming while enhancing the roadway streetscape in downtown Newport. Several hardscape and landscape elements will transform the corridor, and a new decorative streetlighting system will be installed. Low Impact Development (LID) stormwater treatment technologies were incorporated throughout the streetscape area and were praised by the Rhode Island Department of Environmental Management (RIDEM). Primary responsibilities included overall traffic review of plans and addressing specific traffic related comments from RIDOT. Professional Services: 2013; Construction: TBD; Size: 2,100 ft; Cost: TBD

Rhode Island Airport Corporation, Intersection Design, Warwick, Rhode Island. Traffic engineer. Completed as part of the design phase for the Rhode Island Airport Corporation's proposed Winslow Park Sports Complex. Used Synchro/Sim Traffic to analyze possible layout alternatives to determine the effects on level of service during peak hour travel times. Major responsibilities included leading a team of six engineers to complete the signal phasing and timing, intersection layout and design, general plans, and quantity calculations within a severely limited schedule to meet a grant application deadline for the client. A nearby environmental resource required a revised layout. Professional Services: 2014; Construction: 2015; Size: 1 Intersection; Cost: Unknown

Rhode Island Airport Corporation, Traffic Signal Warrant Analysis, Warwick, Rhode Island. Traffic engineer. Completed as part of the planning and permitting phase for the Rhode Island Airport Corporation's proposed Winslow Park Sports Complex. Completed the signal warrant analysis at the intersection of Access Road and Airport Road in Warwick, Rhode Island. As part of this task, a formal report was drafted and presented to the client and RIDOT for review. Professional Services: 2013; Construction: TBD; Size: TBD; Cost: TBD

New Jersey Department of Transportation, Route I-76 and I-676 Bridge Deck Replacements and Roadway Resurfacing, Camden County, New Jersey. Lead Traffic Engineer. Responsible for Concept Development Activities including collecting existing traffic data, development of the VISSIM roadway network model, and analysis of traffic operations during proposed construction staging. The project will extend the service life of nine bridges and rehabilitate two miles of southbound pavement on I-76 and I-676. Louis Berger was initially tasked with the Final Design of three bridge deck replacements and two miles of pavement resurfacing. Field investigations performed as part of the initial project identified six additional bridges in need of rehabilitation. Louis Berger was subsequently tasked with performing three parallel Concept Development studies in order to advance the expanded project through the current NJDOT Capital Delivery Process. Results from the traffic operations analysis and recommendations made for construction staging, detour planning, and project phasing will be incorporated into a comprehensive Traffic Management Plan to be developed and modified over the entire course of the project.

Additional Experience

Maine Turnpike Authority (MTA), Origin and Destination (O&D) Study, Maine Turnpike, Maine. Transportation engineer. Comprehensive analysis of all origins and destinations on the Maine Turnpike. This effort was the largest O&D effort of any toll road in the United States. Responsibilities included planning and organizing the survey distribution effort, assisting with and supervising others during the distribution of surveys, data collection, data input, and summarizing the collected information. Professional Services: 2010; Construction: N/A; Size: 103 miles; Cost: Unknown

New Hampshire Bureau of Turnpikes, Open Road Tolling (ORT) Analysis, Hampton, New Hampshire. Traffic engineer. Analysis and design of an open road tolling system on the mainline barrier in Hampton, New Hampshire. Responsibilities included organizing data and modeling the existing and proposed tolling systems in VISSIM, a type of traffic simulation software. 3D video clips of the analysis were presented to the client as well as queue lengths and delay times for each scenario. Based on the data presented the ORT proposal moved forward and the plaza has since been constructed. Professional Services: 2009; Construction: N/A; Size: 1 Barrier Toll; Cost: $1.98 million

Maine Turnpike Authority, Safety and Capacity Study, Maine Turnpike, Maine. Traffic engineer. Identification of existing and future design hour volumes; analysis of existing roadway, toll plaza, and interchange operation; assessment of existing safety conditions; identification of improvement projects based on results of analysis; and report preparation. Responsible for performing traffic analysis for mainline and ramp locations at each interchange, safety analysis, and development of a preliminary report for Maine Turnpike Authority review and comment. Based on the safety analysis developed during the 2006 study two locations were recommended for installation of Roadway Information Systems (RWIS). These meteorological and pavement sensors alert maintenance teams when the friction factor of the roadway decreases so that plowing and de-icing operations can begin. Professional Services: 2010/2012; Construction: N/A; Size: 103 miles; Cost: Unknown

MTA, Headquarters Traffic Movement Permit, Maine. Traffic engineer. Assisted with data collection, analysis, and drafting of the final TMP for the Turnpike headquarters site on Congress Street in Portland, Maine. Professional Services: 2007; Construction: N/A; Size: 1 Permit; Cost: Unknown

New Hampshire Bureau of Turnpikes, Maintenance and Operations Review, New Hampshire. Transportation engineer. Participated in a review of the New Hampshire Bureau of Turnpikes' maintenance and operations program. Responsible for reviewing and summarizing information concerning the department's maintenance tasks and comparing it to industry standards. Recommendations were provided for existing winter, summer, and fleet maintenance operations. Professional Services: 2009; Construction: N/A; Size: 5 Facilities; Cost: Unknown

MTA, Service Plaza Signing, Maine. Traffic engineer. Designed all signs to be placed on the Turnpike mainline to notify patrons of three new service plazas. Responsible for both sign design and placement in all three locations. Professional Services: 2009; Construction: 2009; Size: 3 Service Plazas; Cost: Unknown

MassDOT, I-495/I-290 Interchange Analysis, Marlborough, Massachusetts. Traffic engineer. Used VISSIM traffic analysis software to analyze possible layout alternatives to determine the effects on level of service during peak hour travel times. This interchange is heavily traveled and is currently an area of congestion for commuters. Findings and recommendations were included in the final report. Professional Services: 2009; Construction: TBD; Size: 1 Interchange; Cost: TBD

MTA, Annual Inspection, Maine Turnpike, Maine. Transportation engineer. Key team member of the most recent annual inspection of the Maine Turnpike. Responsibilities included determining adequacy of signing, striping, pavement condition, toll plaza facilities, and drainage systems. Professional Services: 2012; Construction: N/A; Size: 103 miles; Cost: Unknown

MTA, Intelligent Transportation System On-Call Services, Maine. Traffic engineer. Responsibilities included troubleshooting and maintenance of the existing Highway Advisory Radio (HAR) and Closed Circuit Television (CCTV) systems. Also participated in the testing and implementation of a video sensor traffic count system now used on the southern 40 miles of the Maine Turnpike. This system replaced traffic loops buried in the pavement. For the design portion of these services, assisted with design of layout of highway speed E-ZPass readers on the north end of the Turnpike at three existing interchanges. Also assisted with design and layout of the Maine Turnpike's disaster recovery shelter for file back-up and remote storage of information away from the mainframe computers. Professional Services: 2007-2011; Construction: N/A; Size: N/A; Cost: N/A

MTA, Open Road Tolling Design, New Gloucester, Maine. Transportation engineer. Integral part of the conversion to ORT at the New Gloucester mainline plaza. This conversion required placement of video surveillance, E-ZPass readers, and extensive schematic layout design for the electrical system. Professional Services: 2011; Construction: 2012; Size: 1 Mainline Barrier; Cost: $4.3 million

MTA, Headquarters Site Design, Maine. Engineer. Assisted with the stormwater runoff design and mitigation for the Maine Turnpike's Headquarters on Skyway Drive. The Department of Environmental Protections's Best Management Practices (BMPs) were strictly adhered to since this site is within the Long Creek Watershed's drainage area. Aassisted with hydroCAD modeling, mitigation planning, and plan production. Professional Services: 2007; Construction: 2009; Size: Unknown; Cost: Unknown

MTA, Gorham East-West Corridor Study (Phase I), Gorham, Maine. Traffic engineer. Responsibilities included planning, organizing, and collecting the traffic movement portion of the data. The purpose of the study was to develop viable options to relieve congestion within the study area. Involved in the summary and analysis of both safety data and turning movement counts. Also assisted with developing the existing and optimized traffic models using Synchro/SimTraffic Analysis. Professional Services: 2010; Construction: TBD; Size: TBD; Cost: TBD

City of Lewiston, East Avenue Traffic Study, Lewiston, Maine. Traffic engineer. Completed a requested traffic study of East Avenue which included analysis of eight signalized intersections along East Avenue and Lisbon Street using Synchro/Sim Traffic. The purpose of the traffic study was to develop updated traffic signal phasings, timings, and coordination data based on forecasted traffic volumes. Changes to the coordinated signal network were limited to phasing, timing, and coordination modifications. Involved in the data collection and summary of both safety data and turning movement counts. Also assisted with developing the existing and optimized traffic models. Professional Services: 2008; Construction: 2008; Size: 8 Intersections; Cost: Unknown

MTA, Congress Street Bridge Replacement, Portland, Maine. Traffic engineer. Focused on the development of optimized traffic signal phasing and timing data during bridge construction. Other responsibilities included intersection layout and design, preparing general plans, profiles, and cross sections for the site work on Congress Street as well as quantity calculations. Effort included analyzing existing and bridge closed conditions using Synchro/Sim Traffic for signalized intersections in the project study area. Professional Services: 2008; Construction: 2008; Size: 3 Intersections; Cost: Unknown

MaineDOT, Northbound I-295 Bridge Construction, Portland, Maine. Traffic engineer. Developed a feasible detour plan through the City of Portland during all phases of bridge construction. Specific duties were to optimize traffic signal phasing and timing data at intersections within the study area. Analysis was completed using both Synchro/Sim Traffic and VISSIM software. Final results were presented to the City of Portland using 3D video clips illustrating before and after conditions. Professional Services: 2011; Construction: 2012; Size: 13 Bridges; Cost: Unkown

MaineDOT, Dunstan Corner, Scarborough, Maine. Traffic engineer. Used Synchro/Sim Traffic to analyze possible layout alternatives to determine the effects on level of service during peak hour travel times. While the major responsibility was developing signal phasing and timing data, also assisted in intersection layout and design, preparing general plans, and quantity calculations. Professional Services: 2012; Construction: 2013; Size: 3 Intersections; Cost: $3.35 million

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

JOINT PRE-FILED DIRECT TESTIMONY OF TERRENCE DEWAN AND JESSICA KIMBALL

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Personal Background: Terrence DeWan</u>

Q. Please state your name, title, and business address.

A. My name is Terrence DeWan. I am the principal and founder of Terrence J. DeWan & Associates, a landscape architecture and planning firm located at 121 West Main Street in Yarmouth, Maine.

Q. Briefly summarize your educational background and work experience.

A. I received a Bachelors of Science in Landscape Architecture (BSLA) degree in 1968 from the State University of New York College of Environmental Sciences and Forestry in Syracuse, New York. Over the past four decades I have prepared over 80 VIAs for a wide variety of projects throughout New England, including: hydroelectric dams, port improvements, power generation facilities, electrical transmission lines, substations, liquefied natural gas facilities, industrial buildings, sanitary landfills, roads and bridges, mining operations, wind energy facilities, and new community development. I have considerable experience developing VIAs for electrical transmission projects. One of our largest projects to date has been the VIA and ongoing mitigation planning for Central Maine Power Company's Maine Power Reliability Program, a $1.4 billion project to upgrade the bulk power system throughout nearly 440 miles of transmission lines in 75 communities in southern and central Maine.

Our work in visual assessment procedures has been recognized at the state and national level. I served as a consultant to the Maine Department of Environmental Protection (DEP) in the development of their Scenic Impact Rules. I authored the Scenic Assessment Handbook for the Maine State Planning Office. I served as an advisor to the Governor's Task Force on Wind Power Development in Maine. I also served on a state-sponsored study group to develop an assessment of cumulative visual impacts from wind power development. TJD&A is one of three firms, and the only one in Maine, who is pre-qualified to perform peer reviews of utility scale wind energy projects for the Maine Department of Environmental Protection. Over the past decade I have been invited to deliver presentations on visual assessment procedures and related topics at several national conferences (American Society of Landscape Architects, American Planning Association, National Association of Environmental Professionals). I recently completed two peer reviews for the Argonne National Laboratory on visual impact analysis, one for the National Park Service, the other for the Bureau of Land Management. In 2011, I was elected to become a Fellow of the American Society of Landscape Architects, the first person from Maine ever to achieve that honor. My resume is included as Attachment A.

Q. Have you previously testified before the Site Evaluation Committee?

A. No. But I have testified before many other regulatory boards, including the Maine Department of Environmental Protection, the Maine Land Use Regulation Commission, the Public Service Commission of West Virginia, and the New York State Department of Environmental Conservation.

Personal Background: Jessica Kimball

Q. Please state your name and title.

A. My Name is Jessica Kimball. I am a planner and landscape designer at Terrence J. DeWan & Associates.

Q. Briefly summarize your educational background and work experience.

A. I received my Bachelor of Community Design from Dalhousie University School of Planning in 2007. I served as a planner for the town of Old Orchard Beach, Maine from 2007 to 2010. As town planner, I coordinated the project review and approval process for the Planning Board and Design Review Committee. I received my Master of Landscape Architecture from the University of Toronto Faculty of Architecture, Landscape, and Design in 2013. I spent one year as a Landscape Designer at Sasaki Associates, an internationally recognized planning and design firm in Watertown, Massachusetts, where I was involved with campus planning, master plan development, and construction detailing for built work. I joined Terrence J. DeWan & Associates in July 2014. Since joining the firm, I have worked almost exclusively on visual impact assessments. My resume is included as Attachment B.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is the purpose of your joint testimony?

A. The purpose of our joint testimony is to provide the SEC with an overview of the professional practice of visual impact assessments and to summarize the visual impact assessment that we performed on the Northern Pass Transmission project ("Northern Pass" or "Project").

We spent more than 18 months working on the Project, during which time we visited over 200 sites and conducted detailed assessments on over 70 individual scenic resources. Based on our extensive analysis, we have concluded that Northern Pass will not have an unreasonable adverse effect on aesthetics. See Visual Impact Assessment, Appendix 17.

Aesthetics

Q. You began your work with the preparation of a Visual Impact Assessment ("VIA"). What is a VIA?

A. A visual impact assessment, or VIA, is a systematic analysis of possible changes to the visible landscape resulting from proposed development activity, and the investigation of possible means to avoid, minimize or mitigate the effects of the change. While there are many variations in the process, most VIAs have certain interrelated steps that identify and take into account:

- Physical Characteristics of Project Components
- Regional and Local Landscape Character
- Values of Identified Scenic Resources
- Viewer Sensitivity Levels
- Project Visibility
- Aesthetic Impacts to Scenic Resources
- Mitigation Techniques
- Determination of Acceptability or Undue Aesthetic Impacts

The practice of visual impact assessments can be traced back to the National Environmental Policy Act of 1969 (NEPA). Following NEPA, a number of federal agencies developed techniques and programs to evaluate visual impacts that are specific for their particular areas of jurisdiction. The first was the US Forest Service, which introduced many of the concepts that are used today in evaluating landscapes and determining potential visual effects. The ensuing 40 years has seen a proliferation of other VIA techniques developed by federal and state agencies (e.g., Bureau of Land Management, Federal Highway Administration, State Departments of Environmental Protection). The practice of visual assessment has not remained static; policies are continually updated as agencies gain experience in dealing with development proposals in their jurisdiction.

Q. How did you define the Project Study Area?

A. The first step in any VIA is to define the Project Study Area (also known as the Area of Potential Effect or APE), where the cleared corridor, transmission structures, conductors, and other project components may be visible. For purposes of Northern Pass, our Project Study Area is a band of land that is generally 6 miles in width; 3 miles on either side of the Project route. While narrower study corridors are common for transmission line VIAs in the Northeast, we decided that the more conservative 6-mile width was appropriate. In some instances—primarily in hilly and mountainous regions with elevated viewpoints—we extended our Project Study Area out to five miles to determine if the cleared transmission corridor would be visible from elevated viewpoints. In those areas where the transmission line will be located underground, the Project Study Area was one-half mile in width, one-quarter mile on either side of the line. A key consideration in setting the width of the Project Study Area is the decreased ability of the human eye to make out details at greater distances, which is related to the concept of distance zones.

Q. Please describe the key features of the VIA that you conducted for the Northern Pass.

A. The VIA that we conducted for Northern Pass contains the elements that are common to all VIAs, and included consideration of the proposed rules currently being considered by the Site Evaluation Committee. We became very familiar with the defined Project Study Area and the surrounding region; we identified scenic resources and the groups that use them that may be affected by the Project; we determined where the transmission line would be visible; we developed accurate photosimulations that enabled us to visualize and describe potential changes to scenic resources resulting from the transmission line's visibility; we presented recommendations to the design team on possible measures to avoid and minimize such impacts; and finally, we determined whether the Project would have an unreasonable adverse visual effect on aesthetics, based upon a set of established criteria.

The VIA describes in both a narrative and graphic form the changes to the visual environment that may result from the construction of the Project as well as the measures that have been and are being taken to avoid, minimize, and mitigate adverse visual effects. We determined the visual effects of the Project, based upon our experience with objective criteria, to analyze potential contrast in color, form, line, texture, scale, and dominance between the existing landscape setting and the proposed Project components. The VIA evaluates effects on individual scenic resources and provides the basis for rendering an overall judgment as to whether the Project as a whole would have an unreasonable adverse effect on aesthetics.

Q. Please describe the methodology used in conducting the VIA.

A. The methodology is based upon established criteria developed by federal and state agencies over the past several decades, with modifications to make it specific to both the type of project (i.e., a transmission corridor) and its location (i.e., the state of New Hampshire). The methodology is virtually identical to our previous work with transmission lines and other VIA projects, which follows a systematic path of inventory, analysis, and determination of effect. Each step along the way is important to achieve the necessary level of understanding and to ultimately arrive at a final determination of impact:

- Write a succinct **Project Description** so reviewers can understand the visual characteristics of the various components of the project (e.g., the color, height, and design of the transmission structures).
- Set the **Area of Potential Effect,** which defines the Project Study Area based upon the limits of human perception.
- Reference the **Legal Framework,** as explained to us by counsel, which describes the legal standard that must be met regarding effects on aesthetics.
- Describe the **Existing Landscape Character** in terms of the topography, water features, vegetation, and human development patterns that make up the visible landscape.
- Describe **User Expectations** to provide an understanding of what the average person expects to see when visiting scenic resources along the route.
- Prepare a **Viewshed Analysis,** a computer-mapping process to determine where the project might be visible within the Project Study Area.
- **Inventory Scenic Resources** within the Project Study Area and determine which are the most significant, based upon established criteria that considers cultural value and visual quality.
- Report on our **Fieldwork,** which provides us with first-hand knowledge of existing conditions, project visibility, and use patterns.

- Develop **Visualizations** in the form of photosimulations, computer models, and cross sections, to show (A) how the project may change the appearance of the landscape and (B) the effectiveness of mitigation measures being proposed.
- Determine the **Visual Effect** that describes in narrative form how the project may change the appearance of the landscape and the effectiveness of mitigation measures being proposed.
- Describe **measures that have been taken** to avoid, minimize, or mitigate potential visual impacts.
- Prepare a **Visual Impact Assessment** that summarizes the findings of our work and provides a professional evaluation of whether the site and facility would have an unreasonable adverse effect on aesthetics.

Q. Please provide a general overview of the components of the proposed transmission line that were important to you from a visual assessment perspective.

A. Our analysis considered all the Project components that may be visible within the Project Study Area, which we explain below. These included the various types of transmission structures; the conductors; the shield wires (grounding wires) at the top of the structures; the cleared portion of the right-of-way; the converter terminal; the substations; and the transition stations. Each component has visual qualities that are factored into the evaluation of visibility and their potential to affect the aesthetic characteristics of the surrounding landscape.

The transmission structures received the most attention during the assessment process, since they represented the greatest potential for visual change over existing conditions. This is due to their relative size when compared to existing transmission structures and the trees that define the edge of the corridor; their color and the way light can reflect off their surfaces (especially the galvanized steel structures); and the difference in form when compared to the existing 115 kV and distribution structures that are currently found in the corridor.

For the most part, the visual effect of the existing transmission corridor is not a significant issue because it is already part of the visible landscape, and any additional clearing will occur within the established corridor. With two exceptions (in Concord/Pembroke, where the right-of-way had to be expanded to conform to Federal Aviation Administration standards; the other in the vicinity of the existing Whitefield substation) the width of the existing right-of-way will not change.

The majority of the new corridor will be seen from locations where the viewer is at or below the elevation of the transmission line. There are few places (e.g., Weeks State Park) where the viewer is in a superior position, i.e., looking down onto the corridor. In some of these situations, an observer may be able to see the ground surface within the corridor, which may contrast with the color and texture of the surrounding landscape.

Q. What are distance zones and why are they important?

A. The concept of distance zones—subdividing the visible landscape into foreground, midground, and background—has evolved from the US Forest Service's visual analysis criteria for evaluating visual impacts to forested landscapes. The concept is found in most governmental visual assessment systems and is based on the amount of detail that the human eye can differentiate at different distances and the experience people will have when they see human development in landscape settings. Distance zones provide a frame of reference for describing existing landscape conditions and evaluating the relative visibility of transmission lines from scenic resources, and therefore the visual effect they may have on those resources at varying distances.

- **Immediate Foreground** (0 to 300 feet from the observer): At this distance, details and textures are most noticeable. Observers can differentiate individual components of transmission structures (e.g., insulators, bolts, and foundations for transmission structures) or substations (e.g., fencing, transformers, and mechanical equipment).
- **Foreground** (300 feet to 0.5 mile from an observer): In the foreground observers are able to detect surface textures (e.g., the finish and pattern on a steel transmission structures), details (e.g., the individual components of structures or substations), and a full spectrum of color.
- **Midground** (0.5 mile to three miles from an observer): In the midground the details in the landscape become subordinate to the whole: individual trees lose their identities and become forests; buildings are seen as simple geometric forms; roads and rivers become lines. Development patterns are readily apparent, especially where there is noticeable contrast in scale, form, texture, or line. Colors become somewhat muted (especially noticeable as the distance from the observer increases), an effect that is more pronounced in hazy or rainy weather

conditions, which tend to reduce color intensity and de-sharpen outlines even further. The majority of the viewpoints analyzed for Northern Pass are located in the midground.

- **Background** (greater than three miles away): Most transmission structures cease to be uniquely recognizable at distances greater than 3 miles. In the background the effects of distance and haze will obliterate surface textures, detailing, and forms of individual structures. Changes to the landscape seen at this distance are noticeable only if they present a high level of contrast in line or form.

Q. What are the existing landscape conditions within the Project Study Area?

A. The character of the existing landscape varies widely throughout the Project Study Area, with significant changes in topography, water bodies, vegetation, and cultural patterns. The VIA provides a description of existing conditions at three distinct levels:

- *Subarea*: For purposes of the VIA, the Project Study Area is divided into six subareas. The VIA describes each subarea in terms of its regional landforms, water bodies, vegetation, and cultural patterns. The focus is on overarching characteristics that define the region, and not on specific landmarks.
- *Community*: For each host and adjacent community within the Project Study Area, the VIA provides a description of its general physical characteristics, population, development patterns, and land use planning. Where existing transmission corridors exist, they are described in terms of their physical features, surrounding topography, vegetation bordering the corridor, and adjacent land uses.
- *Scenic Resource*. The description of each scenic resource includes a summary of its landforms, vegetation patterns, water features, and human development. In addition, the VIA describes the existing conditions within the transmission corridor that will be visible from a scenic resource: corridor width; cleared width; and structure type, size, and height.

Q. What are subareas and why are they important?

A. A common way of analyzing linear projects—such as corridor management plans for scenic byways, river corridor plans, or transmission line studies—is to look at them as a series of subareas, distinct but interrelated physiographic regions that have similar physical and visual characteristics. For Northern Pass we have divided the linear corridor into six subareas, ranging in length from 15 to 57 miles, each with between three and eight host communities. This approach recognizes the physical context of the transmission corridor and how the landscape, development patterns, visibility of the existing transmission line, and recreational use change throughout its length. It also responds more closely to the way that people observe and use the landscape, giving more emphasis to natural, rather than political, boundaries.

Q. What are scenic resources?

A. The VIA for Northern Pass is based upon an evaluation of recognized scenic resources within the Project Study Area, rather than on every possible location where the Project may be visible. In keeping with widely accepted methodologies, scenic resources are defined as publicly accessible places that have been designated or recognized by local, regional, state, or national authorities for their scenic or recreation quality and are visited by the general public, in part for the use, observation, enjoyment, and appreciation of natural, cultural, or visual qualities. Examples of scenic resources include state parks, national forests, lakes and ponds, rivers, state-wide trail systems, scenic byways, conservation lands with scenic qualities, tourism destinations, such as recreation areas and grand hotels with scenic qualities, and town and village centers with recognized scenic quality.

All scenic resources that we identified within the Project Study Area were mapped and added to our database for further evaluation.

Q. Please describe how the VIA analyzed scenic resources.

A. Over the course of our study we identified approximately 525 sites within the Project Study Area that met the definition of a scenic resource. With this as our starting point, we went through a process of viewshed analysis (discussed further below), computer modeling, and fieldwork to narrow down the number of resources where the corridor may be visible. Using this process we determined that Northern Pass will not be visible from the vast majority of the scenic resources within three miles of either side of the corridor.

Our next step—if the viewshed analysis, computer modeling, and fieldwork indicated that the Project may be visible from identified scenic resources—was to perform a more in-depth analysis to determine the scenic significance of each resource and the Project’s visual effect. From a scenic and cultural perspective, we recognized that some resources are more significant than others. We evaluated each of the scenic resources with potential visibility to determine its scenic significance, based on its cultural value and visual quality.

The evaluation of *cultural value* considered the value that has been placed on a particular resource, usually by a public agency, and indicated by formal designation, inclusion in current planning documents, or similar sources of information. Scenic resources were classified as having high, medium, or low cultural value. A National Scenic Byway and state parks are examples of resources with high cultural significance. We then evaluated those resources with a cultural value rating of at least a medium to determine their visual quality.

The evaluation of *visual quality* considered the visual appearance of a resource, using a matrix (adopted from the Bureau of Land Management's Visual Resource Management System) that took into account landform, vegetation, water, color, views, uniqueness, and the presence of human development to arrive at a classification of low (common), medium (noteworthy), or high (distinctive). Most scenic assessment systems are based upon a description of existing landscape elements: vegetation, topography (land form), water bodies, and cultural features.

The final step in the analysis of scenic resources combined the ratings for cultural value and visual quality for each resource, using an equally weighted matrix to obtain a determination of *scenic significance*. This provides a measure of the overall significance of each resource by considering inherent visual qualities and the value placed upon these resources by the public who use them. Following the determination of scenic significance, we conducted an individual visual impact assessment for those resources that received at least a medium scenic significance rating.

Q. What is a viewshed analysis?

A. Once we set the limits of the Project Study Area and inventoried the location and extent of the scenic resources within it, we started a filtering process to determine which scenic areas may have a view of the transmission line. One of the first tools that we use is a computerized viewshed analysis, which produces a series of viewshed maps that show (A) where the proposed transmission structures, in whole or in part, will potentially be visible, (B) where the structures will most likely be hidden by trees and topography, and (C) the approximate number of structures, in whole or in part, that may be visible.

Much of the computer analysis used in the preparation of the viewshed maps is based upon two layers of information. The first layer (called the digital terrain model) provides topographic information: the elevation above sea level; the second layer (called the digital surface model) is based upon the heights of trees and buildings. The computer uses these two data sources, along with the height, elevation, and location of each existing and proposed structures, to predict where areas of visibility will occur.

Q. Please describe the viewshed maps and their relationship to the viewshed analysis.

A. We prepared a series of viewshed maps to better understand the relationship between the Project and the existing conditions in the Project Study Area (refer to the Viewshed Maps that are found in Appendix A in the VIA):

- **Existing Structure Visibility:** The first map shows where existing transmission structures, in whole or in part, are currently visible, and the approximate number of such structures that may be seen. This map demonstrates that existing transmission lines already have a visual effect on portions of the surrounding landscape.
- **Proposed Structure Visibility:** The second map shows where both the existing transmission structures and the proposed Northern Pass structures would be visible, in whole or in part, and the approximate number of both existing and proposed structures that may be seen.
- **Increased Areas of Structure Visibility (Delta):** The final map shows areas that will potentially have visibility of a portion or all of a transmission structure for the first time.

In addition to the mapping, we calculated the area of each town that will potentially have views of the Project corridor in the future and compared it to those areas that currently have views of the existing structures.

Viewshed analysis is a starting point in determining project visibility; while the results are generally accurate, the viewshed maps need to be interpreted, verified, and field-checked to arrive at a final determination of visibility or no visibility.

Q. Please discuss the fieldwork you undertook for this assessment and describe where TJD&A visited while preparing the VIA.

A. As noted above, before we went into the field, our team collected published data on approximately 525 potential scenic resources within the Project Study Area. The filtering process, which included viewshed mapping and computer modeling, allowed us to eliminate approximately 325 of these sites where there would be no possibility of the Project being visible, primarily due to the effects of intervening topography, screening vegetation, and distance. A chart explaining the filtering process that we used is included in the VIA for the Project.

Teams of two to three people from TJD&A visited, photographed, and analyzed approximately 200 scenic resources throughout the Project Study Area. Field visits were designed to provide us with first-hand knowledge of existing conditions at the identified resource, to evaluate scenic quality of the resource, to observe human use patterns, to photograph views from key observation points (KOPs), and to record site conditions and other factors that may affect Project visibility. In addition to photographing specific viewpoints with potential Project views, we also visited other areas in the scenic resource where there would not be Project views to be able to describe how the Project would affect the resource as a whole.

One member of the site team photographed the landscape, using a high quality digital camera equipped with a GPS device that captured the location of each image. Photographs were taken for several purposes: to document the characteristic landscape in the vicinity of the scenic resource; to provide images that illustrate the context of the viewpoint(s); and to record images that would be used in photosimulations. Photographs were taken from a number of viewpoints, depending upon tree cover, evidence of public use, accessibility, and visibility of the existing and proposed transmission lines. The other member(s) of the site team reviewed maps and recorded photo numbers as well as observations on weather conditions, user activities, visibility of existing transmission line(s), and the character of the surrounding landscape.

Q. What are photosimulations and why are they important?

A. Photosimulations are montages that combine photographs of the scenic resource with computer-generated models of the transmission line to help provide an understanding of the effect that a project will have on the scenic resources. Photosimulations, when prepared and used correctly—along with the other visualization tools, such as cross-sections, viewshed maps, and three-dimensional models created in Google Earth Pro, AutoCad, SketchUp, and ESRI software—are key elements in the evaluation process. These tools are used throughout the assessment and are included in the VIA to illustrate our findings.

The photosimulations are also useful in demonstrating the effectiveness of mitigation measures that will be employed to reduce visual impacts. The VIA for the Project includes photosimulations from 30 KOPs that accurately represent the design of the proposed structures, materials, heights, conductors, shield wires, new clearing (as appropriate), and other Project components. The locations provide a representative sampling of the characteristic landscapes where the Project is being proposed and show the visual effect on significant scenic resources throughout the route.

Q. How were key observation points selected for photosimulations?

A. The viewpoints selected (key observation points, or KOPs) for the photosimulations are publicly accessible locations in or adjacent to a scenic resource where the greatest number of transmission structures would potentially be visible, and where the most public use occurs or is anticipated.

Scenic resources often have a wide range of viewing opportunities that can be categorized as points, linear features, or scenic areas. The photosimulations provided in the VIA include all three types of viewing opportunities and are representative of the experience that the typical user would encounter.

- "Points" may be scenic overlooks, fishing platforms, historic structures, mountaintops, fire towers, and similar places where a single viewpoint will illustrate the characteristic view.
- "Linear Features" may include scenic byways, river corridors, and hiking trails that may offer sequential opportunities to experience the landscape from a variety of viewpoints.
- "Scenic Areas" may be lakes, historic districts, state parks, and similar locations that cover a relatively large geographic area. In determining where to take photographs for the photosimulation our analysis starts with a review of the viewshed mapping, distance zones, computer modeling, guidebooks, and other resources to determine where the Project would be most visible and where the public goes to enjoy the scenery.

Q. What criteria did you consider when assessing potential impacts on scenic resources?

A. The VIA takes into account two primary factors in determining potential visual impact: (A) *visual effect* of the Project on the scenic resource, and (B) *viewer effect*, which considers the extent, nature, and duration of public use, and the effect that the transmission line would have on the *public's continued use and enjoyment* of the resource. This approach, which considers both the visual and the human effect, is consistent with current professional practice for visual impact assessments and the draft SEC criteria for determining effects on aesthetics. The specific criteria consider:

- The existing character of the landscape within the area of potential effect (APE). In this case the Project Study Area extended out at least three miles from the transmission line (i.e., a six-mile wide Project Study Area). Where the transmission line will be located underground, the Project Study Area extended out a quarter-mile.
- The scenic significance of the resources that may be affected by the Project.
- The distance to the proposed Project from significant public viewpoints within scenic resources.
- The expectation of the typical viewer, and the extent, nature, and duration of potentially affected public uses that occur within scenic resources.
- The scope and scale of the view(s) of the Project as seen from scenic resources.
- The effect that the Project may have on the public's continued use and enjoyment of the scenic resource.
- The effectiveness of measures that have been or will be incorporated into the Project to avoid, minimize, or mitigate effects on aesthetics.

Our evaluation of the potential *visual effects* of the Project was based upon an assessment of landscape compatibility, scale contrast, and spatial dominance, factors that are commonly used in the VIA programs that formed the basis for our methodology. Landscape compatibility evaluates Project elements (transmission structures, conductors, cleared transmission corridors, transition stations, substations, and converter terminal) for potential contrasts in color, form, line, and texture when seen from a scenic resource. Scale contrast evaluates the relative size and visual extent of Project elements and how they will relate to the surrounding landscape. Spatial dominance evaluates the position of Project elements in the landscape and determines their degree of visibility in the landscape (the surrounding landforms, nearby water bodies, or the sky. The details of this analysis are presented in the VIA.

The second part of the VIA evaluates the effect that the Project may have on *public use.* It considers both the expectation of scenic quality that the typical viewer has when visiting the scenic resource, and the extent, nature, and duration of use that the resource currently receives, as evidenced by published reports, field observation, and our experience in similar situations. This is likewise an important consideration, in that it describes the relative importance of aesthetics that the general public places on scenic resources.

Q. Please describe the overall visual impact rating.

A. The overall visual impact rating is the final step in the evaluation process. We employed a matrix that combines the visual effect (i.e., the change in the visible landscape resulting from the construction of the Project) with the potential viewer effect (evaluations of (A) the extent, nature, and duration of current use of the scenic resource, and (B) an assessment of the effect that the Project would have on the public's continued use and enjoyment of the scenic resource). The results of the matrix provide the basis for a determination of overall visual impact.

The narrative portion of the VIA provides the detail behind the overall visual impact rating. It provides a summary of the analysis that was completed for each site and analyzes the anticipated changes to the natural and cultural landscape. It also provides an analysis of whether the changes will have an effect on the way the public now uses the resource. As we described earlier, the photosimulations, existing conditions photographs, cross sections, viewshed maps, and 3-D computer models all play a key role in making the determination of overall visual impact.

Q. Describe how you assessed scenic resources.

A. We first analyzed each scenic resource with a scenic significance rating of at least 'medium' that may have a view of the Project to determine the visual effect of the Project and the potential effect that it may have on public use. The analysis takes into consideration various measures that have been taken to avoid, minimize, or mitigate potential adverse visual impacts. The evaluation takes a holistic approach by describing the potential impact on an affected resource and the likely effect on the resource as a whole.

Once we completed the visual assessment of each scenic resource, we evaluated the visual effect that the Project would have on our six defined subareas to determine whether it would have a cumulative visual effect on the resources within the subarea and the way people now use and enjoy the subarea. As part of this step we evaluated those linear resources (e.g., scenic byways, trails, rivers with noted recreation and scenic values) that extend beyond municipal boundaries and often have more than one location where the Project corridor will be visible.

At the conclusion of our analysis, we looked at the Project as a whole to make a determination of whether there would be an unreasonable adverse effect on the aesthetics within the Project Study Area surrounding the Northern Pass corridor and other Project components (substations, transition stations, and converter terminal).

Q. Please describe the mitigation measures that were employed.

A. We consider mitigation to be an action that is taken or not taken to avoid, minimize, rectify, reduce or eliminate a potentially adverse visual impact. A significant number of mitigation measures have been incorporated into the planning and design of the Project, including:

- *Locating portions of the Project underground* to avoid sensitive visual resources, such as scenic byways and the White Mountain National Forest.
- *Using existing road rights-of-way* for most of the underground sections to minimize the need for new cleared transmission corridors.
- *Co-locating the majority of the transmission line in existing transmission corridors* to minimize the amount of new corridors that would be required for the installation of the Project.
- *Using weathering steel monopole structures* in certain areas. Weathering steel monopoles are generally darker in color and have a hue that is more commonly found in the landscape, resulting in a decrease in color contrasts with the surrounding landscape. Monopole structures are also simpler in appearance than the lattice structures, which reduce the contrast in form. Monopole structures are also considerably thinner than lattice structures (i.e., they occupy a smaller horizontal field of view) so they will appear less dominant than lattice structures.
- *Locating new transmission structures in proximity to existing structures* in certain locations to maintain the same spacing and avoid irregular linear patterns that can be caused by adjacent conductors being out of synch with each other.
- *Matching the materials used for both the relocated 115 kV structures and the proposed transmission structures* to minimize contrasts in color and texture and contribute to a sense of visual continuity within the corridor.
- *Lowering the heights of and relocating existing transmission and distribution lines within the existing corridors* to provide adequate clearance for the Project structures.

- *Maintaining and/or restoring vegetation at road crossings* and underground cable installations where possible, subject to underlying landowner permission, to minimize or screen the view down transmission corridors. Vegetation cannot be capable of achieving a height tall enough to interfere with the electrical conductors. Clear paths will be left for inspection and maintenance.
- *Maintaining and/or restoring riparian vegetation* at river and stream crossings, subject to underlying landowner permission, to minimize boaters' views down transmission corridors and to restore cleared areas with naturalistic landscaping. Riparian vegetation likewise has to be non-capable, i.e., it cannot be capable of achieving a height tall enough to interfere with the electrical conductors.
- *Adjusting the alignment of the underground transmission corridor.* In one location the underground transmission corridor located outside the public highway intersected a designated scenic byway at an acute angle. To a passing motorist or byway tourist this would have appeared as a straight arbitrary line in a largely natural landscape. A reverse curve will be incorporated into the alignment of the underground section to minimize the distance up the cleared corridor that would be visible and to create a more visually pleasing, naturalistic line in the landscape.

Q. What visual effects were avoided by going underground through the White Mountain National Forest?

A. Approximately 52 miles of the Project will be located underground in the vicinity of the White Mountain National Forest ("WMNF"), rather than overhead on an existing transmission corridor that goes through the Forest. This 52-mile section of the Project will be located within public road rights-of-way, where it will not have any long-term visual impact. This is a significant mitigation measure that avoids potential visual effects on a number of scenic resources, both in and outside of the WMNF, which include:

- Appalachian National Scenic Trail / Kinsman Ridge Trail crossing in Lincoln.
- Views from the Appalachian Trail: two viewpoints on South Kinsman Mountain in Lincoln; a viewpoint below the summit of Mt. Wolf in Lincoln; a viewpoint north of the summit of Mt. Moosilauke in Benton; the summit of Mt. Liberty in Lincoln; the summit of Mt. Lafayette in Franconia.

- Other trails in WMNF: Beech Hill Trail, Reel Brook Trail in Easton; Gordon Pond Trail in Woodstock.
- Waterbodies within WMNF: Reel Brook in Easton; Eliza Brook, Bog Pond, Harvard Brook, and Boles Brook in Lincoln; Gordon Pond Brook, Mt. Moosilauke Brook, Pike Brook, and Crooked Brook in Woodstock.
- Other mountains: Bald Peak in Easton in WMNF; Mt. Pemigewasset in Lincoln on the border of WMNF and Franconia Notch State Park; Cannon Mountain and Bald Mountain in Franconia.
- Pemigewasset River crossing in Woodstock.
- River Heritage Scenic Byway crossings (Route 117 in Sugar Hill; Route 116 in Easton and Franconia; Route 112 and Route 3 in Woodstock; Route 175 in North Woodstock, Thornton, and Holderness; Route 49 in Campton).
- Cooley Jericho Community Forest in Easton; Sugar Hill Town Forest in Sugar Hill.
- Church Hill Wildlife Management Area in Ashland.

In addition, impacts were avoided in other locations that are not scenic resources. For example, locating the transmission line underground will minimize potential visual impacts to Interstate 93 in several locations: northbound in the vicinity of Exit 31; views from and crossing the Interstate in Woodstock; views from the Interstate (northbound) north of Exit 28 in Campton; and the view from and crossing Interstate 93 in Ashland.

Draft Environmental Impact Statement

Q. Have you reviewed the draft Environmental Impact Statement?

A. Yes, we have.

Q. What are you able to conclude about the draft Environmental Impact Statement?

A. The Visual Impact Assessment Technical Report for the draft Environmental Impact Statement (DEIS VIA) prepared by T.J. Boyle Associates primarily focuses on two types of analyses, namely, a landscape assessment and viewpoint assessment. The computer-based (GIS) landscape assessment provides a big picture look at the landscape within ten miles of the centerline of the Project. As part of the landscape assessment, the DEIS VIA includes a roads-based analysis that evaluates the views from public roads within 1.5 miles of the Project. The viewpoint assessment, on the other hand, involves a detailed inventory of existing conditions at a few specific sites, the preparation of simulations to illustrate the potential visual impact, and a description of the visual effects of the Project at each of those points. While the DEIS VIA did not offer a conclusion regarding the "unreasonable adverse effect" standard, its results are consistent with the findings of our VIA.

It is important to note that it appears the DEIS VIA overstates the potential effects of the Project on many scenic resources. The DEIS VIA studied a project area up to 10-miles from the centerline of the Project, while recognizing "that the potential for visual impacts from the proposed structures is increasingly unlikely beyond 1.5 miles." DEIS VIA, p. 20. Indeed, anything beyond five miles is described as either far background (5.0 to 10.0 miles) or distant (greater than 10 miles). For the far background, the EIS states that "even on the clearest days, humidity reduces the visual contrast to such an extent that structures and the cleared corridor are difficult to distinguish as other than vague smudges in the landscape." DEIS VIA, p. 29. For distant views, the DEIS VIA states "if any transmission line could be seen, it would have a trivial presence." DEIS VIA, p. 29. The DEIS VIA also notes that "possibility of visual impacts was anticipated to be limited to the near middle ground [0.25 to 1.5 miles], except under special conditions." DEIS VIA, p. 21.

The VIA completed by Terrence J. DeWan & Associates defined the Project Study Area as three miles on either side of the Project. Generally speaking, scenic resources outside of this range would not have a view of the Project.

The GIS-based landscape assessment in the DEIS VIA also appears to consider a transmission structure to be 'visible' if any part, however small, of a structure could theoretically be seen from a particular viewpoint. This approach does not factor in the observers' visual acuity (the ability to differentiate minute objects at certain distances), relative contrast between the structure and its immediate background, the type of structure that would be used, lighting conditions, or other considerations that may influence whether a structure would actually be visible.

Using such an approach limits the usefulness of the DEIS VIA for determining an actual visual effect. For instance, the DEIS VIA counts many structures as "visible" even though the structures may not be apparent to an observer for the reasons just stated. Thus, the DEIS VIA generally overstates the actual conditions of the Project following construction.

The DEIS VIA is consistent with our findings that the underground construction of the Project within public roadways for approximately 60 miles will not result in any measurable visual effects, let alone an unreasonable adverse effect on aesthetics.

Q. Please describe the roads-based analysis in the DEIS VIA and any conclusions that can be drawn about the analysis.

A. The roads-based analysis considered the number of road crossings in the Project area, vehicle exposure on scenic roads, and the visual magnitude of the Project. The analysis utilized the digital terrain model (DTM) and digital surface model (DSM) elevation data within 1.5 miles of the Project and determined the number of roads crossed by the Project corridor for the overhead transmission line.

The vehicle exposure on scenic roads estimates the number of hours that vehicles will travel through areas on state- or nationally-designated scenic roads with visibility of the transmission structures. The analysis considers the visibility from roads within 1.5 miles on either side of the Project while driving at a nominal speed based on the road's functional classification.

While the roads-based analysis looked 1.5 miles on either side of the road, it also took into account transmission structures that would be 10 miles ahead or behind the motorist. As discussed above, expanding the analysis out to 10 miles is over-inclusive; while the Project may be theoretically visible at that distance, it is unlikely that any of the structures analyzed would be recognizable as individual objects by the average motorist at distances greater than 3 miles. DEIS VIA, p. 29.

The visual exposure of the Project was determined by examining where transmission structures may be visible along a road, the amount of time any portion of the Project would be visible on the road, and the annual average daily traffic along that portion of the road. This approach, however, has two flaws. *First*, the analysis includes nighttime hours when the Project would not be visible. *Second*, the analysis does not consider the directionality of the views, namely, that the visual exposure may only be felt by traffic heading in one direction.

The roads-based analysis also considered the visual magnitude of the Project, which is an index of visibility that takes into account the number of structures visible from a particular viewpoint and the distance to the structures. This approach also has several flaws. *First*, the evaluation does not take into consideration how much of a structure would be visible. The analysis counts a structure as being visible if only the top point appears above the surrounding vegetation. However, unless a structure exhibits a certain amount of contrast in color or form, the very top of the structure would generally not be visible; using this approach over counts the visible structures. *Second*, the road-based analysis does not account for the experience of driving a scenic byway, where the relationship between the observer and the foreground and middle ground of the Project is constantly changing, especially in a wooded landscape. Driving in a vehicle is a much different experience than looking at or from a fixed point in the landscape. *Third*, the analysis is not able to account for the presence of roadside vegetation, which will vary considerably in its opacity and the degree that it will screen views.

While the DEIS VIA provides specific numerical values regarding the visual impact of the Project on roads, it only includes limited data to review for the purpose of determining where and to what extent the Project would be visible to passing motorists.

In both the Northern and Southern Sections, the DEIS VIA concluded that there would be an increase in the number of hours per day that the Project would be seen from the roads. In the Northern Section, the DEIS VIA concluded that the visual magnitude of the Project would remain at its current "Low to Moderate level."

In the Southern Section, the DEIS concluded that the visual magnitude would increase from "Low to Moderate" to "Moderate to High," based upon a faulty numerical rating system. As described above, this analysis over-states the visibility and the impact of the project. While the Project would be visible from 8 miles of additional roads, it would not cross any additional scenic roads. The Project would only have 0.1 mile of increased visibility on scenic roads.

Q. What conclusions can be drawn from the key observation points analyzed in the DEIS VIA?

A. The DEIS VIA selected 15 key observation points (KOPs) as representative of the potential impacts that will occur if the Project is constructed. However, nine of the 15 KOPs, or 60%, are no longer representative of the potential impacts due to the amended Project route.

These nine KOPs will not see any adverse visual impacts because of the additional underground segments through the central section of the Project and through the White Mountain National Forest. Any visual impacts associated with these nine KOPs should not be considered.

For the six remaining KOPs, at least two points selected by the DEIS VIA should not be given great weight because they are not located at or near scenic resources. First, the Loudon Road KOP in Concord is an urban shopping center on a major arterial highway adjacent to a 245-foot transmission corridor, and not a scenic resource or an inherently scenic location. In fact, the DEIS VIA states that this KOP is of “low quality, without any special scenery interest or intrinsic character.” DEIS VIA, p. 110. The surrounding environment is auto-oriented and commercial. Therefore, this area is not a location that would be considered sensitive to a visual change. The photosimulation for the Loudon Road KOP also contains technical inaccuracies regarding the proposed transmission line. The DEIS VIA analysis assumed that lattice structures would be used to support the Northern Pass line; however, the present design calls for the use of weathering steel monopole structures in this location, which have less contrast in form.

Second, the Nottingham Road KOP in Deerfield is not in an area considered to be highly sensitive to scenic impact. To a motorist traveling along Nottingham Road, which is not a scenic byway, the view of Project would be relatively brief.

The photosimulation of the Route 145 KOP in Clarksville depicts a transition station where the above-ground section would start its underground route. However, the DEIS VIA does not account for the fact that the photograph used for this analysis was taken from a stationary position through a gap in the roadside vegetation and does not describe the experience of driving on the highway. The existing foreground vegetation consists of scattered to dense successional growth that does not afford an open view of the transition station. The vegetation can reasonably be expected to grow over the next decade and increase the screening in this area. Any potential visual impacts to motorists in this area from the transition station will be minimal.

The photosimulation for the Little Dummer Pond KOP appears to overstate the visibility of the new transmission corridor. The DEIS VIA does not fully consider factors that should be analyzed when determining the sensitivity of Little Dummer Pond, such as the nature of the surrounding commercial forest land, the presence of several wind turbines visible on the horizon from the pond, the character of the access road used to reach the pond the generator lead line that parallels the road, and the lack of public facilities. The DEIS VIA also used a transmission corridor width of 140 feet, which is 20 feet wider than the cleared width being proposed. The photosimulation also does not seem to depict the additional growth that will occur over the next decade and the corridor screening that would be provided.

The photosimulation for the Weeks State Park KOP contains technical inaccuracies regarding the proposed transmission line. The DEIS VIA analysis assumed that lattice structures would be used to support the Project line; however, the present design calls for the use of weathering steel monopole structures in this location, which have significantly less color contrast. The analysis also appears to overstate the visibility of the new transmission line by counting as potentially visible structures that are either partially or barely visible due to vegetative screening, topography, or the effect of distance.

The photosimulation for the Turtle Pond KOP analysis is typical of most of the analyses, in that it only shows a small portion of the landscape and does not give enough information to understand the context of the transmission line. The Turtle Pond analysis also contains technical inaccuracies regarding the proposed line. The DEIS VIA narrative states that lattice structures would be installed between the two 115-kv lines, when in reality, the Project is proposing to use weathering steel H-frame structures in this location. Therefore, the conclusory statements relating to this KOP are based on incorrect information.

Conclusions

Q. What conclusions can be drawn about the visual impact of the Project?

A. Northern Pass will not result in unreasonable adverse effects on aesthetics to either the six subareas that we identified or to the approximately 900 square-mile Project Study Area as a whole. In some locations, the Northern Pass transmission line will be a highly visible component of the landscape, in a manner similar to many of the other transmission lines that now cross the state. However, the presence of the proposed transmission line, in the subareas and its entirety, will not create an unreasonable adverse effect on aesthetics.

We inventoried approximately 525 scenic resources within three miles of the Project. Of these, we determined that approximately 14% of the resources with at least a medium scenic significance rating may have views of the Project, based upon viewshed mapping and other computer-based visibility analyses. We visited and analyzed each of these resources, using a methodology that is consistent with generally accepted professional standards for determining visual impacts. None of the overall visual impacts to scenic resources that we observed were characterized as 'high', based upon that methodology.

Many mitigation measures have been incorporated into the planning and design of the Project. These include locating a significant portion of the line underground, primarily within public road rights-of-way; co-locating the line within existing transmission corridors that will accommodate the Northern Pass line without requiring additional land; using weathering steel monopoles and H-frame structures in areas of heightened scenic sensitivity; matching the materials used for the structures within the corridor; and aligning new structures with existing structures. These will all be effective in reducing or eliminating possible visual impacts on scenic resources within the Project Study Area, to the extent that the Project as originally designed may have caused adverse visual effects. In the White Mountain National Forest, the decision to install the vast majority of the transmission line underground within public road rights-of-way means there will be no visual impacts to one of New Hampshire's most cherished landscapes.

While the transmission line will be visible in varying degrees from many scenic resources throughout the Project Study Area, it is our opinion that the presence of the Project components will not offend the sensibilities of a reasonable person who will have visual contact with it. The Project as a whole will not be a dominant feature in the landscape. The views from most of the scenic resources already contain evidence of existing human development, often prominently visible from the key observation points. Where the transmission corridor is visible from scenic resources, the effect is generally observed within a relatively small part of the overall resource.

The presence of the transmission structures, conductors, cleared corridor, converter terminal, substations, transition stations, and other Project components within the viewshed of the scenic resources along the Project corridor will not have a noticeable effect on the public's continued use and enjoyment of the scenic resources. There is no basis to conclude that people will not continue to drive the scenic byways, visit the parks, swim at the beaches, canoe and kayak the rivers, fish in the lakes, and hike the trails—in a manner that they have for decades—due to the presence of the Project. Human development, including large-scale buildings and other structures, is a fact of life in our organized society. People come to New Hampshire to enjoy its intrinsic scenic qualities, and there is nothing that will be atypical about the type of visual impact the Project will have. Consequently, based on the totality of our analysis, it is our opinion that Northern Pass will not have an unreasonable adverse effect on aesthetics.

Q. Does this conclude your testimony?

A. Yes, this concludes our testimony.

TERRENCE J. DEWAN, FASLA
Principal

Terry DeWan has over 40 years of professional experience in landscape architecture, visual resource assessment, site planning, design guidelines, community development. His experience includes work with communities, state agencies, private developers, utility companies, and the forest products industry in New England. He has written numerous studies on community planning, visual impacts, recreation planning, water access, and highway corridor redevelopment.

Maine Licensed Landscape Architect #6

EDUCATION

State University of New York, School of Environmental Sciences and Forestry, cum laude

VISTA Training, University of Colorado

Visual Assessment Procedures, University of Southern Maine

PROFESSIONAL EMPLOYMENT

1988-Present	Terrence J. DeWan & Associates Yarmouth, ME Principal
1977-1988	Mitchell-DeWan Associates Portland, ME Partner
1976-1977	Center for Natural Areas South Gardiner, Maine Landscape Architect
1973-1976	Moriece and Gary of Maine Portland, ME Landscape Architect
1971-1973	The Architects Workshop Philadelphia, PA VISTA/Landscape Architect
1969-1970	Rocky Mountain Development Council, Helena, Montana VISTA Volunteer
1968-1969	Peter G. Rolland and Associates, Rye, NY

PROFESSIONAL AFFILIATIONS

Maine State Board for Licensure of Architects, Landscape Architects and Interior Designers
American Society of Landscape Architects
Boston Society of Landscape Architects
American Planning Association
Maine Association of Planners
Council of Landscape Architects Registration Boards: Board of Directors
Landscape Architecture Accreditation Board: Roster of Volunteer Evaluators
Royal River Conservation Trust Board Member.

SELECTED PROJECT EXPERIENCE

VISUAL IMPACT ASSESSMENT
SCENIC INVENTORIES

Bull Hill and Hancock Wind Projects, Blue Sky East LLC, Hancock County, ME. Visual Impact Assessment (VIA) for adjacent wind projects with total of 37 turbines.

Spruce Mountain Wind Project, Patriot Renewables, Woodstock, ME.
VIA for 11 turbine wind project.

Saddleback Mountain Wind Project, Patriot Renewables, Carthage, ME. VIA for 12 turbine wind project.

Maine Power Reliability Program. VIA for 352 miles of new 115 kV and 345 kV transmission line corridor system upgrades in 82 Maine towns, for Central Maine Power.

Stetson I & II Wind Project, Evergreen Wind V, LLC, Washington County, ME. VIA for a 38 turbine wind project.

Pinnacle Wind Project and Liberty Gap Wind Project, West Virginia. Visual reports in support of state permitting applications for US Wind Force, LLC.

Maine Governor's Task Force on Wind Power Development. Consultant to Task Force on scenic issues.

Maine DEP / Visual Assessment Rules. Consultant to DEP in the formulation of Chapter 315 Regulations: Assessing and Mitigating Impacts to Existing Scenic and Aesthetic Uses. Served on DEP Task Force for the development of the rules.

Hudson Landing, Kingston, NY
A review of the VIA and Development Guidelines for a 1,750-unit community on the Hudson River. Hudson River Heritage.

St. Lawrence Cement, Hudson, NY
Evaluation of visual impacts of proposed cement plan in a historic Hudson Valley community for Scenic Hudson.

Downeast LNG, Robbinston, ME. VIA for LNG terminal submitted to Maine DEP for Downeast LNG, Inc.

Bath Iron Works, Land Level Transfer Facility, Bath, Maine. VIA and mitigation plan for BIW's $250M modernization plan.

Bangor Hydro-Electric. 345 kV Transmission line from Orrington, ME to New Brunswick

New England Wind Energy Station, Boundary Mountains of Western Maine. Kenetech Windpower, Livermore, California.

AES-Harriman Cove Co-generation Project, Bucksport, Maine. Visual assessment of a coal-fired power plant on Penobscot River.

Route 27 Scenic Byway Corridor Management Plan. MDOT. Long-term plan for Route 27 between Kingfield and Canada.

PEER REVIEWS

Calais LNG, Calais, ME. Peer review of VIA. Prepared visual assessment of potential impact on St Croix Island International Historic Site.

Argonne National Laboratory. Peer reviews: *Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands* and *NPS Visual Impact Assessment Guidance Document.*

Cape Wind Energy Project, Nantucket Sound, MA. Peer review of DEIS prepared by Minerals Management Service.

SELECTED PUBLICATIONS

Scenic Assessment Handbook. Maine State Planning Office. 2008.

Royal River Corridor Study. Town of Yarmouth, Maine. With Stantec. 2008.

A Vision for the Moosehead Lake Region. Natural Resources Council of Maine. 2006.

The Great American Neighborhood, A Guide to Livable Design. ME SPO. 2004.

Scenic Inventory, Mainland Sites of Penobscot Bay. ME SPO. 1990.

SELECTED PRESENTATIONS

The Maine Wind Energy Act, Visual Assessment Procedures for Grid Scale Wind Projects, National Assoc. of Environmental Professional Meeting, Portland, OR 2012

Social Acceptance of Wind Energy- Addressing Visual Impact in Skeptical Communities. ASLA Annual Meeting San Diego, CA. 2011.

Scenic Inventory Training. Maine State Planning Office. 2009.

AWARDS AND DISTINCTIONS

ASLA: Election to Council of Fellows

ASLA Merit Award for Communications
Los Angeles River Project
Chattahoochee River Greenway, Atlanta

Council of Landscape Architects Registration Boards. Presidents Awards

Boston Society of Landscape Architects
Excellence Award for outstanding professional practitioner
Merit Award for Planning: 'From the River to the Bay' A Parks, Recreation, and Open Space Plan for Brunswick, Maine

North American / United Kingdom Stewardship Exchange, Exmoor NP, North Devon, England

Maine Association of Planners Awards
A Guide to Livable Design
Spring Point Shoreway
TV Mini-Series for Planning Boards
Portland Waterfront Walk
Portland Shoreway Access Plan
Falmouth Route One Plan
Scenic Inventory of Penobscot Bay
Brunswick Revitalization Plan

American Planning Association, NNE Chapter: Outstanding project of the year award
Kancamagus Scenic Byway Facilities and Interpretive Plan (with White Mountain National Forest).
Knightville-Mill Creek Vision Plan, South Portland
A Guide to Livable Design

tjd&a

JESSICA WAGNER KIMBALL

Planner / Landscape Designer

Jessica has experience in both community planning, landscape architectural design, and visual impact assessments. Her experience includes visualization studies, master planning, design guideline development, recreational trail planning, and construction detailing.

Jessica is proficient with AutoCAD, Adobe Creative Suite, Google Earth Pro, SketchUp, Rhino, WindPro, Arc GIS, and all Microsoft applications.

EDUCATION

2007 Bachelor of Community Design
Dalhousie University

2013 Master of Landscape Architecture
University of Toronto

PROFESSIONAL EMPLOYMENT

2014-Present TJD&A
Yarmouth, ME
Landscape Designer & Planner

2013-2014 Sasaki Associates, Inc.
Watertown, MA
Landscape Designer

2007-2010 Town of Old Orchard Beach
Old Orchard Beach, ME
Assistant Town Planner

2007-2010 Member of Eastern Trail Management District
2009-2010 Vice-President

Spring 2007 Ekistics Planning and Design
Dartmouth, Nova Scotia
Planning Intern

SELECTED PROJECT EXPERIENCE

Argonaut Talc Mine, Ludlow, VT
Visual Impact Assessment of quarry development. Developed 3-D build out scenarios in Sketchup and graphically represented in photosimulations. (TJD&A)

Northern Pass Transmission Project, NH
Visual Impact Assessment for a 192-mile transmission line from Pittsburg NH to Deerfield NH. (TJD&A)

UT Austin Landscape Master Plan, Austin, TX
Landscape Master Plan and Design Guidelines for the University at Austin Campus. (Sasaki Associates

CenterPoint Landscape Plan, Waltham, MA
Landscape design and construction documentation for former mill buildings and suburban office park. (Sasaki Associates)

Parks and Recreation Master Plan, Bloomfield, CT. Inventory, analysis and recommendations for municipal park system. (Sasaki Associates)

55 Fore Street, Portland, ME
Master plan for proposed mixed-use waterfront community. (Sasaki Associates)

AWARDS AND EXHIBITIONS

2013 *Waterfront Visions 2050*
Masters thesis on sea level rise adaptation exhibit at Portland Society for Architecture Symposium, Portland, ME

2013 American Society of Landscape Architects Merit Award

2012 Site models published in work: Amoroso, Nadia ed. *Representing Landscapes: A Visual Collection of Landscape Architectural Drawings*. New York: Routledge, 2012

2007 Canadian Institute of Planners Award for Academic Excellence

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF VICTORIA BUNKER, Ph.D.

**IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW
HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN
NEW HAMPSHIRE**

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name and business address.

A. My name is Victoria Bunker, Ph.D. My business address is 31 Africa Road, Alton, New Hampshire 03809, with a mailing address of P.O. Box 16, New Durham, New Hampshire 03855.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to provide the Committee with my assessment of the potential effects of the Northern Pass Transmission Project ("Northern Pass" or the "Project") on archeological resources and to offer my opinion that the Project will not have an unreasonable adverse effect on such resources.

Q. Please describe your background and qualifications.

A. I am the owner and principle investigator at Victoria Bunker, Inc. archeological consultants. The company is registered as a business in good standing with the NH Secretary of State. I meet and exceed the 36 C.F.R. § 61 qualifications as an archeologist, with degrees in Anthropology and related fields (Boston University, PhD, Anthropology, 1983). I have over 35 years of professional experience in New England archeology, successfully completing projects in New Hampshire, Maine, Vermont, Massachusetts and Rhode Island. As a professional archeologist, I have conducted Pre-Contact and Post-Contact research, survey, excavation, data analysis, documentation, report writing, report publication, and project management. I am listed as qualified to conduct archeological survey in New Hampshire by the NH Division of Historical Resources (DHR).

I have demonstrated the ability to complete phased archeological surveys throughout the State of New Hampshire in a wide variety of terrain, in all regions of the State and have developed strong working relationships with state and federal agencies, municipalities and individuals. I have completed approximately 750 projects relative to Section 106 compliance at Phase I, II and III level of study as a consultant for agencies, institutions, municipalities, companies and individuals.

I have also served on boards and committees including: New Hampshire Archeological Society, President Emerita, Board of Directors, Editor; Man in the Northeast, Editorial Board; Conference on New England Archeology, Executive Board; NH Rivers Advisory Council, Governor-Appointed Representative for Archeological Resources per nominations for river protection programs.

Of particular relevance to Northern Pass is prior experience along linear corridors such as water and sewer lines (covering approximately 40 NH towns), natural gas pipelines (5 multi-town projects, with individual projects up to 75 miles in length), highway corridors (20 multi-town projects, with individual projects up to 50 miles in length). Over the past 5 years, I have completed over 35 surveys for power line corridors and substations throughout the state. Other relevant experience includes broad, regional research surveys in the Lamprey, Merrimack, Pemigewasset and Mad River Valleys and throughout the White Mountain National Forest.

A copy of my résumé is attached as Attachment A.

Q. Have you previously testified before the New Hampshire Site Evaluation Committee?

A. No.

Q. Are you familiar with the Project that is the subject of this Application?

A. Yes. My staff and I have been working on the Project since 2010. I have been provided with information regarding the Northern Pass route and I have walked over half of it personally. My staff and I collectively have walked its entire length. My staff and I conducted research and field surveying for the proposed Project, synthesized data and prepared reports. I have also communicated regularly with DHR and I have engaged in the Section 106 of the National Historic Preservation Act consultation process with DHR and federal agencies.

Q. Has a study been done on the identification of archeological resources along the Project route and the potential effects that the Project will have on them?

A. Yes; in fact, more than a single study. My team at Victoria Bunker, Inc. and I have done substantial resource identification in our Phase I-A and Phase I-B surveys. In addition, the consultant (SEARCH) working on behalf of the US Department of Energy (DOE) (has also completed a Phase I-A study for the entire route. The Phase I-A and Phase I-B methodologies were approved by NHDHR and the DOE.

Q. What additional assistance did you have in doing your work?

A. The entire staff of Victoria Bunker Inc. assisted in completion of tasks associated with the archeological study. Senior archeologists with qualifications exceeding the 36 C.F.R requirements completed background documentary research and report writing. Among these individuals were two historic sites archeologists. Other team members included a graphics artist for drafting, photography, and report production as well as experienced field supervisors, assistants and crew for walkover survey, shovel test excavation, artifact processing and data compilation. Two of these individuals have extensive experience in northern New Hampshire's uplands and mountainous terrain. I supervised all of these individuals.

Q. Please describe your Phase I-A surveys.

A. The Phase I-A level of survey has identified any known archeological resources and provided an initial broad identification of any likely archeological resources within the overall project area. (This is known as the "Area of Potential Effect" or "APE", as determined by DOE. For this Project the APE has been established by DOE, the lead federal agency, as the extent of the transmission corridor for the above ground segments and generally 20' from the edge of pavement[1] on either side of the public roads where the underground segments will be located). In addition, the Phase I-A survey has provided information on the location of any cemeteries or graveyards within the APE. My staff and I have conducted research and field survey for proposed Project components, synthesized data to prepare reports addressing known archeological sites and areas of archeological sensitivity, prepared DHR site recording forms for sites recognized within the APE during Phase I-A field inspections, and engaged in the Section 106 consultation process with the DHR and DOE.

Q. How did you conduct the Phase I-A studies?

A. Following the DHR-approved approach, we first completed background documentary research using primary and secondary documents (including historic maps, topographic maps, soils maps, town histories, archeological publications, State and National Register listings, Old Graveyards of NH data base, DHR state-wide site files, DHR archeological research files, DHR town files, DHR Review & Compliance files) to develop cultural and environmental contexts, provide information on known resources, and generate expectations for resource occurrence.

Second, a pedestrian survey was conducted for the APE to: confirm the location of any previously recorded sites or cemeteries; collect data on any newly identified sites; define any

[1] For unpaved roads we considered the APE to be appropriately 20' from the edge of the road grade.

zones of sensitivity for either pre-contact Native American or post-contact European-American sites based on landscape qualities or elements visible on the ground surface; and define areas which lacked archeological sensitivity due to terrain (e.g., steep, rocky, ledge, poor drainage, wetlands, standing water), prior impact (e.g., erosion, flooding, soil modifications, cutting, grading, commercial or industrial development, subsurface infrastructure); and, record observations in field notes, in sketches, on project aerials and through representative field photographs.

Third, all field and research data were compiled, site recording forms were completed for newly-discovered sites and submitted to DHR for site recording numbers, reports were prepared with background contexts, expectations for resource occurrence, field results, supporting data (including topographic maps, soils maps, historic maps, field photos of areas with sites or archeological sensitivity, field photos of areas lacking sensitivity, aerials, and site recording forms), and recommendations for continued Phase I-B archeological investigations at sites or sensitive locations recognized during Phase I-A survey.

The Phase I-A survey work we have completed follows the overall approach for the phases of archeological survey as set forth in the *NH Division of Historical Resources Standards and Guidelines (September 2003, Revised May 2004).*[2]

Q. Please describe your Phase I-B archeological review.

A. The Phase I-B effort provided confirmation of archeological site presence or absence within areas exhibiting archeological resource sensitivity for both pre-contact Native American and post-contact European-American resources. Phase I-B survey work has also provided additional data on subsurface conditions and artifact occurrence at sites that were visually defined during Phase I-A work (for example, cellar hole sites).

Q. How did you perform the Phase I-B surveys?

A. Following DHR-approved methodology, visual confirmation was first accomplished in individual sensitivity areas through walkover survey, to document the position of such features as wetlands, bedrock or areas of prior impact where sampling was not conducted. For locations of post-contact European- American resource sensitivity, field crew systematically and intensively walked the APE at five meter interval spacing to recognize the

[2] These guidelines are established expressly only for NH DOT projects.

occurrence of any visible features or components (e.g., footings, wells, trash deposits, fence lines, walls and renegade domestic vegetation including ornamental garden plants, barberry, hops, lilac, grapes or fruit trees).

Second, where post-contact European-American components were present recording efforts included scaled sketch mapping and photography of visible remains.

Third, a shovel test sampling protocol, developed in consultation with and approved by DHR was implemented to address specific cultural features (such as cellar holes, stone walls and alignments) or landscape features (such as margins of streams, ponds or wetlands, terrace edges, knolls, high uplands, ledge or boulder exposures considered attractive to humans in the past). This effort consisted of sampling at 8 m intervals along multiple transects or grids, accompanied by judgmental test placement as needed. All shovel tests measured 50 x 50 cm square and were hand-excavated by shovel and trowel. Soils were screened through one-quarter inch mesh. When artifacts were found in test pits, additional bracketing tests were placed at two meter and four meter intervals at the ends or edges of find locations. This allowed a first-cut understanding of site extent within the corridor and aided in distinguishing isolated or stray finds from larger sites. For all subsurface excavation, notations were made on soil texture and color, utilizing a Munsell Soil Color Chart. Tests were backfilled upon completion and all flagging was removed. Field effort included drafting of scaled plans depicting test locations as well as natural and cultural features. When sites were recorded, shovel test data was superimposed as an overlay layer on project aerials. Representative photographs were taken in the field at all sampling locations and photographs were taken of artifacts discovered at sites. Sampling conducted within the ROW corridor covered the entire corridor width which was considered as the APE for the Project.

Fourth, all field and research data were compiled, site recording forms were revised for previously recorded sites and site forms were completed for newly-discovered sites and submitted to DHR for site recording numbers, artifacts were cleaned, identified, inventoried and prepared for curation, and reports were prepared with detailed discussion of field results and archeological resources. All reports were accompanied by supporting data (including topographic maps, soils maps, historic maps, field photos of areas where sites were encountered, field photos of areas where sites were not encountered, aerials, and site recording forms), and recommendations for continued Phase II archeological investigations at sites where impact cannot be avoided.

The Phase I-B survey work we have completed follows the overall approach for the phases of archeological survey as set forth in the *NH Division of Historical Resources Standards and Guidelines* (*September 2003, Revised May 2004*).[3]

Q. What reports have you prepared?.

A. We have completed Phase I-A and I-B survey reports as follows:

- *Results of Phase I-A Archeological Survey -- Existing ROW Corridor and Franklin Converter Terminal (2013)* (Approved by DHR 6-13-13) (Appendix 19);
- *Results of Phase I-A Archeological Survey -- Proposed Northern Route, Northumberland, Stark, Dummer, Millsfield, Dixville, Stewartstown, Clarksville and Pittsburg, Coos County, NH* (*2013*) (Approved by DHR 12-3-13) (Appendix 20);
- *Results of Phase I-A Archeological Survey -- AC System Transmission Line Upgrades (PSNH 373 Line) Deerfield, Candia, Raymond, Chester, Auburn, Derry and Londonderry, NH* (*2014*) (Approved by DHR 6-5-14) (Appendix 21);
- *Results of Phase I-A and Phase I-B Archeological Survey -- Proposed Expansion of Deerfield Substation Proposed Expansion of Scobie Pond Substation And AC System Transmission Line Upgrades (PSNH 373 Line) Deerfield, Candia, Raymond, Chester, Auburn, Derry and Londonderry, NH (2014)* (Appendix 22);
- *Results of Phase I-A Archeological Survey -- Northern Underground Route, Stewartstown and Clarksville, Coos County, NH* (*2015*) (Appendix 23);
- *Results of Phase I-A and Phase I-B Archeological Survey Transition Stations and Connecting Routes Stewartstown, Clarksville and Pittsburg, NH (2015)* (Appendix 24);
- *Results of Phase I-A Archeological Survey Off Right-of-Way Access Roads Clarksville, Dixville, Dixs Grant, Dummer, Errol, Franklin, Millsfield, New Hampton, Stark, Stewartstown, Pittsburg and Wentworths Location, NH (2015)* (Appendix 25);

[3] These guidelines are established expressly only for NH DOT projects.

- *Results of Phase I-A Archeological Survey -- Underground Route US Route 3 Bridgewater, Plymouth, Campton, Thornton, and Woodstock NH Route 112 Woodstock and Easton, NH Route 116 Easton and Franconia, NH Route 18 Franconia, Sugar Hill and Bethlehem, and US Route 302 Bethlehem, NH (2015)* (Appendix 26);
- *Results of Phase I-A and Phase I-B Archeological Survey Bridgewater and Bethlehem Transition Stations (2015)* (Appendix 27);
- *Results of Phase I-A Archeological Survey Off Right-of-Way Lay Down Areas Millsfield and Clarksville, NH (2015)* (Appendix 28);
- *Results of Phase I-B Archeological Survey Existing ROW Corridor Deerfield, Allenstown, Pembroke, Concord and Canterbury, NH (2014)* (Approved by DHR 7-8-14) (Appendix 29); and
- *Results of Phase I-B Archeological Survey -- Northern Route Stark, Millsfield, Dixville, Stewartstown and Pittsburg, NH (2015*) (Appendix 30).

Additional Phase I-A if and as needed and Phase I-B survey work will be completed as part of the Section 106 process.

Q. Have you reviewed other assessments of archeological resources that may be adversely affected by Northern Pass?

A. Yes.

Q. Please explain.

A. I have completed review of two reports and accompanying appendices prepared by the DOE Consultant (SEARCH). A DOE report submitted in 2014 presented results of Phase I-A archeological study for the existing 140-mile corridor between Deerfield and Northumberland and the +/- 50 miles of existing and proposed new overhead and underground ROW between Northumberland and Pittsburg, a series of proposed off ROW access roads in the northernmost project area as well as lay-down areas and transition stations. A DOE report submitted in 2015 presented results of Phase I-A archeological study for a series of proposed alternate routes. My team and I have correlated the DOE findings with our own Phase I-A findings. Through this effort we determined that there is substantial overlap between the sites/areas that were identified in the two sets of Phase I-A reports, but there are also areas that we identified that DOE did not identify, and *vice versa*. The sites/areas identified by SEARCH that did not coincide with VBI sites/areas will be reviewed in future Phase I-B survey work.

I have also reviewed the material on archeological resources in the DOE Draft Environmental Impact Statement.

Q. Have you coordinated with DHR?

A. Yes.

Q. Please describe how you have done so.

A. We have consulted extensively with DHR. We submitted for approval and subsequently obtained approval for the Phase I-A and Phase I-B methodology. Project personnel have met numerous times with DHR as part of Section 106 agency consultation. The Project submitted the DHR Request for Project Review form. During on-site survey work, we regularly submitted site recording forms and survey reports, followed by clarifications and responses to DHR questions. We also arranged field tours for DHR staff to confirm field methodology, and we have had discussions with DHR staff on artifact typology and materials.

Q. Please explain the results of your Phase I-A and I-B studies and the SEARCH Phase I-A study.

A. Taken together, the Phase I-A archeological surveys have resulted in identification of previously recorded/known archeological sites, newly discovered archeological sites, cemetery and graveyard locations, and zones exhibiting sensitivity for archeological resource occurrence. The subsequent Phase I-B archeological study completed to date has expanded upon and refined the Phase I-A results. The Phase I-B survey identified additional archeological sites and also eliminated many sensitivity areas through subsurface sampling and intensive surface inspection. Where subsurface sampling was negative, those areas were removed from the list of locations initially considered sensitive.

Q. Is there new information in the DEIS that has affected your review of archeological impacts?

A. No. I have read and reviewed the Cultural Resources Technical Report for the Draft Environmental Impact Statement prepared by Ecology and Environment, Inc., July 2015. The findings in this report are consistent with the results provided by the DOE independent consultant as presented in their 2014 and 2015 Phase I-A reports. As such, no new information has been introduced.

Q. What steps has Northern Pass taken to avoid and minimize impact?

A. The Project has taken and will continue to take substantial meaningful measures to avoid and minimize potential adverse effects. We shared the results of the Phase I-A and Phase I-B surveys with the design engineers, and I consulted with them on specific areas of potential effect. They reviewed and revised the design of the transmission line to reduce impact to archeological resources, and the Project's decision to place an additional 52 miles of the route underground in the already disturbed part of public roads substantially reduces potential adverse effects.

Other measures will also be implemented, such as buffering of cemeteries or graveyards to accommodate the potential for unmarked graves or funerary goods that may occur beyond fence lines. During construction, where appropriate, there will be on-site technical oversight by one or more cultural resources monitors. A series of best management practices for protection of resources will be followed. They may include training of construction personnel, use of barrier fencing, protective fill, or other protective measures. Information about the location of known archeological resources will be kept confidential. Construction drawings will, however, be marked with areas that construction crews should avoid in order to minimize impacts on archeological resources. The areas will be marked on the plans as either culturally or environmentally sensitive areas.

Also, Northern Pass will follow an "unanticipated finds" policy to address resources discovered during construction in areas where previous study failed to identify archeological deposits. Generally, this is accomplished through such efforts as monitoring, recovery or documentation.

Q. What steps will Northern Pass take to mitigate any unavoidable adverse effects on archeological resources?

A. Mitigation measures may range from "data recovery" to "preservation in place." According to the *NH DHR Standards and Guidelines*, Phase III Data Recovery is "a full-scale investigation of the portion of the site affected by the project." As such, this effort entails a series of steps including (1) development of a research design, (2) collection of detailed information on past environmental conditions and context, (3) completion of research, field investigations and analysis of features, strata, and artifacts pertinent to research questions, and (4) reporting on results and findings.

All mitigation measures will be developed in coordination with DOE and DHR. As mentioned above, we expect that a Programmatic Agreement and a Cultural Resources Management Plan will be developed that will set forth the measures that must be undertaken for mitigation of any adverse effects.

Q. Are the Project's potential effects on archeological resources also being reviewed under Section 106 of the National Historic Preservation Act?

A. Yes.

Q. What is the status of the Section 106 archeological review process?

A. In connection with DOE's oversight of the Section 106 process, the Project's active consultation with DHR on the archeological survey continues. DHR has approved both the Phase I-A and Phase I-B methodologies and has approved all archeological reports and site recording forms that were submitted prior to the SEC application filing date. That includes Phase I-A survey reports for the entire route (from me and my team, and from SEARCH), and Phase I-B for much of the route, including the nine development sites. Additional Phase I-A reports are being submitted with the SEC application.

Q. What are the next steps in the Section 106 review process?

A. The Section 106 process will provide the framework for further determination of effects and mitigation measures for resources within the APE. The process will entail site identification through a complete Phase I-B survey; assessment of site significance through any necessary Phase II survey work (e.g., defining qualities which would permit a site to be considered eligible to the National Register of Historic Places ("NRHP") under one or more criteria); and development of mitigation plans for significant sites. As such, any adverse effects on significant archeological resources will be mitigated.

In consultation with DHR and with approval from DOE, a data recovery plan (Phase III) will be developed for archeological resources that are considered eligible for inclusion on the NR and that cannot be avoided. For resources that would be directly and adversely affected by the

Project, a data recovery plan will be implemented with the consent of the underlying property owner. Any resources that are adjacent to an area of direct effect will remain *in situ*.

As requested by the DOE, it is expected that the federal agencies will consult with Northern Pass and other consulting parties about a Programmatic Agreement (PA). As part of the PA, I expect that a Cultural Resources Management Plan ("CRMP") will be required. This plan will establish the procedures to further identify the boundaries of the potentially eligible sites for areas within the APE and will describe the measures that will be taken to further avoid, minimize and mitigate potential adverse effects to such resources.

Q. In your opinion will this Project have an unreasonable adverse effect on archeological resources?

A. No. I believe that the Project will not have an unreasonable adverse effect on archeological resources. My opinion is based on (1) the results of my archeological survey work for the Project, (2) my decades of experience in the field of archeology in New Hampshire, (3) my knowledge of how Northern Pass will address potential effects through avoidance, minimization, and mitigation of impacts, (4) DOE's and DHR's continuing vigorous oversight role, (5) and my prior experience with the Section 106 and DHR review process.

In general, my opinion is based on the findings from archeological surveys completed to date, the anticipated results of archeological survey to be completed, and confidence that the Section 106 process will be completed properly. In particular, my opinion is based on the following:

- Phase I-A survey has been extensive, with two separate surveys completed for the entire project -- one conducted by my team and me, and one conducted by the contractor working on behalf of the DOE. Combined, these two reports have identified all areas of archeological sensitivity within the Area of Potential Effect (APE) for the Project. These efforts inform us that approximately 20% of the project area is considered sensitive for archeological resources and the other approximately 80% of the route does not exhibit the potential for archeological site occurrence. Further, for much of the area initially deemed sensitive, we learned that no archeological resources are present.
- The underground route will have minimal effect on archeological resources, as resources are not present within much of the APE. In particular, resources are believed to be

absent below the traveled way of the public roads, with the exception of several cemetery locations and/or cemetery buffer zones. In addition, substantial zones of prior impact have been identified within the underground route.

- Phase I-A survey work has also defined the occurrence of cemeteries, graveyards and potential locations for graveyards that are no longer visible on the ground surface. Adherence to a 25-foot buffer as required by law will prevent any effect to these resources.

- Phase I-A survey work also indicates that no archeological sites within the Project have already been listed or determined to be eligible for listing to the National Register of Historic Places. Therefore, there will be no effect to previously recognized NRHP-eligible archeological sites.

- My team and I have also completed extensive Phase I-B survey work involving excavation of shovel test pits, site recording and resource mapping following a DHR-approved protocol for areas of archeological resource potential within the APE Elsewhere, in areas initially recognized as archeologically sensitive, there will be no effect on resources because resources were found to be absent. This is consistent with my prior experience on numerous other New Hampshire projects.

- Phase I-B archeological efforts will continue for the Project. Results will inform us to what extent resource avoidance is possible Phase II archeological survey is recommended only for those archeological sites where impact could not be avoided by project design. As such, continued investigations will be conducted in consultation with DHR and DOE to determine whether a site exhibits qualities that would allow it to be considered as eligible to the NHRP under one or more criteria. Based on my prior experience, I estimate that no more than a handful of sites will exhibit qualities making them eligible for the NRHP.

- Mitigation will be required and done for any unavoidable impacts at any sites considered eligible for listing on the NRHP. In general, archeological sites are often assigned significance under Criterion D for their ability to yield important information. For these sites, procedures will be identified in the CRMP on measures to be taken, such as preparation of a data recovery plan involving additional field inspection and research. All efforts will be completed to the satisfaction of DOE and DHR.

- The Programmatic Agreement will require that a CRMP be implemented to include procedures for addressing the unanticipated discovery of archeological resources that are potentially eligible for listing on the NRHP. I anticipate that, among other things, those procedures will include a halt in construction work in the immediate area of the find with sufficient time allotment for the appropriate archeological resource personnel to make a determination with respect to further appropriate actions to be taken. Construction crews will receive training regarding the protection of known archeological resources and the steps to be taken in the event of unanticipated discoveries of such resources during construction. I have full confidence that the oversight responsibility of the DOE, in consultation with DHR, will address any potential impact concerns. Adverse effects will be minimized to the extent practicable and to the satisfaction of DOE and DHR.
- As is customary in SEC proceedings, I recommend that, as a condition of any approval of the Project, the SEC require Northern Pass to continue to consult with DHR with respect to effects on archeological resources, to comply with the PA and the CRMP, as well as any agreements and memoranda of understanding with DHR, and to report to the SEC and DHR any new information or evidence about archeological resources in the project area. Based on prior precedent, I also recommend that the SEC delegate to DHR monitoring and compliance authority with respect to historic and cultural resources. These expected conditions provide an additional level of assurance that Northern Pass will fully execute any and all requirements imposed on it with respect to the identification, avoidance and minimization, and mitigation of impacts on such resources.

Q. Does this conclude your pre-filed testimony?

A. Yes.

ATTACHMENT A

VICTORIA BUNKER, PHD

Victoria Bunker, Inc.
Archeological Consultant
PO Box 16
New Durham, NH 03855

603-776-4306

vbi_wp@tds.net

Victoria Bunker, Ph.D.
P.O. Box 16, New Durham, NH 03855♦603-776-4306♦vbi_wp@tds.net

RESUME

PROFESSIONAL EXPERIENCE

1981-present	Victoria Bunker, Inc., Cultural Resources Management. Owner and Principal Archeologist for woman-owned business to conduct cultural resource reviews and impact evaluations for archeological resources.
1982-1986	Archeologist, NH Historical Society. Director of research for state-wide survey and planning, volunteer training, public education, workshops and lectures.

EDUCATION

1983	Doctor of Philosophy, Boston University
1977-80	Center for Materials Research in Archeology and Ethnology: Massachusetts Institute of Technology
1976	Master of Arts, Tufts University
1974	Bachelor of Arts, University of New Hampshire

RECENT PUBLICATIONS

2011	Water-Powered Mills, Dams and Canal Sites in Wakefield, New Hampshire. The New Hampshire Archeologist 51(1). With Charles and Howe.
2010	Reflections on a Graveyard. The New Hampshire Archeologist 50(1):57-74.
2009	The Bomber Crash of 1942. The New Hampshire Archeologist 49 (1).
2006	Time and Place: The Archeology of the Eddy Site. The New Hampshire Archeologist 46-47(1).
2002	Hornfels Tool-Making Industry in Freedom, NH. The New Hampshire Archeologist 42(1).
2002	Analysis and Interpretation of Early Ceramics from Sewalls and Amoskeag Falls, Merrimack River Valley, New Hampshire. In A Lasting Impression. Greenwood Publishing Company.

1999	Early Occupation in the Far Upper Connecticut River Valley. The New Hampshire Archeologist 39(1):70-81 (with Potter).
1998	Rescue Archeology at the Lodge Site, NH 31-6-6. The New Hampshire Archeologist 38(1):1-33 (with Gengras).
1996	The Place Between: Archeology at the Mine Falls Park Site, Nashua, New Hampshire. The New Hampshire Archeologist 36(1): 38-64 (with Potter).
1994	New Hampshire's Prehistoric Settlement and Culture Chronology. The New Hampshire Archeologist 33/34(1): 20-28.
1992	Stratified Component of the Gulf of Maine Archaic Tradition at the Eddy Site, Amoskeag Falls. Occasional Publications in Maine Archeology 9:135-148.
	New Hampshire Archeological Society President Emeritus, Board of Directors, Past Editor, Numerous publications and presentations.

Victoria Bunker, PhD
Professional Profile

Victoria Bunker, PhD, is the Principal Investigator on all projects undertaken by Victoria Bunker, Inc. Responsibilities include administration, scheduling, development of research and field methodology, and technical writing. Victoria Bunker is responsible for assessing significance of results, insuring ethical conduct, and meeting standards.

Victoria Bunker has worked in New England archeology since 1977. She received her doctoral degree in Anthropology at Boston University, has held teaching positions at several New England institutions, and has been active in volunteer and avocational archeological programs. She contributes to journals and has served as both Editor and President for the New Hampshire Archeological Society. She has also served two terms on the governor's New Hampshire Rivers Management Advisory Committee, representing historic interests in developing protection plans for New Hampshire rivers.

Victoria Bunker, PhD, offers expertise in pre-contact Native American archeology.

Victoria Bunker, Ph.D.
P.O. Box 16, New Durham, NH 03855♦603-776-4306♦vbi_wp@tds.net

Victoria Bunker, Inc.
Company Description and Philosophy

Victoria Bunker, Inc. is a woman-owned business specializing in New England archeology and cultural resources management. The Company is incorporated in the State of New Hampshire, and based in Alton, New Hampshire. Services in archeological research include site survey and reconnaissance, site examination and data recovery for Environmental Assessments and Impact Statements. Personnel are available for preservation planning, research and National Register nominations for archeological sites, ruins or districts of both post-contact European American and pre-contact Native American age and cultural affinity. Our staff, along with an extended network of experienced professionals, meets the needs of each client and project. Our personnel and project-based sub-consultants are qualified to address industrial, underwater, urban, rural, military, ritual, and funerary resources at the Phase I, II and III survey levels, and are able to prepare research designs, eligibility statements, and address such topics as settlement, subsistence, culture history, artifact analysis, site integrity, and overall resource values. We have worked throughout New Hampshire on a variety of impact assessment projects for Federal, State and local governmental agencies, utilities, engineering firms, developers and private individuals for more than 30 years. Principals have also published results of findings on a regular basis.

Project Team and Secretary of Interior Standards

The Project Team at Victoria Bunker, Inc. includes Senior Staff and Field Crew. All have been trained in New England archeology and all hold degrees in related disciplines. Together, the team is qualified to address Native American, Historic, Industrial and Underwater archeological resources.

The Senior Staff of Victoria Bunker, Inc. meets the Secretary of Interior Standards for Professional Archeologists as follows:

Victoria Bunker, PhD, 34 years of experience in New England archeology and cultural resources management

Sheila Charles, MA, 38 years of experience in New England archeology and historic research

David Trubey, MA, 13 years of experience in New England terrestrial and underwater archeology

Other staff have completed training in New England archeology at the undergraduate level and have compiled extensive experience in special topics as follows:

Dennis Howe, 30 years of experience in New England and New York particularly in the areas of military sites, water-powered mills, industrial sites, history of concrete and related research and graphics arts.

Field Crew have attained or are enrolled in undergraduate degree programs in anthropology, history and have attended archeological field schools.

In addition, Victoria Bunker, PhD has received a certificate for professional training from the Advisory Council on Historic Preservation for historic preservation responsibilities under Section 106 of the National Historic Preservation Act.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF CHERILYN E. WIDELL

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name and business address.

A. My name is Cherilyn E. Widell. My consulting business is Widell Preservation Services LLC. It is located at 105 North Water Street, Chestertown, Maryland 21620.

Q. Please describe your background and qualifications?

A. I have a Bachelor's degree in History from Hood College in Frederick, Maryland. I have worked in the field of historic preservation throughout the United States and internationally for 39 years. I am a former state historic preservation officer (SHPO) and federal preservation officer. My background and training meets the Secretary of the Interior's professional qualification standards, 36 C.F.R. Part 61, for both historian and architectural historian. I was named a Senior Fulbright Scholar to Japan in historic preservation and have been nominated to the Board of the United States Committee of the International Council on Monuments and Sites ("ICOMOS").

I began my career documenting hundreds of historic buildings and landscapes through field surveys in Maryland. I was appointed by the Governor of California to serve as State Historic Preservation Officer with oversight for all aspects of historic resource protection throughout California. In this capacity, I was responsible under Section 106 of the National Historic Preservation Act for consulting with all federal agencies with undertakings which may have an effect on historic properties in the state. Specifically, federal agencies consulted with me on the identification of historic properties in Areas of Potential Effect, determinations of eligibility for the National Register of Historic Places ("NRHP" or "National Register"), assessment of effects and resolution of adverse effects through avoidance, minimization and mitigation and preparation of agreement documents as needed. Among those federal actions were the repair and seismic retrofit of the Los Angeles Memorial Coliseum and Los Angeles City Hall following the Northridge Earthquake, the closure of 29 military installations caused by the Base Realignment and Closure Act ("BRAC") and numerous Department of Energy ("DOE") and FERC projects. I was also responsible for compliance of all state undertakings under the California Environmental Quality Act ("CEQA") which might have an adverse impact on historic resources.

I also served as the federal preservation officer for the Presidio Trust, the federal agency responsible for the conversion of the Presidio of San Francisco from an Army post to a National Park. In this capacity, I was responsible for agency compliance with NEPA and NHPA for over 450 historic buildings and the archeological resources located in a National Historic Landmark district.

A copy of my résumé is attached to this pre-filed testimony as Attachment A. It contains further information regarding my education, training, background and qualifications.

Q. What is the purpose of your testimony?

A. I provide my assessment of the potential effects that the Northern Pass Transmission Project ("Northern Pass" or the "Project") may have on above-ground historic properties and cultural landscapes.[1] I conclude with my opinion that the Project will not have an unreasonable adverse effect on historical resources.

Q. Are you familiar with the Project?

A. Yes. I have viewed substantial portions of the route, observed the location of the Project in relation to historic resources, and evaluated its potential effect on such resources. I have obtained information on the Project's components and location of the transmission lines and facilities. I have spent considerable time reviewing the route using online tools. I have also devoted substantial time and effort in reviewing documents and photographs and again using online data to focus on specific locations along the route.

<u>Potential Impact on Historic Resources</u>

Q. Have the potential impacts of the Project on historic resources been studied?

A. Yes. The results of that study are set forth in a report entitled *Northern Pass Transmission Project -- Assessment of Historic Properties*, dated October 2015. In addition, the contractor working on behalf of DOE to review historical resources issues for the Draft Environmental Impact Statement ("DEIS") and for purposes of complying with Section 106 of

[1] RSA 162-H and the SEC's rules use the term "historic sites" to describe both below ground (archeological) and above ground (architectural or built) resources. I will generally use the term "historic resources" to describe the above ground historic properties that are the subject of this testimony.

the National Historic Preservation Act[2] has completed a DEIS and Project Area Forms ("PAFs") for the Project.

Q. Please describe the assessment of historic properties.

A. Historic resources compliance review generally involves three major steps—identification, evaluation and mitigation. As the first step in this progression—the identification phase—a Northern Pass consultant, Preservation Company, completed a comprehensive field survey to identify historic resources meeting the 50 year age-eligibility criterion and having a possible visual effect within the two mile-wide Area of Potential Effect (APE) for the Project.[3] The identification of historic resources was aided by Preservation Company's background knowledge from over 30 years of historic resources survey and documentation in New Hampshire. Preservation Company surveyed, mapped and catalogued all identified and previously unidentified properties that were constructed prior to 1966.[4] In the field, viewshed mapping along with actual sight analysis was used to preliminarily assess the properties' historic settings and visual relation to the Project for possible visual affect. Field survey findings were extensively augmented and revised by desktop efforts including address research, parcel mapping, tax card/historic aerial map date research (for later properties) and a variety of digital mapping tools used to refine our understanding regarding views of the Project.

At the next step—the historic significance and integrity evaluation phase—conclusions were drawn using Preservation Company's and my best professional judgment applying the NRHP Criteria of Evaluation. Properties eligible for the NRHP are those that:

---

[2] The National Historic Preservation Act was originally codified in Title 16 of the United States Code. In 2014, Public Law 13-287 moved the Act's provisions to title 54 of the United States Code. The provision that was formerly Section 106 of Title 16, became Section 306108 in Title 54. In this testimony, I use the still-used term "Section 106."

[3] DOE has established an APE for direct and indirect effects. The potential effects of the Northern Pass Project will be largely visual, so indirect. DOE proposed an indirect APE for assessing potential for adverse visual effects on historic properties to be approximately one mile on either side of the centerline of the ROW and a 1-mile radius around new aboveground facilities such as substations. DHR concurred with that proposed APE, adding that "the approximate determination is appropriate because there may be some situations where the visual effects may extend somewhat beyond the one mile limit due to local topographic and historic factors." Letter from Richard Boisvert at DHR to Brian Mills at DOE dated March 28, 2013.

[4] Resources dating from 1966 to 1968 were mapped and included in the database but received no further analysis because they were less than fifty years old and did not meet the NRHP age-eligibility criterion.

a) Are associated with events that have made a significant contribution to the broad patterns of our history; or

b) Are associated with the lives of persons significant in our past; or

c) Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d) Have yielded, or may be likely to yield, information important in prehistory or history.

As under Section 106, we assessed integrity using the NRHP evaluation criteria of location, design, setting, materials, workmanship, feeling, and association. 36 C.F.R. § 60.4. Properties that have been compromised and do not satisfy the criteria for integrity are not considered eligible for listing on the National Register.

The Northern Pass historic resources assessment complements the identification and effects analysis of historic resources that is being conducted by the DOE in fulfillment of that agency's responsibility under Section 106 of the National Historic Preservation Act for the Project in consultation with DHR. The identification and evaluation methodology used by Northern Pass is consistent with 36 C.F.R. § 800.4 (Identification of historic properties), 36 CFR 60.4 (Criteria for evaluation), and National Park Service publications and directives related to the identification of properties eligible for the National Register of Historic Places, such as *How to Apply the National Register Criteria for Evaluation (updated 1997)*, the *Secretary of the Interior's Standards for the Identification and Evaluation of Historic Properties (1983)* and *Guidelines for Evaluating and Documenting Rural Historic Landscapes (Updated 1999)*. Thus, the Northern Pass assessment will also help inform the remaining work to be completed under Section 106.[5]

[5] As discussed below, I expect that, at DOE's request, the interested federal agencies, DHR and other interested parties ("consulting parties" under Section 106) will negotiate a Programmatic Agreement to set forth the remaining work to be completed under Section 106.

The last step in the evaluation phase is assessment of potential adverse effects of the Project on the resources. According to the Advisory Council on Historic Preservation ("ACHP") regulations, "an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association." 36 C.F.R. § 800.5(a)(1).

I worked extensively with the Preservation Company team to analyze potential eligibility of historic resources in the APE and to assess the Project's potential effects on those resources. Our assessment was based principally on 36 C.F.R. § 800.5. However, because DHR does not have guidance specifically relating to determining visual effects, we also consulted two other sources: the Vermont Division for Historic Preservation (VT/SHPO) *Criteria for evaluating the Effect of Proposed Telecommunications Facilities, Transmission Lines, and Wind Power Facilities on Historic Resources* and the Virginia Department of Historic Resources (VA/SHPO) *Assessing Visual Effects on Historic Properties.*

In assessing whether the Project would affect a historic property, our analysis began with a review of the property's historical significance, character-defining features and setting. We then looked at whether and how those settings/character-defining features might be affected by the Project. In particular we looked at the following: (1) where the Project will be substantially visible in the main public view *of* the historic resource; (2) where the Project will be substantially visible in historically significant views *from* the historic resource; (3) where the Project will create a focal point that distracts from the appreciation of an historic resource; and (4) where the Project will isolate the historic resource from its historic setting.

Q. Please explain the results of the historical resources assessment.

A. We identified a total of 1,284 properties with a construction date prior to 1966 within the APE for the above-ground portion of the Project. Of these properties, 194 had a sufficient visual relationship with the Project to merit further assessment of their historic character and potential effects of the Project. Historic resources assessment forms were completed on all of these properties and are included in the report *Northern Pass Transmission Project* **--** *Assessment of Historic Properties*, October 2015, Appendix 18.

We first assessed these 194 properties to gauge whether they were potentially eligible for inclusion in the National Register. For those that had that potential, we assessed the Project's potential adverse visual effect on that property. This analysis relied on the field observations, topographical mapping, photographs, 3-D modeling and photo overlays. With each property, we determined the degree of visibility resulting from the presence of the Project by considering viewing distance, screening and back dropping (adjacent vegetation, terrain and development) and the degree of Project contrast with its surroundings. As explained below, I have taken that analysis further to determine whether the adverse effects noted in the Assessment are unreasonably adverse, and I conclude that they are not.

In the above ground segments of the Project, we ultimately determined that 12 of the 194 historic properties we identified and analyzed might be adversely affected by the Project. A list of these 12 properties is attached to my testimony as Attachment B. One of these properties, which contributes to a potentially National Register-eligible grouping of tourist cabins, will be demolished and will be directly affected by the Project. The other 11 properties will be potentially indirectly affected. For these, the Project's visual impact may potentially alter the historic characteristics of the property and diminish the integrity of some features.

In the underground segments of the Project, it is very unlikely that there will be adverse effects to historic resources because the transmission line will be buried within the already-disturbed area of existing roadways.

Q. Has the information provided in the Project Area Forms prepared for DOE been considered as part of the Northern Pass Report and of your testimony?

A. Yes, it has. Preservation Company historians and I have reviewed the PAFs carefully. They provide important additional geographic and historical contextual information about the APE and beyond. Following DHR guidelines, SEARCH concentrated on identifying contexts and buildings falling within those contexts that require further study. Our survey effort went into greater detail, by (1) identifying properties that could or do qualify for the National Register that might be affected by the Project, and (2) assessing potential effects on those properties. For this reason the studies are different although complementary.

I have also reviewed and considered the DEIS for the Project. Both the PAFs and the DEIS have further informed my conclusion that there will be no unreasonable adverse effect on historic resources from the Project.

Q. Please describe how Northern Pass has coordinated with DHR.

A. Northern Pass has met on numerous occasions (going back to at least December 2010) with DHR in the normal course of sharing information about the Project and our work. At those meetings and in written communication with DHR, Northern Pass has also sought direction on the identification and evaluation of historic resources that may be affected by the Project. In March 2015, I participated in a meeting with DHR and DOE staff, and in August 2015 I participated in a meeting with DHR. In an effort to obtain guidance from DHR on the approach taken by the Project to address historic resources, Northern Pass provided a preliminary version of Preservation Company's overall methodology, and sample assessment forms for 12 properties in the Town of Lancaster. Subsequently, on August 19, 2015, the Project submitted to DOE, DHR and other consulting parties an updated version of the overall methodology of the Northern Pass assessment, and individual resource assessment forms and other documents for Lancaster (updated) and for Concord. The Project has also submitted the DHR Request for Project Review form. In addition, Preservation Company has reviewed DHR files for information on previously identified historic properties within the direct and indirect (visual) APE. Finally, as discussed below, SEARCH has coordinated with DHR throughout their work on the PAFs.

Q. In addition, is the Project's potential effect on historic resources also being reviewed under Section 106 of the National Historic Preservation Act?

A. Yes.

Q. Please describe that process.

A. The Section 106 review of historic properties was triggered in this case by the Presidential Permit application filed with the DOE. The DOE has been consulting with DHR, and has invited local governments, Indian tribes, and other interested parties to share information about known historic properties and to participate in the Section 106 consultation process. DHR has requested participation by the ACHP in development of a Programmatic Agreement ("PA"), and the ACHP has agreed. SEARCH has begun the process of identifying historic properties listed on or eligible for listing on the National Register likely to be affected by the undertaking by completing PAFs. The PAF is completed for projects in New Hampshire as part of the DHR Section 106 review process.

Q. What are the next steps in the Section 106 historical resource review process?

A. After completing the identification of potential historic resources, the next steps for DOE will be to apply the criteria for determining eligibility of properties for listing on the National Register within the APE, which the DOE will do in consultation with DHR. DOE will then determine the potential effects of the Project on these identified historic properties, again in consultation with DHR. The final step of the Section 106 Process is to explore remaining alternatives to avoid and minimize adverse effects on historic properties and to establish appropriate mitigation for unavoidable adverse effects. This all, again, will be done in consultation with DHR, ACHP and consulting parties. Before some or all of these steps it is expected that a PA will be developed by DOE to memorialize the responsibilities for completing the Section 106 process, including the necessary work efforts such as the completion of individual and area inventory forms and ways to avoid, minimize or mitigate adverse effects. This remaining work effort is expected to be set forth in a Historic Properties Treatment Plan (“HPTP”) as part of the PA for the Project.

Q. What steps has NPT taken to avoid and minimize impact?

A. NPT has designed the Project in a way that substantially avoids and minimizes potential visual effects on historic sites and properties where the landscape and open spaces add to the significance or setting of the property. Locating 99.5 miles of the line in existing transmission rights-of-way (ROWs) is a very effective way of avoiding impact altogether or minimizing effects on historic resources. The decision to place 60.5 miles of the line underground has meant that the Project has taken into account and eliminated adverse visual effects over long distances and potentially eligible large area historic properties through the White Mountain National Forest and areas to the north and south.

Additionally, in the specific locations where the Project could have or does have an adverse effect, the Project has undergrounded segments and changed planned structure heights, designs and locations to avoid or minimize effects on historic resources. A summary of those design changes is contained in Appendix 18. These changes have meaningfully reduced potential adverse effects to historic properties.

Q. What plans does Northern Pass have to mitigate any potential unavoidable effects of the Project on historic properties?

A. As is typical in the Section 106 process, NPT will be required to provide mitigation for any unavoidable effects. The required mitigation elements will be memorialized in the PA, which will continue beyond the SEC timeframe. These mitigation elements will be determined through consultation among DOE, DHR, NPT, and the consulting parties with oversight provided by the ACHP. For this reason, it is premature to identify specific mitigation measures for unavoidable potential adverse effects.

Q. In your opinion will this Project have an unreasonable adverse effect on historic sites? Please explain.

A. No. My extensive work on the historic resource assessment, including the use of visual modeling and my site visits to potentially affected properties and landscapes, has provided a very strong basis for me to conclude that the Project will not have an unreasonable adverse effect on historic resources. I base this conclusion on the following:

- NPT evaluated the potential historical resource impacts of alternative routes early in the planning process. Route selection of a preferred route was the product of a deliberate process to minimize the potential visual impacts of the Project. Minimizing impacts to cultural resources, state parks, conservation areas, trails, and scenic byways were all considerations in the route selection process.
- 99.5 miles of the route are located within existing transmission lines and ROWs, many of which have been present since 1929. This is an effective way to avoid and minimize impacts on cultural resources and landscapes.
- The 60.5 miles of underground avoids visual effects on natural and cultural landscapes entirely, especially those located in the White Mountain National Forest such as the Appalachian Trail.
- It became apparent as I inspected the route and studied the proposed Project in the field, and used aerial mapping and other tools, that in most locations there will be little or no effect on historic resources. This is primarily due to the route location. Tree cover and

topography hides most views of the Project so that it is not visible from the vast majority of historic properties within the APE. Obviously, the decision to place a total of 60.5 miles of the line underground eliminates indirect visual impact for many potentially eligible properties and landscape-scale historic resources. Placing 99.5 miles of overhead lines along a pre-existing transmission line corridor, most of which has existed for 50 to 75 years, also reduces impacts substantially. Combined, then, over 83% of Northern Pass is located along public roads (the underground segments) or along an existing transmission corridor, which reduces visual indirect effects to historic resources very effectively.

- Northern Pass has avoided or minimized effects on historic sites in the northern 32 miles of the route resulting in only one finding of an indirect adverse effect to historic resources in this part of the route. This segment of the line crosses rural, forested areas with very few cultural resources. Twenty-four miles of the new ROW is located in an active working forest where the Granite Reliable Wind Project is also located.

- The Historic Resources Assessment Report has considered the most appropriate way to group neighboring historic resources that could be affected by the Project. Resources have been considered together that share common contexts and settings irrespective of the size of the resulting grouping.

- There are, in my judgment, 12 historic resources that are likely to be determined eligible for listing on the National Register that will be adversely affected by the Project; only one of these will be directly affected, while 11 will be indirectly affected due to the Project's visual impact. This is not many, especially considering the large number of historic resources that our assessment considered.

- The indirect adverse effects on the single property that is already listed on the National Register (the Weeks Estate) would not cause it to be removed from the National Register because of a loss of integrity.

- The Project will not have an adverse effect on the setting of the Webster Farm/Daniel Webster Family Home, the only National Historic Landmark within the APE. While photosimulations for the site indicate that the tops of 3 structures could be in view from an area near the cemetery, they would be distant and barely visible among the tree tops.

- The indirect visual effects on the other nine of the 11 properties would not prevent them from being determined eligible for listing on the National Register.
- The 11 indirect adverse effects are not located in one discrete geographic area. Rather, they are dispersed along the length of the Project, from Deerfield to Stark.
- Only one indirect adverse effect is located along the 32 miles of new above ground ROW. That property is the Dummer Pond Sportsmen's Club, where the existing Granite Reliable Wind Park turbines and feeder transmission lines are also present in the viewshed.
- In some cases, the Project is often only visible at considerable distance and will not noticeably alter or diminish aspects of a property's historic setting that might contribute to its significance. These adverse effects are not of an unusual or disproportionate degree given the scale of the Project. The degree of effect on the integrity of an historic resource is greatest when a resource will be demolished. Here, of the 12 likely adverse effects, only one historic resource has to be removed, and that one adverse effect is to a 1950s ranch house, which is eligible due to its historic association with the Baker Brook Cabins. (This is due to the change to the Project design to place it underground in Bethlehem, which has the effect of reducing visual impacts on The Rocks and the Baker Brook Cabins historic district.) These cabins have been vacant for a number of years and have greatly deteriorated due to neglect. It is unlikely that the ranch house would be found individually eligible for the National Register.
- The remaining 11 properties are affected by visual elements of Northern Pass being placed in the existing PSNH transmission corridor. Although I have concluded that there is adverse effect to the integrity of the setting or landscape of those sites, it is my opinion that the actual effect on those above ground historic resources is small.
- Collectively, the potential adverse impact to the 12 properties is not substantial.
- Furthermore, the Project has minimized adverse effects at the 11 overhead route locations by making design modifications where practicable. After the initial assessment of adverse effects was completed, we met with the design engineers for the Project to discuss how the potential effects on each historic resource could be reduced. Structure locations and structure design type (lattice to monopole) were modified at 16 of the properties, as set forth in Appendix 18.

- As a matter of practice, the identification, evaluation and mitigation of historic resources under the federal Section 106 process is an iterative process that will continue beyond the time frames set forth in RSA 162-H, and any remaining requirements will be memorialized in a PA for the Project between the DOE, NPT, DHR, and consulting parties with oversight provided by ACHP. This comprehensive identification and evaluation process provides assurance that any adverse effect on historic sites will be addressed, and that DHR and ACHP will have a continuing role in the Project until its completion. I expect that DOE in consultation with DHR will determine at the end of the Section 106 process, as I have, that there will be some adverse effects from the Project. The Section 106 process will require that any adverse effects will be mitigated.
- As is customary in SEC proceedings, I would request that, as a condition of any approval of the Project, the SEC require NPT (1) to continue to consult with DHR with respect to effects on historical resources, (2) to comply with the PA, as well as any agreements and memoranda of understanding with DHR, and (3) to report to the SEC and DHR any new information or evidence about aboveground historical resources in the project area. Based on prior precedent, it is also reasonable to expect that the SEC will delegate to DHR monitoring and compliance authority with respect to historic resources. These expected conditions provide an additional level of assurance that NPT will fully execute any and all requirements imposed on it with respect to the identification, avoidance and minimization, and mitigation of impacts on historical resources.

Q. Does this conclude your pre-filed testimony?

A. Yes.

ATTACHMENT A

Cherilyn Ellen Widell
105 North Water Street
Chestertown, Maryland 21620
443-480-2862
cwidell809@yahoo.com

June, 2008-Present President, Seraph LLC/ Widell Preservation Services
Chestertown, Maryland

Provides consultant services in historic preservation compliance and historic property redevelopment, federal and state rehabilitation tax credits, public/private funding strategies, economic and greenhouse gas analysis of historic property reuse, historic research and natural and cultural resource management of protected areas for Federal and State agencies, property owners and non-governmental organizations.

Selected Projects:

1) Prepared visionary document for designation, rehabilitation and funding of Beinn Bhreagh Hall (Alexander Graham Bell's 1893 Summer Residence) Baddeck, Nova Scotia
Developed recommendations for the descendants and Trustees of the Preservation Trust for designation as a Canadian National Historic Site; laser documentation of the historic building and cultural landscape, public/private funding opportunities **August 2013- Present**
Client: Mr. Gilbert Grosvenor, Bell descendent and retired Editor of National Geographic Magazine

2) Prepared the Statement of National Significance for the 1100 acre Woodlawn Property, Wilmington, Delaware accepted by National Park Service Director Jarvis in December, 2012 and designated by President Obama as a National Monument and Delaware's First National Park on March 25, 2013
Client: Mr. Blaine Philips, The Conservation Fund, Centreville, Delaware

3) Project Principal Investigator, <u>Demonstrating the Environmental & Economic Cost-benefits of Reusing DoD's Pre- World War II Buildings</u> funded by the Department of Defense Environmental Security Technology Certification Program (ESTCP Project SI-0931)
Led a team of ten to create and analyze 24 data sets of life cycle assessment and life cycle cost analysis comparing rehabilitation costs and greenhouse gas generation to determine the least costly and most "green" alternative between rehabilitation and new "LEED" construction for creating space for DoD mission uses. Presented results to the National Academy of Sciences in January 2013.
Client: Ms. Maureen Sullivan, Federal Preservation Officer and Director of Environmental Protection, Office of the Department of Defense Undersecretary for Installations and Environment, The Pentagon.

4) Served as Director of Heritage Assets (Natural and Cultural) for the Commonwealth of VA's Fort Monroe Authority, Fort Monroe, VA.
Responsible for preserving and finding new uses for 170 historic buildings owned by a state agency

through public/private partnerships, supervised resource staff and managed resource protection in a government owned land unit. Worked with citizen groups, Congressional representatives and the National Park Service to establish a National Park; develop design guidelines for the National Historic Landmark; oversee environmental restoration planning and cleanup and water quality improvement. Instrumental in obtaining National Monument designation through the Antiquities Act from President Obama which led to establishment of a National Park unit in November, 2011. Client: Fort Monroe Authority, (Commonwealth of Virginia) Fort Monroe, VA 2010-2011

5) Researched and prepared a Monuments and Memorials Plan to improve visitor experience and interpretation in the National Historic Landmark District at the US Naval Academy, Annapolis, MD
Client: United States Naval Academy, Annapolis, Maryland 2009

2012 Adjunct Professor, Corcoran Gallery of Art Graduate School of Art and Design, Washington, DC
Taught Historic Preservation and Sustainable Design to graduate students in Interior Design, Corcoran Gallery Graduate School of Art and Design, Corcoran Gallery of Art, Washington, DC

2005-2008 Federal Market Leader, HNTB, Washington, D.C.
Provided technical expertise in Section 106 of the National Historic Preservation Act to FEMA decision makers on disaster recovery priorities and hazard mitigation for historic properties on the Gulf Coast of Mississippi following Hurricane Katrina. Directed team architects and engineers on the application of the Secretary of the Interior's Standards for the Treatment of Historic Properties for new construction and rehabilitation of historic buildings, rail stations and bridges nationwide.
Selected Projects:

1) **Deployed to the communities of Biloxi, Gulfport (Turkey Creek), Pass Christian and Bay St. Louis, Mississippi on September 12, 2005 following Hurricane Katrina as part of NISTAC for compliance of FEMA with Section 106 of the National Historic Preservation Act.** Completed over 100 condition assessments of public and private historic properties listed or eligible for listing on the National Register, including Beauvoir, the home of Jefferson Davis, a National Historic Landmark; provided technical guidance related to disaster recovery and financial assistance to NGOS, local governments and Mississippi State Historic Preservation Officer
Client: Federal Emergency Management Agency, Jackson, Mississippi 2005-2006

2) Developed an Historic Structures Report for Offices of the Commanding Officer and histories of both the Army Air Artillery Defense School and the Safeguard Missile Training Program at Fort Bliss, Texas.
Client: Department of Public Works, US Army, Fort Bliss, Texas

1998-2003 Federal Preservation Officer, The Presidio Trust, The Presidio of San Francisco, Presidio National Park, Golden Gate National Recreation Area, San Francisco, California September 1998- October 2003
Appointed as the first Federal Preservation Officer for the Presidio Trust, a federal corporation (Title I of H. R. 4236, P.L. 104-333 with amendments) established by Congress to make the Presidio of San Francisco, a former Army Post, an economically and environmentally sustainable National Park not administered by the National Park Service by 2013. Worked extensively with National Park Service staff of the Golden Gate National Recreation Area on joint natural and cultural resource issues including identification of cultural

landscapes, environmental restoration and water quality improvement to foster stewardship of this treasured landscape. Designed planning and implementation strategies for resource protection including vegetation management plan, historic forest characterization study and historic building rehabilitation priorities.

1)Worked extensively with developers and tenants on projects using long term leasing of federal property and the 20% Investment Tax Credit for repurposing income producing buildings within the Presidio National Park, GGNRA. Oversaw rehabilitation and maintenance of over 470 former military structures within a National Historic Landmark. Developed a training program with the College of the Redwoods for Presidio Trust construction crews working on historic properties.

2)Developed guidelines consistent with the Secretary of the Interior Standards for Archaeology and Treatment of Historic Properties for the Letterman Digital Arts Center to ensure compatibility of design and determination of " no adverse effect" under the National Historic Preservation Act(NHPA) for the new 800,000 sq. ft. constructed by George Lucas within the National Historic Landmark District. Negotiated the first Programmatic Agreement for Section 106 compliance with NHPA with SHPO and the Advisory Council on Historic Preservation for all planning, construction and maintenance within the Presidio of San Francisco.

3)Supervised Presidio Trust cultural resources staff and developed a joint archaeological resources laboratory with the NPS GGNRA. Established an annual public archaeology program on the Presidio with Stanford University and University of California at Berkeley. Developed interpretation and education programs for buildings, landscapes and archeology to educate and engage youth. Established the first Presidio Trust cultural resources internship program.

4)Co-authored <u>The Presidio Trust Green Buildings Guidelines for the Rehabilitation of Historic and non-Historic Buildings .</u>Responsible for Presidio Trust compliance with the National Environmental Policy Act, National Historic Preservation Act, Archaeological Resources Protection Act, Native American Grave Protection and Repatriation Act.

1994-1998 State Historic Preservation Officer (SHPO) appointed by Governor Pete Wilson and Deputy Director, California Department of Parks and Recreation and of California, Sacramento, CA

Gubernatorial Appointee and supervisor of a staff of 30+ historians, archeologists, resource specialists responsible under the National Historic Preservation Act for all aspects of both state and federal law especially the National Register of Historic Places and Section 106 for the identification, designation and conservation and preservation of land and cultural landscapes, historic properties and archeological sites throughout California and manager of the California Heritage Fund.

1) Worked extensively with Native American communities to develop effective agreements and establish tribal preservation programs. Identified large landscapes values, traditional cultural properties and indigenous landscapes through ethnographic studies for natural resources such as Mount Shasta, to determine eligibility for listing in the National Register of Historic Places

2) Expedited repairs, new construction and seismic retrofit of over $125 million dollar project for the Los Angeles Coliseum, a National Historic Landmark and many other historic structures in Southern California following the 1994 Northridge Earthquake through the use of a new, innovative nationwide programmatic agreement for NHPA Section 106 compliance with FEMA. Established the first ever CA regional SHPO office to provide disaster assistance and compliance review in Los Angeles following the Northridge Earthquake. Oversaw federally funded base isolation and rehabilitation of the San Francisco City Hall, Los Angles City Hall and California Supreme Court.

3) Identified problems, issues, negotiated conflict and streamlined consultation for Section 106 Compliance with the National Historic Preservation Act with the closure or realignment of 29 military installations affected by the 1995 Base Realignment and Closure Act (BRAC) including Long Beach Naval Station, Mare Island and San Diego Naval Training Center.

4) Expanded statewide use of the Federal Rehabilitation Tax Act program and co-sponsored with the NPS the National Conference," Tax Incentives for Developing Historic Properties." Expanded the NPS Certified Local Government Program from 25 to 42 governments in California.

5)Established the international Alta and Baja California Mission Heritage Corridor with INAH In Mexico through a partnership agreement; Inauguration of the Binational Heritage Corridor," El Camino Real Misionero de las Californias"an agreement between Centro INAH-Baja California, the regional branch of Instituto Nacional de Antropologia e Historia (INAH) and the State Office of Historic Preservation of California.

6) Researched and prepared planning documents including <u>Forging a Future with a Past, A Comprehensive Statewide Historic Preservation Plan for California</u> <u>and " The Government's responsibilities for the Preservation of Cultural Resources for Disaster Management Programs for Historic Sites;</u>"

1991-1992 Senior Fulbright Scholar to Japan, Ministry of Cultural Affairs, and Tokyo National University of Fine Arts, Tokyo, Japan

Focused research on Japanese protection of both tangible and intangible cultural resources. Worked with local governments, national government, universities and NGO throughout Japan in preservation and adaptive reuse policy and implementation of commercial historic districts and preservation of the Tokyo Railroad Station and Frank Lloyd Wright's Jiyu Gakuen in Tokyo c. 1921

1. **Developed an international campaign which included an advertisement in the New York Times with the Friends of Myonichikan, Taliesen and Frank Lloyd Wright Building Conservancy to successfully designate, save and restore the 1921 Frank Lloyd Wright Building, Jiyu Gakuen in Tokyo and reuse it for a center for continuing education for senior citizens.** Co- Chaired, Program Committee for the U.S. Japan Conference on Frank Lloyd Wright Buildings in Japan in 1992 entitled," To Whom Does the Cultural Heritage Belong?" which included US National Park Service participation.

2. **Interviewed in Magnificent Obsession: Frank Lloyd Wright's Buildings and Legacy in Japan, a 2005 DVD documenting his work.** Published articles in **Places, A Quarterly Journal of Environmental Design and Journal of the International Association for the Study of Traditional Dwellings and Preservation News** on the promise and difficulties of preservation in Japan.

1985-Present Consultant to Developers in Adaptive Reuse of Historic Properties and acquisition of Federal Rehabilitation Tax Credits in MD, NJ, CA

Directed developers, architectural firms, commercial property owners and small businesses from downtown Palo Alto, CA to Berlin, Chestertown and Baltimore, MD on methods for profitable architectural rehabilitation and restoration totaling more than 100 million dollars. Self-employed consultant involved in over 50 National Park Service Federal Rehabilitation Tax Act projects. Projects included affordable housing projects, commercial/industrial conversions, office buildings, railroad stations and public buildings with long-term leases to private entities.

1985-1988 Co- Founder and First Executive Director, National Alliance of Preservation Commissions, Washington, D.C.
Co-founded and developed the first national network of landmark, historic district commissions and cultural heritage boards in the United States.

1. Advised the National Park Service Technical Preservation Services on the development of regulations and implementation for the new Certified Local Government Program (CLGS) and coordinated relations between National Park Service, SHPOS, and local governments on public policy and regulatory matters.
2. Testified before both Houses of U.S. Congress on historic preservation policy and federal funding of the Historic Preservation Fund.
3. Speaker and trainer to state historic preservation offices in over 30 states on certified local governments and local historic preservation issues related to local preservation ordinances and commissions. Wrote the NPS publication <u>Local Preservation Volumes I and II</u>.

1981-1985 Co- Founder and First Executive Director, Maryland Association of Historic District Commissions, Annapolis, Maryland
Co-founded the first statewide network of historic district commissions. Served as a circuit rider technical expert in historic preservation for over 35 MD communities with historic district ordinances based on Article 66B of the Maryland State Law.

1976-1981 Frederick, MD Revitalization/ Historic Sites Surveyor, Office of Historic Preservation, City of Frederick/ Frederick County Department Economic and Community Development, Frederick, Maryland
Served as Preservation Planner for Frederick County and the City of Frederick Historic District Commission. Responsible for Main Street Revitalization program and façade improvement program for Frederick, Maryland. Formulated special zoning provisions and adaptive reuse plans for empty or underutilized historic properties; developed funding and tax incentive packages for commercial and industrial adaptive reuse of old buildings and land conservation strategies with the Maryland Environmental Trust; documented over 500 properties for the Maryland Historic Sites Survey in rural agricultural areas; prepared over 20 National Register nominations

<u>Appointments, Awards and Honors</u>
<u>2011- Current Board of Directors, Athena Sustainable Materials Institute, Ottawa, Canada</u>
Non-profit expert organization in Life Cycle Assessment (LCA) of Building Materials through the use of the Impact Estimator tool for determining Scope 3 Greenhouse Gas Emissions in the construction of new and reuse of existing buildings

<u>2012-2014 Special Studies Instructor, Chautauqua institution, Chautauqua, New York</u>
Instructor for week long program in the Federal and State Rehabilitation Tax Credits for historic properties and how the Presidio of San Francisco became an economically self-sufficient National Park

2012 Environmental Scholar, Aspen Institute, Aspen, Colorado
Designated an Environmental Scholar by the Aspen Institute to attend the 2012 Environmental Forum on Climate Change in Aspen, Colorado

1995-1996 National Preservation Award Winner from the National Trust for Historic Preservation for the repair and seismic retrofit of the Los Angeles Coliseum.

1994-1998 Appointed as California State Historic Preservation Officer by Governor Pete Wilson(R)

1991-1992 Named Senior Fulbright Scholar to Japan in Urban Conservation, Council for the International Exchange of Scholars

1988-1990 Appointed to the New Jersey Historic Sites Council by Governor Thomas Kean(R)

1985 Received the Calvert Prize for work with the Maryland Association of Historic District Commissions, the highest historic preservation award in Maryland from the Maryland Historical Trust and Maryland Governor Harry Hughes(D)

1973-1974 Smithsonian Fellow, Division of Costume and Furnishings and Office of Ethnic and Western Cultural History, Smithsonian Institution, Washington, D.C.

Education
1975 Hood College, Frederick, MD Bachelor of Arts, American History
1976-77 Graduate Work Smithsonian Program in American Studies, George Washington University, Washington, D.C.

Publications/ Multimedia Productions

Demonstrating Relative Cost-Benefits for the Reuse of DoD Historic and Non-Historic Properties Using Scientifically Derived Data ESTCP Grant 0931, Environmental Security Certification Program, Department of Defense, Washington, DC

Rockford Woodlawn Statement of National Significance for the National Park Service, Accepted by Director Jon Jarvis, Director of the National Park Service for documentation of Delaware's First National Park, December 2012

Local Preservation Volume I and II, National Park Service a guide to establishing, educating and administering local preservation ordinances for local governments and state historic preservation offices

Training Manual on Commercial Renovation, Home Builders Institute, National Association of Home Builders, Washington, D.C.

Built by Design Videotape/slide program for training design review boards responsible for overseeing changes to historic properties funded by the National Endowment for the Arts, Frederick, Maryland

A Brief History of the Japan Society of Northern California 1905-1995, Published for the 90th anniversary of the organization, San Francisco, CA

Editor, Maryland Association of Historic District Commissions Newsletter and National Alliance of Preservation Commissions Newsletter

Numerous national and international magazine article publications including:
'Preservation News" National Trust for Historic Preservation
Places, A Quarterly Journal of Environmental Design
Journal of the International Association for the Study of Traditional Dwellings
Maryland Municipal Magazine
Architectural Institute of Japan
Japan Times
Interviews with National Public Radio
Department of Defense Cultural Resources Newsletter
National Park Service, Cultural Resources Management Publication

ATTACHMENT B

HISTORIC PROPERTIES – POTENTIAL ADVERSE EFFECT				
ID	**Town**	**Address**	**Single or Multiple Property**	**Property Name**
DEER31	Deerfield	235 Middle Road	S	Quimby-Fife House
DEER138	Deerfield	65 Nottingham Road (on)	S	Lindsay/Menard Cabin
PEMB37	Pembroke	105 North Pembroke Road	S	Montminy Farm and Country Store
CONC47	Concord	183 Shaker Road	S	Maple View Farm
BRIS10	Bristol	Peaked Hill Road; Locke Road; Old Stage Road	M	Locke Neighborhood
BRIS51	Bristol	171 Jeffers Road	S	Jeffers Farm
BETH16	Bethlehem	1108 Main Street, 1071 Main, 1000 Main	M	Baker Brook Cabins and Motor Inn Area
LANC02	Lancaster	202 Weeks State Park Road	M	Weeks State Park – John Wingate Weeks Estate
LANC42	Lancaster	188-457 North Road/4-29 Grange Road	M	North Road Agricultural District
STRK14	Stark	404, and 496 Northside Road	M	Northside Road Agricultural Area
STRK26	Stark	405 Bell Hill Road	S	Leighton Farm
DMMR19	Dummer	Off Dummer Pond Road, on Big Dummer Pond	S	Dummer Pond Sporting Club

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF ROBERT W. VARNEY

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name and business address.

A. My name is Robert W. Varney and my business address is 25 Nashua Road, Bedford, NH 03110.

Q. Who is your current employer and what position do you hold?

A. I am employed by Normandeau Associates, Inc. and hold the position of President.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to provide the SEC with my assessment of the benefits that the operation of the Northern Pass Transmission Project ("Northern Pass" or the "Project") as proposed by Northern Pass Transmission LLC ("NPT") will have on air quality and the Project's consistency with the goals of state, regional and national air quality and climate change policies. I conclude with my opinion that the Project will not have an unreasonable adverse effect on air quality.

Q. Please describe your background, experience and qualifications

A. I am President of Normandeau Associates, an environmental science consulting firm based in Bedford, NH. I began my tenure there as Executive Vice President in 2009. Founded in 1970, Normandeau is an employee-owned company serving a broad range of clients such as federal, state, and local agencies, water utilities, energy generation and transmission companies, ski areas, developers, non-profit organizations, and many others.

Prior to joining Normandeau, I served for nearly 8 years as Regional Administrator of EPA, New England, where I was responsible for implementation and enforcement of numerous federal environmental laws and programs. This included the review, evaluation and resolution of numerous high-profile complex EIS and permitting issues involving major highways, airports, energy facilities and developments within the six New England states. I also undertook some initiatives associated with climate change, energy efficiency and renewables, integration of energy and environmental programs and restoration of rivers, lakes and coastal areas.

From 1989 to 2001 I served as Commissioner of the NH Department of Environmental Services. By virtue of that position, I also served as a member and as Chairman of the NH Site Evaluation Committee for that same 12 year period.

I was appointed by the Governor as Director of the New Hampshire Office of State Planning (NHOSP) in 1989 before being appointed as NHDES Commissioner in that same year. NHOSP is responsible for local, regional and statewide planning, growth management and interagency coordination. It has since been merged with the former Governor's Energy Office, and is now the Office of Energy and Planning (OEP). Prior to my appointment as Director of NHOSP, I served as Executive Director of the Nashua Regional Planning Commission and the Upper Valley Lake Sunapee Regional Planning Commission, and was senior planner at the Lakes Region Planning Commission.

I hold a bachelor's degree in economics from the University of New Hampshire and a master's degree in urban planning from Michigan State University.

A copy of my résumé is attached. Attachment A.

Q. What is your experience with air quality issues?

A. As DES Commissioner and EPA New England Administrator, I worked to improve air quality to protect public health and the environment. This included efforts to develop and implement policies and strategies, including both voluntary and regulatory programs, to reduce emissions to the earth's atmosphere and address air pollution issues such as acid rain and acid deposition, fine particulate matter ($PM_{2.5}$), ground level ozone (or smog), nitrification of surface waters, climate change, regional haze and toxic air pollutants.

While I was DES Commissioner, we began to address the issue of climate change in the early to mid-1990's, when we included climate change in the state's clean air strategy and hired a climate change specialist to focus on the issue. In the late 1990's, I served on the EPA/ECOS Climate Change Forum consisting of a group of federal air quality officials and state environmental commissioners. During my last year as DES Commissioner we published the New Hampshire Clean Power Strategy (2001) and I joined with then Governor Shaheen, and state legislators to propose multi-pollutant state legislation which would simultaneously reduce carbon dioxide (CO_2), nitrogen oxide (NO_x), sulfur dioxide (SO_2), and mercury (Hg) emissions from New Hampshire's existing electric power plants.

My efforts to address climate change and improve air quality continued while I was at EPA-NE. We established EPA's first "Energy Team" which encouraged energy conservation and efficiency, renewable generation, improvements in transmission infrastructure and promotion of programs such as the Community Energy Challenge and ENERGY STAR. We also helped our partners develop and implement the NE Governors/Eastern Canadian Premiers' Regional Climate Action Plan, the Regional Greenhouse Gas Initiative (RGGI) and other initiatives such as using brownfield and landfill sites for electricity generation (wind, solar, methane), increasing energy efficiency and renewable generation at water and wastewater treatment facilities and promoting sustainability and reducing GHG emissions at college and university campuses.

Q. What is your experience with energy issues and energy facility projects?

A. At the NHDES, we were responsible for permitting, compliance, and enforcement associated with existing and new energy facilities. As mentioned above, I also served as a member and as Chairman of the New Hampshire Site Evaluation Committee (SEC) for 12 years, from 1989 to 2001. SEC proceedings during this time included proposed power plants, electric generation facilities, electric transmission lines, and natural gas pipelines. As Regional Administrator of EPA, I was involved in energy facility permitting, compliance and enforcement, and the NEPA review of energy projects across New England, including wind generation, LNG terminals, hydroelectric facilities and gas and electric transmission projects.

Assessment of Air Quality Benefits

Q. What did you consider in your assessment of how this Project will help to address air quality and climate change goals?

A. In addition to drawing on my many years of professional experience, I considered a broad range of state, regional and national energy policies including the *New Hampshire Climate Action Plan*, the *New Hampshire State Energy Strategy; New Hampshire Clean Power Strategy;* the *New England Governors' Renewable Energy Blueprint*, the *Regional Greenhouse Gas Initiative*, the *National Climate Assessment*, and the *President's Climate Action Plan*. I also reviewed the pre-filed testimony of Julia Frayer and the report prepared by London Economics International LLC, on the impacts of the Project on the wholesale electricity market, the environment, and local economy, which was submitted as part of the SEC application. Finally, I reviewed air quality information on the U.S. EPA and NHDES websites and the draft Environmental Impact Statement ("DEIS") issued by DOE on July 21, 2015.

Q. Please describe the anticipated effects of the Project on air quality.

A. The report entitled *Cost-Benefit and Local Economic Impact Analysis of the Proposed Northern Pass Transmission Project*, Appendix 43, and direct pre-filed testimony, both prepared by Julia Frayer, Managing Director of London Economics International, LLC, included projected annual average emission reductions for CO_2, NO_x, and SO_2 across New England from 2019 to 2029, which represents the first 11 years of Project operation, as follows:

1) Carbon Dioxide (CO_2): 3.3 – 3.4 million metric tons
2) Nitrous Oxide (NO_x): 537 – 624 short tons
3) Sulfur Dioxide (SO_2): 261 – 460 short tons

These reductions are projected to occur as energy delivered to New England by the Northern Pass Project "will displace the production of older, less efficient generation, including fossil fuel-fired plants; therefore the emissions of such pollutants will decrease in New England," See pre-filed testimony of Julia Frayer. As noted in her testimony, Julia Frayer considered factors such as the Cross-State Air Pollution Rule ("CSAPR"), Clean Air Interstate Rule ("CAIR"), Regional Greenhouse Gas Initiative ("RGGI"), emissions which may be associated with Hydro Québec's hydropower reservoirs and other information in preparing her estimates—which she considers to be conservative.

The DOE concluded in the DEIS that "the implementation of the Project could have major, long-term beneficial impacts to air quality within the ISO – NE region by reducing annual criteria pollutants and GHG emissions." (P.58, Air Quality and Greenhouse Gas Technical Report for the DEIS). Citing a Valuation Study by Edgeworth Economics and GE Energy Consulting (GE Energy Consulting, 2015), the DEIS projected annual emission reductions of 10-12% for NO_x and 4-5% for SO_2 and a 9-11% reduction of annual carbon emissions compared to the baseline for Alternative 2 (1,200 MW) by the year 2025. The Valuation Study also projected cumulative annual emission reductions if the proposed New England Clean Power (TDI New England, 2015) and the Champlain Hudson Power Express (Transmission Developers, 2015) projects were developed. Under this scenario, the study predicted that cumulative annual emission reductions in 2025 would be similar with a 10% decrease in NO_x, 6% decrease in SO_2 and an 11% decrease in CO_2 (pages 58-59, Air Quality and GHG Technical Report for the DEIS. These numbers may change in the DOE's supplemental EIS, which is currently evaluating the Project proposal for a 1,000 MW transmission line.

I also considered potential air emissions associated with construction of the Project and a potential reduction in carbon sequestering and storage capacity due to the loss of some forest cover as trees are cleared from the right-of-way and access roads. Temporary impacts to air quality may result from construction vehicles and equipment, transportation of construction workers and materials to and from project sites and the operation of concrete batch plants. The DOE’s DEIS provides estimates of potential construction-related NO_x, SO_2, CO_2 and other pollutants. I agree with the DEIS conclusion that construction emission goals are low and would be localized and temporary. I also agree with the DEIS that reductions in New Hampshire’s heavily forested carbon sink will be minimal. (Air Quality and Greenhouse Gas Technical Report).

Fugitive dust is considered a state-regulated form of air pollution when soil, demolition debris or stored materials become air borne due to activities such as construction, soil and wind erosion, demolition, material storage, sand and gravel operations and mining. Northern Pass has indicated that its contractors will be required to develop BMP’s and written protocols to prevent, abate and control fugitive dust during the construction process. This may include practices such as wetting and sweeping surfaces, covering or enclosing stockpiles, vegetative controls and use of wind breaks as appropriate.

Q. What are some of the air quality issues facing New Hampshire and how will the Project help address these issues?

A. The Northern Pass will improve air quality and public health and the environment and help address climate change by reducing pollutants such as NO_x, SO_2 and CO_2 emissions that affect New Hampshire and the ISO-New England region.

Air quality issues affecting public health and the environment in New Hampshire include ground-level ozone, small particle pollution, regional haze (visibility), mercury contamination, climate change (greenhouse gases), acid deposition, and air toxics. New Hampshire’s approach to improving air quality is through the use of tools such as regulatory source controls, voluntary programs, incentives, as well as local, regional, and national collaborations. The following is a brief summary of key pollutants and air quality issues which Northern Pass may help address.

<u>Nitrogen Oxide</u>: Nitrogen oxide (NO_x) emissions are caused primarily by the combustion of fuels in power plants, industrial boilers, motor vehicles and off-road equipment. NO_x contributes to multiple air quality and water quality problems, including ground-level ozone (smog), fine particle pollution (PM2.5), acid deposition (acid rain) and nitrate loadings in lakes, ponds and wetlands. Northern Pass will help improve the environment in New Hampshire by reducing NO_x emissions which contribute to these issues and may also help improve public health.

<u>Ozone</u>: Ground-level ozone, or smog, forms as a result of chemical reactions when nitrogen oxides (NO_x) combine with Volatile Organic Compounds (VOCs) and oxygen in the presence of sunlight and heat. NO_x emissions are the result of burning fuels in utilities, industrial boilers and mobile sources such as cars and trucks. VOCs are emitted by sources such as vehicles, gas stations, solvents, lawn equipment, fuel containers, consumer products, landfills and factories. In addition, a large percentage of the VOC emissions in our air is naturally–occurring. High ozone levels can cause health problems, often associated with respiratory conditions, as well as harm to agricultural crops and forests.

The State of New Hampshire and upwind states have significantly reduced NO_x and VOC emissions since the passage of the Clean Air Act Amendments of 1990. As a result, New Hampshire is classified as in attainment with EPA’s 2008 8-hour ozone standard of 75 ppb. (Some of Connecticut and a small area of Massachusetts were still classified as non-attainment in 2015). However, it should be noted that on October 1, 2015, the U.S. E.P.A. set a more stringent standard of 70 ppb. This may cause some areas of New England to slip back into non-attainment status. In addition, New England states classified as in attainment continue to have unhealthy air quality days during the summer ozone season. Based on preliminary data, there were 24 days in the region when ozone monitors recorded unhealthy levels in 2015.

Northern Pass will help improve the environment by helping to reduce ozone levels within New Hampshire and the ISO-New England states and may help improve public health. It also may help states, counties and local communities maintain or achieve attainment status for ozone as more stringent standards are adopted.

<u>Sulfur Dioxide</u>: Sulfur dioxide (SO_2) pollution is emitted by power plants, refineries, smelters, residential oil furnaces, mobile sources (especially those with diesel fuel) and large marine vessels. These emissions may contribute to respiratory and lung problems, acid rain, formation of fine particle pollution, reduced visibility, corrosion of surfaces and acid deposition (acid rain). On its website, NHDES estimates that sulfuric acid, originating from SO_2, accounts for about two-thirds of the acidity of deposition (rain, snow, fog and dry particles) in New Hampshire. The NHDES website lists about 40 lakes and ponds in New Hampshire which it considers to be acidified.

Portions of three counties in New Hampshire – Hillsborough, Merrimack and Rockingham – have been designated as non-attainment for the EPA's 2010 one-hour standard of 75 ppb. This area includes: Goffstown in Hillsborough County; Candia, Deerfield and Northwood in Rockingham County; and Allenstown, Bow, Chichester, Concord, Dunbarton, Epsom, Hooksett, Loudon, Pembroke and Pittsfield in Merrimack County.

The wet scrubber installed at PSNH's Merrimack Station in Bow has reduced SO_2 emissions in New Hampshire. Northern Pass is expected to further reduce SO_2 emissions in New England and the State, thereby improving the environment and visibility and may also improve public health.

Carbon Dioxide and Climate Change: Carbon dioxide (CO_2) is both a naturally-occurring and human-induced greenhouse gas. While CO_2 is present in the earth's atmosphere as part of the natural carbon cycle, it is the largest single source (82%) of greenhouse gas emitted by human activities. GHG's include water vapor, carbon dioxide (CO_2), methane, nitrous oxide, chlorofluorocarbons (CFC's), ozone and aerosols. International, national, regional and state climate change strategies have focused on the need to reduce CO_2 emissions associated with combustion of fossil fuels for electricity generation, transportation, heating and industrial processes. These strategies also note that our oceans, wetlands, coastal areas and forests function as carbon sinks, storing and removing carbon from our atmosphere. Northern Pass is estimated to further reduce CO_2 emissions in New England by up to 3.3 – 3.4 million tons annually; the equivalent of removing over 690,000 cars from our roads. See pre-filed testimony of Julia Frayer.

Regional Haze: As mandated by Congress, EPA's Regional Haze Rule requires states and federal agencies to work together to improve visibility in designated national parks and wilderness areas across the nation. There are 156 so-called Class I Areas in the U.S., including two in New Hampshire (Great Gulf Wilderness and Presidential Range – Dry River Wilderness), one in Vermont (Lye Brook) and three in Maine (Acadia, Moosehorn and Roosevelt Campobello International). The Great Gulf Wilderness Area, 5,552-acres is just north of the summit of Mt. Washington. The Presidential Range – Dry River Wilderness Area, about 20,000 acres in size, is just south of the Mt. Washington summit. Both areas are managed by the US Forest Service.

The Regional Haze Rule is intended to address the combined visibility impairments of various air pollution sources over a large geographic area. To achieve this goal, EPA designated five Regional Planning Organizations ("RPO's") to coordinate and address the regional haze issue.

The Mid-Atlantic and Northeast States, as well as the District of Columbia and Northeast Tribes, formed the "Mid-Atlantic/Northeast Visibility Union ("MANE-VU"). Each state, including New Hampshire, is required to meet the requirements of the Regional Haze Rule in its State Implementation Plan ("SIP"). The long-term goal is to reduce regional haze to natural visibility conditions (background levels) at all Class I areas by the target year of 2064.

Regional haze is caused by several air pollutants such as SO_2, NO_x, VOC's, fine particles ($PM_{2.5}$) and ammonia (NH_3), which are emitted from stationary sources, areas sources, mobile sources and biogenic sources (trees, grasses, crops). The NHDES notes that the predominant cause of regional haze pollution is sulfate particles (aerosols) present in and formed by emissions when oil and coal is burned, and electric generating units in the eastern half of the U.S. as the largest source of these emissions. The State's current strategy to address regional haze includes implementation of BART (Best Available Retrofit Technology) and SO_2 reductions at existing electric generating plants in NH and the Region.

Northern Pass will help the nation, MANE-VU Planning Region and State of New Hampshire reduce air pollution, including NO_x and SO_2, which contributes to the regional haze problem, improving visibility in our national and state parks and wilderness areas across New Hampshire and the region.

<u>Particle Pollution</u>: Particulate matter, which is a mixture of solid particles and liquid droplets in the air, is included in smoke, dust, condensing vapors and fly ash. $PM_{2.5}$ refers to fine particles smaller than 2.5 microns in diameter and PM_{10} refers to particles with a diameter between 2.5 and 10 microns in size. Particulate matter pollution can be created by burning of wood, fossil fuels, fires, fugitive dust, and industrial processes. Potential effects include respiratory illnesses, heart and lung disease, as well as reduced visibility. Since SO_2 and NO_x contribute to the formation of particulate pollution, SO_2 and NO_x reductions associated with Northern Pass will help to reduce particulate emissions as well.

***Acid Deposition*:** Acid deposition is created when NO_x and SO_2 emissions react with water, oxygen and oxidants to form compounds such as nitric acid and sulfuric acid. These compounds are transported in the atmosphere and fall to our lands and waters as acid rain, snow or fog, or as dry fine particles.

Many of New Hampshire's lakes and ponds, especially those which are remote and at high elevation, as well as the health of our forests, have been adversely affected by acid deposition. The NHDES lists about 40 lakes and ponds in New Hampshire which it considers to be too acidic. Northern Pass will reduce SO_2 and NO_x emissions which contribute to the State's acid rain problem and help improve the health of New Hampshire's lakes, ponds and forests.

Q. Will the Project support State, regional and national air quality and climate change policy?

A. Yes. As noted above, efforts to reduce air pollution have been on-going at the national, regional and statewide levels for many years. The federal government and each New England state have worked to implement state laws and the federal Clean Air Act to reduce air pollution as regulatory standards continue to become more stringent over time.

Efforts to reduce greenhouse gases and address the issue of climate change have accelerated in recent years. At the federal level, the President's Climate Action Plan is a blueprint intended to slow the effects of climate change by deploying a clean energy strategy. One of the Plan's recommendations directed the EPA to develop carbon pollution standards for new and existing power plants, recognizing that fossil fuel-fired power plants are the largest source of U.S. carbon dioxide emissions accounting for about 31% of total U.S. greenhouse gas emissions. In August, 2015, the EPA issued the final rules for the Clean Power Plan (CPP) to achieve a 32% reduction of CO_2 emissions by 2030 from 2005 levels. The President's "All-Of-The-Above" Energy Strategy recognizes that "low- and zero-carbon renewable, nuclear, and clean coal energy sources along with energy efficiency, have a central role to play in a clean energy future," and supports the production of electricity from renewables.

The EPA and the New England States have long recognized that regional approaches are needed to help reduce air emissions. The New England Governors Association, Coalition Of New England Governors (CONEG), Northeast States for Coordinated Use Management (NESCAUM), the Ozone Transport Commission (OTC), the Regional Greenhouse Gas Initiative (RGGI) and other groups have been working together cooperatively for many years to improve air quality and address climate change in the region.

New Hampshire's Climate Action Plan sets goals to reduce greenhouse gas emissions 80% below 1990 levels by 2050, which is consistent with the New England Governors' and Eastern Canadian Premiers' resolutions. The Plan supports the construction of high voltage transmission lines to import clean power generated from Canadian hydro and wind sources as a complementary policy to developing non-carbon emitting sources of power in New Hampshire. The Plan states that the importation of electricity from Canadian hydropower and wind resources "could provide new power sources to offset future local and regional growth and facilitate retiring or curtailing the operation of fossil fuel-fired plants in New England." (P. 44)

In summary, it is my opinion that Northern Pass will help improve air quality and reduce greenhouse gases in New Hampshire and New England, consistent with national, regional, and state air quality and climate change goals.

Conclusion

Q. What overall conclusion do you reach on the Project's effects on air quality?

A. Overall, Northern Pass will reduce CO_2, NO_x and SO_2 emissions, improve air quality and help New Hampshire and the region address issues such as smog, acid rain, regional haze (visibility) and climate change. The Project will provide significant long-term benefits to the State and region. As a consequence, the Project will improve State and regional air quality and certainly will not have an unreasonable adverse effect on air quality.

Q. Does this conclude your testimony?

A. Yes, it does.

ATTACHMENT A

ROBERT W. VARNEY
President

Considered one of the nation's most experienced and respected environmental leaders, Robert Varney is a former Environmental Protection Agency (EPA) New England Regional Administrator, who joined Normandeau Associates in 2009. He was the longest-serving regional administrator and the top environmental official in New England and is recognized for instituting many innovative approaches and policy initiatives that have served as national models. Prior to EPA, Mr. Varney was one of the longest-serving state environmental commissioners, appointed by three Governors of both political parties.

He is nationally recognized for his efforts on global climate change; energy efficiency and renewables; integration of energy and environmental programs, homeland security and preparedness; clean air, clean water and safe drinking water; superfund and brownfields cleanup and redevelopment; environmental justice and healthy communities; restoration of rivers, lakes and coastal areas; strong and consistent enforcement and compliance assistance; strengthening partnerships and improved agency management and performance.

PROFESSIONAL EXPERIENCE

Normandeau Associates, Inc. (2009-Present). Mr. Varney serves as President of Normandeau Associates, Inc., managing one of the largest and most respected science-based environmental consulting firms in the United States serving both the private and public sectors. Founded in 1970, the company is well known for delivering sound, innovative scientific solutions to a global clientele. Normandeau's staff includes marine, aquatic, wetland, and terrestrial ecologists; environmental planners; fisheries biologists and limnologists; soil scientists, geologists, and hydrologists; engineers; regulatory specialists; public involvement professionals; statisticians and data processing specialists. Headquartered in Bedford, New Hampshire with 18 offices in 12 states, Normandeau is 100% owned by its employees. For more information please visit

EDUCATION

M.S., Urban Planning, Michigan State University

B.A., Economics, University of New Hampshire

PROFESSIONAL EXPERIENCE

2009-Present	Normandeau Associates
2001-2009	Regional Administrator, EPA, Region 1: New England, Boston, MA
1989-2001	Commissioner, New Hampshire Department of Environmental Services, Concord, NH
1989	Director, New Hampshire Office of State Planning, Concord, NH
1987-1989	Executive Director, Nashua Regional Planning Commission, Nashua, NH
1983-1987	Executive Director, Upper Valley-Lake Sunapee Council, Lebanon, NH

PROFESSIONAL AFFILIATIONS

- Past Chairman, JPAC (U.S., Canada, Mexico, appointed by President Obama)
- Board of Trustees, The Nature Conservancy
- Board of Directors, Lakes Association of NH
- Commissioner/Past Chair, NE Interstate Water Pollution Control Commission
- Past President, Environmental Council of the States (ECOS)
- Past Chairman, Federal Ozone Transport Commission (OTC)
- Past Chairman, Governmental Advisory Committee (advisory committee to EPA Administrator Carol Browner on environmental effects of NAFTA)
- Past Chairman, State/EPA Superfund Policy Forum, representing National

www.normandeau.com.

EPA, Region 1; New England (2001-2009). Mr. Varney served as Regional Administrator of EPA Region 1 in New England, where he managed a staff of 700 employees and a budget of $532 million. He was responsible for implementation of numerous federal environmental laws and programs such as the Clean Water Act, Clean Air Act, Safe Drinking Water Act, Superfund, brownfields redevelopment, hazardous waste management, emergency response and preparedness, environmental justice, children's health, wetlands permitting and protection, stormwater controls, enforcement and compliance assistance, environmental sampling and laboratory analysis and grants to state and local governments. He also undertook many initiatives regarding energy efficiency and renewables, climate change, environmental justice, creation of a Healthy Communities Grant Program for disadvantaged communities, collaborative efforts to clean up the Mystic River and the Charles River, elimination of chronic beach closures, designation of all coastal waters as "no-discharge" areas, and development of innovative stormwater controls in significantly impaired watersheds. He helped achieve several high-profile settlements to clean up and restore the Charles River, South Boston beaches, Mt. Hope Bay, Portsmouth Harbor, and portions of the Connecticut, Merrimack, and Assabet rivers.

New Hampshire Department of Environmental Services (1989-2001). As one of the nation's longest-serving state environmental commissioners, Mr. Varney was appointed by three governors of both political parties. He managed a state agency with over 450 employees and an annual budget of $100 million. The Department of Environmental Services is responsible for solid and hazardous waste management, air quality, dam inspections as well as operation, maintenance and reconstruction of State-owned dams, wetlands permitting and protection, water supply systems, wastewater treatment plants, septic system design and installation, laboratory analysis, rivers and lakes management, groundwater protection, geological studies, permitting and enforcement, emergency oil spill and chemical response and other associated environmental programs. During difficult economic times, Mr. Varney significantly increased revenue generated by the agency to make it more self-supporting, greatly improved internal management, successfully undertook several legislative initiatives including new State grant programs for municipal wastewater and drinking water infrastructure, landfill closures and protection of local water supply lands. He also greatly improved communication with the legislature, municipalities and professional groups. He was elected by his peers as President of ECOS, the national association of state environmental commissioners and served as chairman of numerous federal, regional and state commissions, boards and committees. He was widely credited with instituting many innovative approaches and policy initiatives that served as national models.

New Hampshire Site Evaluation Committee (1989-2001). Mr. Varney has vast experience with the state energy facility siting process. For 12 years he served as Chairman of the New Hampshire Site Evaluation Committee, and has coordinated with siting board members throughout New England for the past 25-plus years. As Chairman of the NH SEC, Mr. Varney was responsible for all aspects of the state's energy facility siting process; providing pre-application advice to applicants, chairing all public hearings and committee works sessions, coordinating multiple federal, state and local agencies, managing SEC staff and preparing documents and environmental permits for all energy facilities in the state within legislatively-prescribed timelines. Projects approved and successfully permitted during his tenure included several electric generation facilities, electric transmission lines and natural gas pipelines.

New Hampshire Office of State Planning (1/89-7/89). As State Planning Director, Mr. Varney managed 40 employees and an $8.6 million annual budget and served in the Governor's Cabinet. Agency was responsible for local, regional and statewide planning, growth management and interagency coordination. Also responsible for Coastal Zone Management Program, Great Bay National Estuaries Research Reserve program, Community Development Block Grant Program (housing, water, sewer, community facility, and economic development grants), coordination with regional planning commissions and local boards and officials, monitoring of federal funds in New Hampshire, administration of state's intergovernmental Review Process, statewide database management, preparation of population estimates and projections. Also initiated and designed Governor's Recycling Grants Program.

Nashua Regional Planning Commission (1987-1989). Mr. Varney directed New Hampshire's largest regional planning agency in one of the fastest growing areas of the country. NRPC is responsible for the regional Transportation Improvement Program, regional database management, water resource mapping and protection, development of local and regional plans, coordination of household hazardous waste collections and the solid waste district. Initiatives included preparation of the state's first Regional Recycling Plan and development of the Merrimack River Management Plan, the first such plan completed pursuant to the state's new river management and protection program. Other projects included the Nashua-Boston Passenger Rail Feasibility Study, an impact fee handbook and evaluation of Nashua's bus system, local water resource management and protection plans, and local conservation plans. Chaired Route 101-A Bypass Study Steering Committee composed of federal, state and local officials. Also initiated and chaired the Water Supply Task Force, a public/private partnership formed to prepare a long-range water supply plan for the rapidly growing southern tier of New Hampshire. A high percentage of these plans and proposals have been implemented.

Upper Valley-Lake Sunapee Council (1983-1987). Mr. Varney directed a unique bi-state regional planning agency serving 31 communities in New Hampshire and Vermont. Recruited to revitalize a troubled agency contemplating abolishment. Within 18 months, membership doubled from 15 to 30 communities, and staffing grew from two to fourteen. Responsible for directing all council activities including local and regional planning, preparation and administration of grants for housing rehabilitation, economic development, community facilities, and wastewater and drinking water systems, environmental protection, historic preservation, transportation, downtown revitalization, industrial development, recreation planning and water resource management. Chaired Hanover-Lebanon Area Highway Study Committee.

Lakes Region Planning Commission (1979-1983). Mr. Varney worked as a regional planner, economic development specialist and community development director at a regional planning commission serving 32 communities in the Lakes Region of New Hampshire. Duties included preparation of local master plans, downtown revitalization strategies, zoning ordinances and subdivision and site plan review regulations, regional economic development strategy, regional tourism plan and environmental impact assessments, coordination of the Concord-Lincoln Rail Study; and management of Franklin's CDBG loan program in the central business district.

AWARDS AND AFFILIATIONS

Mr. Varney's professional affiliations and honors are extensive. Mr. Varney has chaired the Environmental Council of the States (ECOS), State/EPA Superfund Policy Forum, Federal Ozone Transport Commission (OTC), Governmental Advisory Committee to the US Representative to the Commission for Environmental Cooperation (CEC), Gulf of Maine Council on the Marine Environment, New England Interstate Water Pollution Control Commission and New England Governors' Conference Environment Committee. He also was a member of EPA's Environmental Justice Advisory Council. Mr. Varney currently serves on the NH Board of Trustees for The Nature Conservancy (TNC) and was appointed by President Obama to (and chaired) the CEC Joint Public Advisory Committee (US, Mexico, Canada). Mr. Varney is the recipient of numerous environmental awards such as the EPA Lifetime Achievement Award, NE Water Works Association's John H. Chafee Award, Charles River Watershed Association's Anne Blackburn Award, Environmental Business Council of NE's Paul Keough Award and the ECOS Founder's Award.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF JACOB J. TINUS

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name and business address.

A. My name is Jacob J. Tinus. My business address is 670 N. Commercial Street, Manchester, NH 03101.

Q. Who is your current employer and what position do you hold?

A. I am employed by Burns & McDonnell ("BMcD") as a Project Manager in the Environmental Studies and Permitting ("ES&P") Global Practice.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide my assessment of the potential effects of the Northern Pass Transmission Project ("Northern Pass", or the "Project") as proposed by Northern Pass Transmission LLC ("NPT") on surface water and groundwater quality.

Q. Briefly summarize your qualifications, employment experience and educational background.

A. I have more than 15 years of environmental consulting experience related to permitting and monitoring projects that involve altering and restoring wetlands, water bodies and other natural resources. Over the past 10 years, my focus has been managing the permitting and siting activities for large and small scale electric and gas transmission, substation and distribution projects. In May 2013, I was hired by BMcD as a project manager to work solely on the Project permitting team.

My environmental consulting career started in 2000 when I joined Vanasse Hangen Brustlin, Inc. (VHB), as a staff scientist where I received training in assessing and delineating wetlands, streams and other natural resources and prepared various permitting documents in support of hundreds of commercial, transportation and energy projects. I was quickly promoted to senior scientist and task manager at VHB in 2002 and I performed and supervised natural resource assessments and delineations in the field, and prepared an equal number of environmental studies, permit applications and documents filed under the requirements of the Massachusetts Wetlands Protection Act (WPA), New Hampshire RSA Chapter 482-A Fill and Dredge Act, National Environmental Policy Act (NEPA), Massachusetts Environmental Policy Act (MEPA), and other statutes and regulations. My permitting work was conducted principally in New Hampshire and Massachusetts with a lesser number of projects in Vermont and Maine. I obtained my professional registration as a Certified Wetland Scientist in 2003 through the New Hampshire Joint Board of Licensure and Certification and I maintain my certification to the present.

From 2005 to 2007, I consulted full-time to the NH Department of Transportation ("NHDOT") Bureau of Environment's stormwater permitting and compliance program. My primary role included interpreting and advising NHDOT on the requirements of the US Environmental Protection Agency ("USEPA") National Pollutant Discharge and Elimination System ("NPDES") Construction General Permit ("CGP"), Small Municipal Separate Storm Sewer System ("MS4") General Permit, and Multi-Sector General Permit ("MSGP") for Industrial Activities. I was the principal author of the NHDOT Stormwater Management Plan ("SWMP") document, prepared and filed Small MS4 Annual Reports to USEPA, and I had responsibility for overall program management on behalf of the Bureau of Environment. I assisted NHDOT staff with procedure review and writing, recommended stormwater BMPs, trained NHDOT staff, reviewed Storm Water Pollution Prevention Plans ("SWPPPs") for accuracy and compliance, and assisted Small MS4 municipal stormwater and watershed groups with various aspects of their programs including drainage mapping and illicit discharge detection and elimination. In 2007, I obtained my professional registration as a Certified Professional in Erosion and Sediment Control ("CPESC") through the International Erosion Control Association ("IECA") and I maintain my certification today through EnviroCert International which assumed responsibilities for this certification from IECA. In addition to my CPESC certification, and in-house consulting experience at NHDOT, I have thousands of hours of field experience monitoring stormwater and construction activities involving surface waters, wetlands and other natural resources for electrical distribution, substation, transmission and wind energy facilities as well as transportation and land development projects in compliance with Certificates of Site and Facility and various state, federal and local permits.

I have served on the Board of Directors of the New Hampshire Association of Natural Resource Scientists ("NHANRS"), which is the supporting professional association for wetland scientists, soil scientists and wildlife biologists. I am currently an active member of NHANRS as well as the Northeast Chapter of the IECA and the Association of Massachusetts Wetland Scientists ("AMWS").

I hold a Bachelor of Arts degree in Biology from the State University of New York ("SUNY") at Potsdam and a Master of Science degree in Resource Management and Administration from the Environmental Studies program at Antioch University New England in Keene, New Hampshire.

A copy of my résumé is attached. Attachment A.

Q. How are you familiar with Northern Pass?

A. I am very familiar with the Project, having viewed much of the 192 mile route from roadside vantage points and have walked segments of the Project corridor, existing substation locations, and proposed transition station sites. I have reviewed aerial photography and other GIS-based data of the Project area. I have also examined the proposed Project plan sheets and I have reviewed the U.S. Department of Energy's July 2015 draft Environmental Impact Statement.

Water Quality Permits

Q. Please describe your efforts with respect to permit applications for the Project.

A. I have been involved since May of 2013 in many facets of environmental permitting for the Project. This includes drafting permitting documents, and reviewing, coordinating and managing tasks and other team members who are preparing permit applications to be submitted for review by the SEC and state and federal agencies. I have directly overseen the preparation of the New Hampshire Department of Environmental Services ("DES") Alteration of Terrain ("AoT") permit application and the request from DES for a Section 401 Water Quality Certification ("WQC"). Part of the preparation process has included pre-application meetings and communications with state and federal regulatory agencies.

Q. What permits has the Project applied for?

A. The entire list of required permits for the Project is set forth in Section (d) of the SEC application. For water quality specifically, the Project will require several state permits, namely:

- *Wetlands Permit* -- Under RSA 482-A, a permit from the DES Wetlands Bureau is required for excavating, removing, filling, dredging or constructing structures within jurisdictional areas including wetlands. The Wetlands permit application includes a description of the wetland and stream resources, describes efforts to avoid, minimize and mitigate for impacts, and provides plans that show the locations of wetlands and surface waters, project components and unavoidable impacts.

- *Alteration of Terrain (AoT) Permit* -- Under RSA 485-A:17, the AoT permit process regulates activities affecting New Hampshire surface waters, drinking water supplies and groundwater by requiring the control of soil erosion and management of stormwater runoff from developed areas. More specifically, the AoT rules are principally intended to protect wetlands and surface waters from potential impacts during construction, and from non-point source pollutants that may emanate from a development once it has been constructed and is operational. The AoT permit application filed for the Project includes detailed engineering for the 9 "development sites"[1]. As requested by DES, permit plans are also provided for the overhead and underground transmission corridors.
- *Section 401 Water Quality Certification* – This is a Clean Water Act-required certification by DES that the state surface water quality standards will be met. A Section 401 certification (§401 WQC) typically include enforceable conditions, including monitoring requirements.
- *Shoreland Water Quality Protection Act Permits* -- The Shoreland Water Quality Protection Act (RSA 483-B) establishes minimum standards for the use and development of protected shoreland adjacent to the state's public water bodies. A permit is required for new construction, excavation and filling activities within the Protected Shoreland. In accordance with a DES request, the Project has submitted 33 separate Shoreland applications, one for each municipality in which activities are occurring within a protected shoreland of a specific waterbody.

[1] These nine facilities are the converter terminal in Franklin, the Deerfield and Scobie Pond substations and the 6 transition stations at the overhead/underground junctions.

Federal water quality permits are also required by the Project. They include:

- *Clean Water Act Section 404 Wetland Permit* – This is issued by the United States Army Corps of Engineers. It contains much of the same required information as the DES Wetlands Permit.
- *Clean Water Act NPDES Construction General Permit* -- The other major federal permit administered by the USEPA is the CGP, which governs construction activities as they relate to stormwater. This general permit requires applicants to submit a Notice of Intent ("NOI") to comply with the general permit requirements at the time construction begins and also requires the preparation of a SWPPP. The SWPPP presents specific BMPs relating to erosion and sediment control along the Project rights-of-way ("ROW"), and at the substation, converter terminal and transition station facilities. The SWPPP is meant to be used to verify and document contractor training, monitoring events and reports, and importantly, any modifications made in the field to proactively manage stormwater during the construction phases, and intended by United States Environmental Protection Agency ('USEPA") to be a "living" document to be updated as necessary.

  As is customary, the NOI will be submitted by the Project's construction contractor just prior to the time construction begins. NPT has, however, prepared a SWPPP that is intended to be used to support the NOI at the time it is filed with USEPA. The SWPPP is appended to the DES AoT Permit application and found at Appendix 6.

Q. Did the Project have pre-application meetings with permitting agencies?

A. Yes, as is typical for any large project and as encouraged by the agencies, NPT sought guidance from permitting agencies before filing the applications. The principal focus of all pre-application meetings and communications was for NPT to ask questions of the agencies on specific aspects of the permit applications. A list of all pre-application consultations is included at Appendix 48.

<u>Surface Water Quality – Overall Considerations</u>

Q. Please describe how the Applicant has considered the potential effects of the Project on water quality.

A. NPT has planned, routed, designed, and engineered the Project to protect water quality by carefully avoiding resource impacts, and minimizing impacts where total avoidance is not possible. The principal water quality issue for the Project is stormwater. Stormwater has the potential to translocate sediments eroded from disturbed land which, if not properly managed, can be carried to wetlands and aquatic resources thereby affecting their quality. To minimize this risk, construction activities will be carefully monitored throughout the construction process. A suite of Best Management Practices (“BMP”) will be required in the AoT permit and § 401 WQC and will be used to minimize erosion and sedimentation, stabilize soils, and restore disturbed areas once construction activities have been completed in a given area. They are shown on the plan sheets and notes accompanying the permit applications.

The AoT permit application covers the nine “development sites” in detail and addresses BMPs for all elements of the Project. Those nine facilities are the converter terminal in Franklin, the Deerfield and Scobie Pond substations and the 6 transition stations. In addition to construction-phase erosion and sediment control BMPs, each of the facilities will employ permanent stormwater BMPs. The stormwater management systems are engineered specifically to each site, considering such factors as: existing drainage patterns and contribution areas, properties of native soils, slopes and pollutant loading. The stormwater systems are designed to treat and attenuate stormwater flows and achieve post construction flow conditions that are similar to pre-construction flow conditions.

NPT has followed DES rules (Env-Wq 1500 Alteration of Terrain) in the design of the Project, and its contractors will follow during construction the approaches and BMPs contained in these manuals: *Erosion Control on Timber Harvesting Operations in New Hampshire* (NHDES, 2004); *Utility Maintenance in and Adjacent to Wetlands and Waterbodies in New Hampshire* (NHDRED, 2010); and *Routine Roadway Maintenance Activities in New Hampshire* (NHDOT, 2001). Project engineers relied on the *NHDES Stormwater Manual*, Volumes 1 – 3 to guide analyses of site conditions, select BMPs to minimize the effects of stormwater on water quality during construction, and to design stormwater system infrastructure for the converter terminal, the three substation and the six transition station sites.

The Project will meet DES and USEPA requirements by managing potential short-term water quality impacts through the use of erosion and sediment control BMPs during construction phases and post-construction through the installation of permanent engineered stormwater infrastructure at the nine development sites. The measures that will be employed are fully set forth in the site plans provided with the AoT permit application and described in the SWPPP that is part of the AoT application.

Q. What has the Project done to avoid and minimize impacts to water quality?

A. Avoidance and minimization of impacts to wetlands, vernal pools, streams and other surface waters has been an essential consideration during the various phases of the Project, including route selection, design, engineering, and construction management planning. As described in detail the wetlands permit applications and in the testimony of Lee Carbonneau, it has guided the transmission line route selection; narrowing of clearing of ROWs; siting and configuration of structure foundations; incorporating underground segments in roads and road shoulders; siting of the converter terminal, substation expansions and transition stations; selection of access road locations (both on and off the ROW); selection of construction BMPs; and scheduling of work during frozen ground conditions (to the extent practicable), including vegetation clearing, to reduce destabilization of ground surfaces and potential for erosion and sedimentation.

Q. What measures will the Project take during construction to avoid water quality impacts?

A. As required by the AoT rules, erosion and sediment control BMPs are indicated on permit plans based many factors, including: slope of the land, drainage patterns, contributing drainage areas, soil types, proximity to wetlands, streams and vernal pools, locations of access roads, structures and other project elements, and knowledge of the construction methods, equipment and vehicles. Prior to construction activities commencing in a particular area, NPT contractors will mark or delineate the locations of aquatic resources and other sensitive areas using flagging, signage or fencing. Next, contractors will install erosion and sediment control BMPs including, but not limited to: stabilized construction entrances, silt fence, silt socks (compost mulch tubes), pervious berms consisting of shredded bark and/or stump grindings, erosion control matting, and diversion berms (water bars). During construction, temporary ditches and swales with check dams, sediment traps and sediment basins may also be required. Permanent stormwater infrastructure, including grass swales, ditches, underdrains, infiltration basins and detention basins have been designed for the facility sites. These features will be installed prior to rough grading the site and other earth moving activities. The Project has shown the limits of erosion and sediment control barriers for the entire transmission corridor, in addition to the nine individual facility sites, with the understanding that the placement of such measures is subject to change based on consideration of construction activities and their timing, weather events, localized conditions and permit conditions.

NPT will retain appropriately credentialed Environmental Monitors ("EM") during all phases of Project construction. Working on behalf of NPT, the EM will be responsible for understanding all of the conditions of the Project's environmental permits and other impact avoidance and minimization measures NPT has committed to and for ensuring that project contractors abide by these conditions and commitments. Regular inspections of the erosion and sediment control BMPs will be performed in accordance with conditions specified in the Certificate of Site and Facility, Construction General Permit and other permits. Ongoing monitoring meetings with the contractors working on the Project will be held to proactively manage construction activities. Documentation of the Project team's aforementioned interactions and communications relative to permitting agencies is provided in the permit applications that are appended to the SEC application.

Q. Please describe the SWPPP.

A. The SWPPP (a requirement of the CGP, but also submitted with the AoT permit application as requested by DES) provides information for the contractors on planning and protection measures, monitoring, maintenance and, when necessary, restoration/mitigation measures. In addition to the avoidance and minimization measures used during the planning and design phases of the Project (described further below), the SWPPP describes the measures the Project will take to avoid and minimize stormwater impacts and ultimately to protect water quality. These include, but are not limited to:

- no application of pesticides (including herbicides);

- restricted use of fertilizers for vegetation reestablishment and within Outstanding Resource Waters (ORWs), Class A watersheds, and near other sensitive waters and wetlands;
- adherence to specific BMPs relating to tree clearing, erosion and sediment control and construction activities (described above) and blasting (described below);
- adherence to a horizontal direction drilling (HDD) frac-out plan (described below); and
- prohibition on use of road salt (sodium chloride) on temporary access roads or work pads (to prevent the introduction of chlorides into surface waters and groundwater).

<u>Surface Water Quality – Development Sites</u>

Q. How has the Project addressed surface water quality issues at the nine development sites?

A. It is addressed in the AoT and § 401 WQC permit applications. As presented in the permit applications and accompanying site plans, civil engineering design involved development of stormwater runoff analyses for both quantity and quality of non-point source stormwater runoff for the converter terminal and each of the substation and transition station sites. As required by DES in its *Stormwater Manual*, pollutant loadings were calculated using the "Simple Method" for each of the sites to model pre-construction conditions versus post-construction conditions. The Simple Method estimates pollutant loading of stormwater runoff for urban and developing areas. The technique is recommended by DES because of the modest amount of information it requires, which includes subwatershed drainage area and impervious cover, annual precipitation, and stormwater runoff pollutant concentrations. At this time, DES requires pollutant loading analysis to include only total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). Although projects may have other pollutants of concern, TSS, TP, and TN are used as surrogates for other parameters. Importantly, the results of these analyses were used to specify and size pollutant-specific stormwater BMPs based on their removal efficiencies to address any potential increase in pollutants generated from the land development activities, *i.e.* construction of development sites. To summarize, the pollutant loading calculations indicate that as shown on the AoT permit plans, the stormwater measures to be constructed at each of the development sites will not result in increased loading of TSS, TP and TN. The pollutant loading calculations and results are provided in the individual stormwater reports included in the AoT Permit Application for each of the facilities.

<u>Surface Water Quality –Transmission Line (Overhead and Underground Segments)</u>

Q. How will the Project address surface water quality issues for the overhead segments of the route?

A. For overhead transmission line construction, permanent or temporary impacts to perennial streams have been avoided. For intermittent and ephemeral streams, there will be a negligible amount of approximately 33 square feet of total permanent impact due to placement of transmission structures or foundations. The only permanent impacts from the Project occur in discrete locations from the installation of structure foundations. The use of access roads (20-foot width) and installation of temporary construction pads to allow access travel and operation of construction equipment and vehicles involves temporary impacts to surface waters in some locations. These impacts will be minimized with the use of appropriate erosion and sediment control BMPs such as swamp mats, stone-lined construction entrances, water bars, stone-lined ditches with check dams, grassy swales, temporary settling basins and other measures typically used to control stormwater on linear utility projects. Areas temporarily impacted will be restored once construction activities are complete.

To address steep slopes, BMcD ran a GIS model to identify steeply-sloped areas (defined by DES as areas having 15 percent or greater slopes) along the Project route and incorporated this information as a visible feature on the AoT permit plans. NPT will also employ specialized BMPs for work occurring in the steeply-sloped areas, as referenced on the permit plans and accompanying plan notes.

Q. How will the Project address surface water quality issues for the underground segments of the route?

A. With respect to water quality issues related to underground cable construction, no permanent impacts to perennial or intermittent streams will occur. Temporary impacts to perennial and intermittent streams amount to approximately 5,300 square feet. No new or permanent upgraded stream crossings (culverts or bridges) are anticipated. Contractors will conduct walk-downs prior to construction and should any locations be identified that require new or upgraded stream crossings, they will be designed, permitted, and constructed in accordance with DES Stream Crossing rules (Env-Wt 900).

The transmission cable along the underground portions of the Project will be placed in sections in excavated trenches and construction will be performed in a "cut and cover" fashion, whereby trenches will be backfilled and restored on the surface or covered with metal plates until they can be fully restored. This approach greatly reduces the amount of open ground surface at any particular location and in turn reduces the potential for erosion and sedimentation from the movement of stormwater, as well as protects the cable infrastructure and supports public safety.

In order to avoid and minimize impacts to the banks and channels of surface waters, the Project will use trenchless installation (HDD or the like) to route the cable beneath most streams and rivers. A specialized Monitoring and Operations Plan will be developed[2] to address risks associated with HDD such as "frac-out", *i.e.*, inadvertent release of drilling fluid into the environment. All areas disturbed by trenching will be backfilled and restored to preconstruction conditions either by repaving road surfaces, reinstalling road shoulders or loaming and seeding to reestablish vegetation. No new impervious surfaces will be created by the undergrounding activities. Dewatering is expected to be required in portions of the trenches and at some splice locations (pits or vaults) which will be handled by the appropriate specialized BMPs described within the permit applications and plans. Because the underground work will be located within and along the edge of existing roadways, the underground cable installation work is not likely to create a high potential for impacts to water quality if the appropriate BMPs are followed. Thus, as requested by DES, the Project has included drawings for the underground facilities with cross sections as part of the AoT application.

Q. How will the Project address surface water quality issues for the access roads and laydown areas?

A. As with other aspects of the Project, surface water quality will be protected along access roads and at laydown areas. If a portion of an existing access road is in disrepair or poses an impediment to access by construction vehicles or equipment, repairs or modifications may be required. For example, a rutted uneven area may need to be filled. In this case, geotextile fabric

[2] The Project has developed a general Monitoring & Operations Plan, but it will require input from the underground contractors who have not been chosen yet.

will be laid down and suitable fill will be placed on top of the fabric and appropriate stormwater BMPs will be installed. Similarly, a short incline or small rise that prevents construction equipment access may need to be flattened by removing material. Here again, appropriate BMPs will be used to prevent or reduce the likelihood of erosion and sediment transport by stormwater while the access road is being modified. Once construction access is no longer needed, geotextile fabric and the materials that were placed upon them will be removed and the areas will be restored to establish a stable vegetated surface outside of the established access road.

In some locations, wetlands and streams will need to be crossed by construction vehicles and equipment. As shown on the permit plans, appropriate BMPs such as mats or temporary bridges will be installed and then removed upon completion of construction activities in a given area. Impacted wetland areas will be fully restored in accordance with accepted BMPs and permit conditions relative to these activities. To the extent possible, access roads within the overhead transmission ROWs were designed such they are located on existing access roads found within much of the ROW. In some cases the roads will need to be widened or modified in order to accommodate equipment. Some access roads would be needed only during construction and thus would be used temporarily, whereas other access roads may be required permanently for the long-term operation and maintenance of the new transmission lines. For those roads that are temporary in nature, the access roads will be removed and the land will be restored to its original condition. For those roads that may be permanent in nature, NPT requests that the SEC delegate any required approvals for permanent access ways to DES, in accordance with the delegation request contained in (d)(2) and (g)(8) of the Application.

Wetland areas that are temporarily impacted will be restored in accordance with DES rules, BMP manuals, and permit conditions. NPT will designate EMs who will observe construction activities and inspect erosion and sediment control measures and make timely recommendations of adjustments to contractors where needed.

With respect to water quality issues associated with laydown areas (for the storage of Project components, supplies and equipment), these locations have been chosen based on several factors, including: access to the Project corridor; presence of flat/even terrain, and lack of sensitive resources such as wetlands, streams, vernal pools or rare, threatened and endangered species or habitat. None of these resources will be impacted by the use of the laydown areas;

only upland areas will be used. As with all other Project locations, erosion and sediment control BMPs will be used to protect any nearby sensitive resources.

Q. How will the Project affect groundwater?

A. In general, sensitive groundwater resources including aquifers, wells, public water supply sources and source and wellhead protection areas were proactively avoided throughout the siting of the major Project components. Wells and other water supplies have been identified; construction impacts to any water lines within the Project corridor will be avoided. None of the development sites are located within source or wellhead protection areas. The implementation of BMPs during construction to control erosion and sedimentation will help protect groundwater resources during and following construction. Other BMPs such as the *Best Management Practices for Fueling and Maintenance of Excavation and Earthmoving Equipment* (NHDES, 2010) will be followed to reduce the likelihood of spills of fuel or other hazardous materials.

The Franklin Converter Terminal and Deerfield substation will contain oil-filled equipment. Therefore, a Project-specific Spill Prevention, Control and Countermeasures ("SPCC") Plan is required and has been prepared. The SPCC outlines preventive measures to assure that a potential spill from oil-filled equipment is contained and countermeasures are established to prevent oil spills that could reach navigable waters. The SPCC plan is provided with the Request for a 401 Water Quality Certification.

Q. How does the Draft Environmental Impact Statement compare to your conclusions regarding water quality impacts?

A. While there are some differences in the methodologies between the Draft Environmental Impact Statement ("DEIS") and the Project's approach, the conclusion presented in the DEIS, namely, that impacts to water resources will be minimized by implementing BMPs, and mitigation, is consistent with our findings.

Conclusions

Q. What is your overall assessment of the Project's impact on surface water and groundwater quality?

A. The Project's impact on surface water will minimized, both by designing the route to avoid impacts where practicable and by incorporating BMPs and other measures based on DES rules, guidance documents, experience with similar projects, and discussions with DES staff. The Project will not cause degradation of outstanding resource waters ("ORWs"), or cause further degradation of waters by pollutants causing the existing impairment. Overall, temporary and permanent impacts are very low due to careful consideration of natural resources during the planning, design and engineering phases.

Over 83 percent of the Project is located on existing utility and roadway ROWs where prior disturbances have occurred and will continue to occur. Most of these areas are subjected to regular vegetation maintenance activities such as tree and brush clearing or mowing which is typically performed in accordance with recognized BMPs in order to minimize permanent resource impacts. In addition, utility and road maintenance activities also occur in portions of the project corridor with regularity. These activities follow established BMPs and are recognized by DES as "minimally impacting." With proper installation and maintenance of erosion and sediment control BMPs, effective construction monitoring, and coordination with contractors, water quality will not be adversely affected.

The Project's impacts associated with construction activities along the transmission line ROWs are expected to be temporary in nature and due primarily to access by construction vehicles and equipment. As described previously, these effects will be minimized through the use of appropriate BMPs. Permanent impacts are associated with installation of transmission structures along the ROW and construction of the development sites. Post construction impacts are expected to be very minimal as a result of the low intensity of use of the Project corridor and permanent stormwater management infrastructure to be constructed at each of the development sites. Access to the substations and transition stations, as well as the transmission line ROWs will generally only be required for inspection, maintenance and repairs. In the northern segment of the route, 24 of the 32 miles of new overhead ROW is located in working forest land that is already subject to disturbance from ongoing logging activity. To the extent practicable, the Project has avoided or minimized impacts to the more intact forest areas and other ecologically sensitive areas. All tree clearing activities must follow DES approved BMPs which thereby limit impacts to wetlands, surface waters and other resources.

There will be no long-term effects on surface water quality or groundwater quality resulting from construction and operation of the Project. The Project does not involve any direct surface water discharges. The Project will use existing, unimproved gravel access roads located on the ROW (rather than building new access roads) and existing suitable off ROW access roads (to avoid sensitive resources on the ROW). Certain portions of existing access roads within the ROW will be shifted to avoid resource areas and structures and crane work pads have been located to completely or partially avoid or minimize impacts to aquatic or other resources. Similarly, the footprints of substation and transitions stations have been located within the sites to lessen impacts to resource areas. Site drainage at the development sites has been designed to maintain existing flow patterns as much as possible to minimize potential effects on wetland and surface water hydrology. These facilities have been designed so that they will not increase levels of TSS, TP and TN exported from the sites.

Q. Does this conclude your pre-filed testimony?

A. Yes, this completes my pre-filed testimony.

ATTACHMENT A

Jacob J. Tinus, CWS, CPESC

Environmental Project Manager

Expertise

- Project management
- Environmental siting
- Permitting
- Wetland delineations
- Functional assessments
- Environmental monitoring
- Natural resource, wildlife and vernal pool assessments

Education

- MS, Environmental Resource Management and Administration, Antioch University New England
- BA, Biology, State University of New York

Organizations

- New Hampshire Association of Natural Resource Scientists
- International Erosion Control Association

Registration

- New Hampshire Certified Wetland Scientist #228
- Certified Professional Erosion & Sediment Control #3900

Burns & McDonnell Experience

3 Years

Other Firms Experience

20 Years

Mr. Tinus serves Burns & McDonnell as an environmental project manager in the Environmental Siting & Permitting division. With over 23 years of experience in land development, energy utilities, transportation and environmental restoration projects, Mr. Tinus brings unparalleled expertise to the projects he manages. He has considerable applied knowledge in erosion and sedimentation control and water quality monitoring on construction projects in the New England area, most extensively in New Hampshire and Massachusetts. Mr. Tinus provided in-house consulting to the NHDOT for their stormwater program. A summary of Mr. Tinus' experience is highlighted below.

Burns & McDonnell

Eversource and Public Service of New Hampshire – Northern Pass Transmission Project – April 2013-Present

Mr. Tinus is serving as the environmental siting and permitting manager on the $1.4 billion program. The project scope includes approximately 150 miles of high voltage direct current (HVDC) transmission, 35 miles of 345-kV alternating current (AC) transmission, a DC/AV converting station and substation upgrades. The 1,200MW transmission project is proposed to transmit predominately hydroelectric power from Hydro Quebec's system using HVDC technology that crosses the United States/Canadian border in Pittsburg, New Hampshire, and is extended south to Franklin, New Hampshire where it will be converted to 345-kV AC. The 345-kV AC line will extend to Deerfield, New Hampshire and connect into an existing substation.

National Grid Comerford 230kV Substation/HVDC Converter Terminal Retirement – Monroe to Lisbon, NH

Served as Project Manager for permitting two related projects with NHDES Wetlands Bureau and USACE consisting of constructing a new access roadway between two electrical transmission facilities retiring a 12-mile ground electrode feeder line and involves temporary wetland impacts. Responsible for managing all stream and wetland delineations, access recommendations, preparing/reviewing permitting documents, overseeing wetland restoration activities, interagency and project team coordination, cultural resources assessments and mitigation, NPDES Phase II stormwater permitting and monitoring and overall staff and budget management.

Iberdrola Renewables – Groton Wind Farm – Groton, NH

As designated Environmental Monitor (EM) for the project, provided weekly inspections, monitoring and reporting for the 48 MW wind energy facility. Interfaced with regulators, contractors and client to ensure successful construction of the project to meet a tight schedule. NHDES expressed satisfaction with project. Prior to EM role, conducted and managed natural resources survey and assessment fieldwork on wetlands, streams, vernal pools and wildlife and supported the Site Evaluation Committee (SEC) review process by authoring various sections of permit applications and responded to post-submittal requests for supplemental technical information during review of the project which was issued a Certificate of Site and Facility by the SEC.

NHDOT – NPDES Phase II Program Manager – Concord, NH

As in-house program manager consultant to NHDOT, managed technical and administrative components of the NHDOT stormwater program. Mr. Tinus interpreted and applied requirements of the Small MS4, Construction, and Industrial Activities general permits as they applied to NHDOT operations and activities. Mr. Tinus was principal author of the NHDOT Stormwater Management Plan (SWMP) document, Small MS4 Annual Reports to USEPA, and managed his tasks using Microsoft Project software. Assisted NHDOT staff with procedure review and writing, recommended stormwater BMPs, reviewed patrol shed SWPPPs for accuracy and compliance, and assisted Small MS4 municipal stormwater groups with various aspects of their programs including drainage mapping and illicit discharge detection and elimination.

NHDOT – Draft and Final EIS – Interstate 93 Improvements – Salem to Manchester, NH
Senior Wetland Field Scientist responsible for wetland/stream delineations and QA/QC review of delineations. Performed wetland functional evaluations, stream crossing assessments and vernal pool surveys. Authored respective sections of Draft and Final EIS. Performed initial reconnaissance and field study of potential mitigation parcels on thousands of acres of land suitable for preservation, restoration or creation within project corridor. Analyses yielded strategy and recommendation for suitability of various properties for inclusion in compensatory wetland mitigation package.

Fidelity – Campus Pond Bank Repair and Restoration – Merrimack, NH
Project Manager for permitting through NHDES Wetlands Bureau. Responsible for production of permit applications, restoration plans and construction coordination. Project involves drawing down 10-acre pond to recreate stabilized vegetated banks through bioengineering practices involving the use of coir logs, compost tubes and replanting pond bank, aquatic emergent, and shrub-scrub wetland communities. Another aspect of project involves removal of invasive species from adjacent wetland.

DDR Corporation – Cains Brook/Mill Brook Salt Marsh Restoration, Seabrook, NH
Task Manager for permitting through NHDES Wetlands Bureau. Responsible for production of permit applications, development of restoration plans, establishment of monitoring protocol and restoration contractor construction coordination. Project involves restoring healthy salt marsh community in 35-acre marsh through removal of invasive plants, re-contouring of marsh substrate and replanting of native vegetation. Other components include baseline data collection, post restoration monitoring, hydraulic modeling and cultural resource investigations.

Tournament Players Club – TPC Golf Course – Norton, MA
Oversaw onsite construction (excavation, backfilling, grading, and planting) of created and restored wetlands on 18-hole golf course and commercial development site. Ensured success of created wetlands through careful monitoring of hydrologic conditions, in-field modification of created wetland areas, review of soils and materials, and supervision of wetland plantings. Monitored invasive species removal and replacement plantings. Established vegetation monitoring plots and groundwater level monitoring wells in large forested wetland to determine possible effects from irrigation well water withdrawals. Prepared baseline monitoring report, first year monitoring evaluation and subsequent year reports providing qualitative and quantitative data on vegetation, soils, and hydrology for study areas. Overall project viewed as a model for others by MADEP.

NHDOT – Spaulding Turnpike/Little Bay Bridge – Newington-Dover, NH
Task Manager for wetlands and vernal pool mapping, wetland functional assessment and mitigation assessment/review/coordination. Assisted with development of compensatory wetland mitigation package which provided recommendations on suitability of reviewed properties for restoration or preservation. Presented findings at

interagency meetings and public hearings. Authored representative sections in EIS.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF LEE CARBONNEAU

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name and business address.

A. My name is Lee E. Carbonneau. My business address is 25 Nashua Road, Bedford, NH 03110.

Q. Who is your current employer and what position do you hold?

A. My current employer is Normandeau Associates, Inc., where I am a Senior Principal Scientist in the Wetlands/Terrestrial Group. I am Normandeau's assistant project manager and permitting lead for the Northern Pass Transmission Project ("Northern Pass" or the "Project") as proposed by Northern Pass Transmission LLC ("NPT"). My testimony describes the wetland and aquatic resource surveys, impact avoidance and minimization and proposed mitigation.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide an assessment of the potential effects of Northern Pass on wetland resources (including wetlands, streams and vernal pools), shoreland permitting, and aquatic resources (including cold water fisheries and mussels). I conclude with my opinion that Northern Pass will not cause an unreasonable adverse effect on water quality or on the natural environment.

Q. Please describe your background and qualifications?

A. I have been in the natural resource field for my entire professional career. I have a BS degree in Forest Biology from the State University of New York College of Environmental Science and Forestry. I worked for The Nature Conservancy at two seasonal internship positions, and then attended the University of New Hampshire where I received an MS in Wildlife Ecology. I worked as an environmental consultant for several years during and after graduate school before joining Normandeau's Terrestrial/Wetlands group in 1989. I have conducted field delineations of wetlands, wetland assessments, mitigation design and construction oversight, wildlife surveys and habitat evaluations, and permitting for projects in all parts of New Hampshire, and elsewhere in the Northeast. I have assisted with aquatic and fisheries surveys and habitat evaluations. I have worked on well over 100 projects while at Normandeau Associates, Inc. I am a Professional Wetland Scientist with the Society of Wetland Scientists ("SWS"), and a Certified Wetland Scientist with the New Hampshire Association of Natural Resource Scientists ("NHANRS"). I am a founding member and was the first treasurer of the New Hampshire Association of Wetland Scientists (now part of NHANRS), and I have served in the past on the Loudon Conservation Commission, and on the Board of Directors and

Stewardship Committee of the Five Rivers Conservation Trust. A copy of my resume is included as Attachment A.

Q. How are you familiar with the Project?

A. I have worked on the Project since 2010. My primary role is to oversee the data collection and analysis of natural resources and water quality impacts to inform Project design and permit applications. In this role, I oversaw the development resource survey work plans and discussed them with state and federal agency personnel; reviewed resource reports; interpreted natural resource data for the engineers; reviewed design drawings and identified opportunities to avoid and minimize resource impacts; reviewed the draft EIS and comments received by the United States Department of Energy ("DOE"); supervised Normandeau staff in the collection of natural resource data and compilation of the state and federal permit applications and the SEC filing; and communicated with state and federal regulatory agencies during project design and permit application phases in the development of work plans and applications. I have conducted some of the wildlife surveys, habitat evaluations, field reconnaissance visits, mitigation parcel assessments, and wetland delineation review site walks with the US Army Corps of Engineers ("USACE") in selected locations. Through the course of my work on the Project, I have reviewed plans and aerial images of the entire Project area. For purposes of my testimony, the Project area includes principally the existing and proposed Project ROW, access roads and site footprints. In our analysis of potential wildlife impacts, we also considered an area approximately one-half mile wide on each side of the corridor, and for aquatic species, some additional stream habitat upstream and downstream of the ROW.

Wetland Studies

Q. Please summarize Normandeau's studies of wetland resources.

A. Wetlands, streams and vernal pools were delineated, classified, and assessed using standardized methods accepted by the NH Department of Environmental Services ("DES") Wetlands Bureau and the US Army Corps of Engineers (US Army Corps of Engineers 1987, 2009, 2012; Cowardin, *et al*. 1979; Federal Highway Administration 1999; New Hampshire Fish and Game Department 2004, Calhoun and Klemens, 2002). Specific details and protocols were discussed with state and federal regulators prior to field work. Delineations were completed during the growing seasons from 2010 through 2015 by, or under the supervision of, New Hampshire Certified Wetland Scientists (NH CWS), consistent with State requirements. Quality control field reviews were conducted by a Normandeau NH CWS throughout the project area; and by USACE in selected locations in 2014 and 2015. With few exceptions, USACE concurred with the resource delineations.

Q. Were the results of these wetland studies documented in reports?

A. Yes. Normandeau produced a technical report that describes existing conditions in the Project area, as well as the expected impacts to the resources. This technical report, titled *Wetlands, Rivers, Streams and Vernal Pools Resource Report and Impact Analysis* and found at Appendix 31, was used to develop permit applications and is appended to permit applications to provide details for agency review. The measures taken to avoid and minimize impacts to wetlands, streams, and vernal pools, and the compensatory mitigation proposed for unavoidable impacts, are described in the *Natural Resource Mitigation Plan*, Appendix 32.

Q. Please describe the Project's work to avoid and minimize wetlands impacts.

A. Avoidance and minimization of impacts to wetlands, streams, vernal pools, and other natural and cultural resources has been an essential element of route selection, Project design, and construction management plan. It has guided all phases of the Project, including: transmission line route selection; siting and configuration of structure foundations; siting of the converter terminal, substation expansions; selection of access road locations (both on and off the ROW); selection of construction Best Management Practices (BMPs); and scheduling of work, especially vegetation clearing.

The decision to place an additional approximately 52 miles of the Project underground in roadways and shoulders from Bethlehem to Bridgewater reduced direct, permanent wetland impacts by approximately 0.6 acres, reduced temporary impacts by over 30 acres, and reduced secondary impacts to wetlands, streams and vernal pools by over 70 acres. These categories of impacts are defined further in the next section of my testimony. Almost two acres of impacts to sensitive plant communities and state-listed plants were also avoided by placing this portion of the line underground. The change to a V-string insulator design for all HVDC overhead structures allows for a narrower cleared ROW, further reducing secondary impacts, plant community impacts, and wildlife habitat impacts. These route and design changes reduced the area of proposed forest clearing by approximately 160 acres.

The environmental resource team and the design team also collaborated during overhead structure siting to adjust the structure layout. This was initially based on maximum spacing and avoidance of transportation and river corridors, with shifts to avoid as many wetlands, vernal pools, small streams, stone walls, regulated shoreland, archeological resources, and rare, threatened and endangered plants as practicable. During an iterative review process, Normandeau scientists made recommendations to the design team for modifying the location or layout of proposed structures, access paths and work pads that were in or near sensitive natural resources. Plans were refined again after "constructability walkdowns" by a transmission construction manager and wetland/wildlife scientist in the fall and winter of 2012 and spring of 2013. This resulted in further reductions of permanent and temporary resource impacts.

In addition, many seasonal restrictions, construction measures and survey requirements have been proposed by the Project to minimize impacts to wildlife or other sensitive resources at critical life stages. Examples include seasonal tree-cutting restrictions wherever acoustic surveys identify possible long-eared bats, leaving tender twigs at the edge of deer wintering areas during winter tree clearing, and searching black racer and turtle nesting habitat during construction activities to avoid accidental crushing by equipment. Some of these avoidance and minimization measures were developed to comply with existing regulations or agency guidance, some reflect BMPs and others are recommendations by Project resource specialists. These measures may be revised during the permitting process, and may be incorporated into permit approvals along with other agency-recommended permit conditions.

Q. Please provide your assessment of the Project's potential impacts to wetland resources.

A. Over 2,000 wetlands, 271 vernal pools, and over 1,000 streams were delineated and assessed during Project field work on the proposed and alternate transmission line routes, facility locations, and off-ROW access roads. Wetlands and waterbodies comprise approximately 26 percent of the proposed Project area. As noted above the Project has fully addressed state and federal requirements to avoid and minimize impact, but it was not possible to avoid all wetland impacts due to the need to clear trees, the limits of structure spacing and the location of other landscape features that have to be considered (roads, driveways, existing transmission and distribution lines, rivers, cliffs, ravines, etc.). Unavoidable wetland impacts were calculated in three categories: permanent, resulting from permanent fill or grading changes; temporary, where timber mats or temporary fill are placed for construction access and work pads; and secondary, including the conversion of forested wetlands to shrub or emergent wetlands by tree cutting, removal of trees in stream buffers and vernal pool buffers, or compression of organic soils by heavy equipment.

The unavoidable permanent wetland/water impact of 2.53 acres is spread out over the 192-mile project. The individual transmission structure foundation footprints are typically spaced hundreds of feet apart, and will have minimal effects on the functions and values of wetlands along the corridor. Permanent impacts to perennial streams were avoided.

There are several Project facilities with larger footprints and correspondingly greater impacts to wetlands. The locations of these facilities were dictated by the transmission design, land availability, constructability issues, and natural resources, and efforts were made to minimize impacts. These facilities must be located on relatively flat ground and their locations are restricted by their purpose. Transition Station 1 is located at the base of a seepy slope. It needs to be adjacent to the transmission line where the overhead line transitions to underground cable, but located low in the landscape to minimize visual impacts. No alternative parcels were available for Transition Station 5, which will require filling in an already-disturbed, low-functioning wetland. The Deerfield substation has been designed in an upland location, but is accessed across a wetland swale that will be modified for truck access. A detention basin was originally located within this wetland, but moved to comply with a strong DES preference to keep detention basins out of wetlands. The primary functions and values of the wetlands affected by the Project are groundwater recharge and discharge, wildlife habitat, and production export (support to the food chain and aquatic energy cycle).

Temporary wetland impacts primarily associated with construction access paths or roads and crane pads will total approximately 140 acres. Large wetland systems in the existing ROW present a construction access challenge as off-ROW access around those wetlands from public roads or adjacent land is not generally available, and therefore construction access from one structure to the next traverses the ROW. To the extent practicable, these areas will be worked on in winter during frozen conditions, or in late summer when ground saturation is generally lowest, thereby minimizing temporary impacts. However, access during other times of the year may be necessary, and in this case, timber mats and other impact minimization techniques will be used. All temporary wetland resource impacts will be restored in place, following a Project-specific restoration plan that makes use of native seed mixes. Secondary impacts, as defined by the USEPA for this project, include the permanent removal of tree canopy from forested wetlands (wetland conversion); clearing of upland forest within 100 feet of all vernal pools and perennial streams; clearing within 50 feet of intermittent streams; clearing within 25 feet of ephemeral streams; and the placement of temporary timber matting on deep organic soils. Secondary impacts total approximately 180 acres, and are highest in the northern portion of the Project route where a new ROW will be cleared. Cutting trees in wetlands or stream/vernal pool buffers can impact certain functions, particularly plant and wildlife habitat. Placing timber mats on deep organic soils may lead to soil compression, and small, local habitat changes. Therefore, the USEPA and USACE require compensation for a percentage (5 to 20%) of secondary impacts. Compensatory mitigation for permanent impacts and secondary impacts is described later in my testimony.

Q. Has NPT filed wetlands applications with state and federal agencies?

A. Yes. Applications for state and federal wetland permits have been submitted with the SEC application for Project activities in wetlands and waterbodies in accordance with RSA 482-A and Env Wt 100-900 and under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act as administered by USACE. (Normandeau also collaborated with Project engineers to develop the 401 Water Quality Certificate application, which provides an assessment of the Project's effect on surface waters, and the Alteration of Terrain Permit application, which details Project-specific drainage plans and stormwater control, in accordance with NH RSA 485-A.)

Q. Please describe the Northern Pass wetlands mitigation package.

A. The plan for mitigating unavoidable wetlands impacts was developed in accordance with the New Hampshire Wetland Rules (Env-Wt 800) and federal regulations for mitigation in New England under Section 404 of the Clean Water Act (40 C.F.R. Part 230). The plan was also designed to address unavoidable impacts to rare, threatened and endangered plant species and wildlife. In an effort to identify mitigation opportunities that were regionally or locally important, NPT researched local and regional planning documents, including the Wildlife Action Plan, for important conservation objectives; and conducted extensive outreach to seven local/regional land trusts operating in the project area, five local river advisory committees, 15 municipalities (with the majority of wetland impacts), and several regional conservation organizations. Suggested conservation and restoration projects were vetted by the Project team and the state and federal regulators. Appendix 48 summarizes the outreach effort and results. Numerous discussions were also held with potential conservation easement holders, and these efforts continue. The final proposed package has been discussed with the DES Wetlands Bureau, the US Army Corps of Engineers, the US Environmental Protection Agency, the NH Fish and Game Department ("NHFG"), the New Hampshire Natural Heritage Bureau, and the US Fish and Wildlife Service ("UWFWS"), during pre-application meetings, correspondence and calls.

Unavoidable temporary impacts to wetlands are addressed in the Project restoration section of the mitigation report, which describes the approach for reestablishing grades, soils and vegetation. Additional details will be included in the final Project construction specifications, which will be developed once permits are obtained. Most temporary wetland impacts will result from the placement of timber mats over low vegetation, where restoration needs will be limited to re-seeding with wetland seed mix, or in some locations, minor regrading. Special treatments for locations with rare plants are also described. The routinely-accepted agency expectation is that if wetland hydrology and soils are in place and vegetation is restored, then wetland functions will become re-established in these areas over time.

Unavoidable permanent and secondary impacts to wetlands, stream buffers, and vernal pool buffers will be mitigated through a compensatory mitigation plan that was developed with input from state and federal agencies. See the *Natural Resource Mitigation Report* at Appendix 32. The quantity of permanent and secondary impacts that must be compensated for is 31.14 acres. Most of the Project impacts are to shrub and forested wetlands and buffers. The largest component of the Project's mitigation plan is preservation of upland buffers around good quality wetlands, one of the DES's preferred mitigation methods, and one which will also provide in-kind mitigation for wildlife habitat impacts.

The proposed mitigation package elements, as summarized in the DES Mitigation Commitment Agreement Form, includes the preservation of 1,668 acres of land in Pittsburg, Clarksville, Stewartstown, Dixville, Columbia, Concord, Pembroke and New Hampton with forested and shrub wetlands, low elevation spruce-fir forest, high elevation spruce-fir forest, perennial, intermittent and ephemeral streams, vernal pools, and some field and old field habitats. This includes the planned preservation and habitat enhancement of pine-barrens habitat in Concord, NH for mitigation of impacts to wild lupine and Karner blue butterfly, at a location yet to be finalized. This total commitment to preservation is 3.5 times the federal regulatory ratio of 15:1 for wetland mitigation through preservation, and five times higher than the state preservation ratio of 10:1. The project continues working to identify one or more conservation easement holders.

NPT has also proposed additional mitigation to comply with the State's preference to distribute mitigation throughout the affected watersheds and towns. To this end, NPT will also make a payment of approximately $3 million to the Aquatic Resource Mitigation Fund (ARM Fund), which compensates for 19.5 acres of wetland impacts in the towns and watersheds with no proposed preservation parcels or local mitigation projects. Appendix 32 shows the distribution of conservation land, local projects, and ARM fund payments by municipality and watershed.

Through consultation with state and federal wildlife agencies, it was determined that additional funding for wildlife habitat management of compensatory mitigation parcels will be an important part of the mitigation package. The Project will work with the agencies to identify the appropriate funding commitment and mechanism for parcel management.

In the event that the completion of the preservation portion of the mitigation package is not successful for any reason, NPT would provide a payment to the ARM Fund sufficient to address all Project-related wetland impacts (calculated to be approximately $4.8 million). Further consultation with state and federal wildlife agencies would take place to develop a compensatory mitigation strategy for unavoidable impacts to wildlife and/or protected plants.

Finally, a contribution of $3 million over three years is being made by NPT to the National Fish and Wildlife Foundation (NFWF). This donation is not considered part of the required wetland compensatory mitigation package, but will enhance natural resource conservation efforts nonetheless. This donation is matched with other corporate and federal dollars and will be made available for on-going NFWF initiatives in New Hampshire including the Early Successional Forest Initiative, Northeast Rivers Initiative (Eastern Brook Trout), and Trust for Public Land's White Mountain Initiative. These funds may also be used for restoration or enhancement of degraded water resources, purchase of lands or conservation easements, and support for scientific research, protection and educational programs associated with endangered species and other wildlife, including species potentially affected by the Project.

Q. Please describe the Project's efforts to consult with state and federal resource agencies.

A. Many multi-agency pre-application meetings have been held to discuss the Project and application requirements for state and federal permits. These meetings included staff and managers from the NH DES Wetlands Bureau, NH DES Alteration of Terrain Program, NH Shoreland Program, USACE, and USEPA. Additional meetings, correspondence, and conversations were held with state and federal technical staff at various times during project design. Meetings were also held with NHFG, NH Natural Heritage Bureau, and USFWS to discuss Project effects on, and mitigation for, rare, threatened and endangered plants and wildlife. Appendix 48 tabulates all of the outreach and pre-application meetings held with the state and federal resource agencies. The Project's wetlands applications and mitigation package include the guidance from these agency personnel, and the notes from discussions with them are included in the DES wetlands application.

<u>Shoreland Water Quality Protection Act</u>

Q. Please describe the Project's work to address the requirements of the Shoreland Water Quality Protection Act.

A. Permit applications for work in the upland portions of the 250-ft protected shoreland of the five ponds and 15 rivers/brooks in the project area that are regulated under the NH Shoreland Water Quality Protection Act (SWQPA, RSA 483-B) and its regulations (Env-Wq 1400), have been submitted with this SEC application. Wetland work is covered in the wetland application, so only work in uplands within the protected shoreland is addressed in the shoreland applications. The activities that are addressed in the shoreland permit applications include earthwork, construction activities, and increases in impermeable surfaces within the various shoreland zones regulated by DES. Tree clearing is also included if there is other construction work taking place. Most of the Project is located in existing ROW, where the earthwork, footprint of the proposed structures, and necessary clearing within protected shoreland is fairly limited and unavoidable. To the extent practicable, new or relocated transmission structures were located outside of the 50-foot Waterfront Buffer zone, although this was not possible in all cases.

The greatest amount of construction activity within the protected shoreland will be near the Pemigewasset River in New Hampton, Ashland and Campton. In New Hampton and Ashland, the overhead line is parallel to the Pemigewasset River within the existing transmission ROW, and construction access and structures will result in temporary and minor permanent impacts. In Campton, the impacts would result from trenching to install underground cable in the existing road ROW, and all impacts are temporary. Shoreland impacts in the new ROW portion of the Project are limited to upgrades of temporary construction access roads in the shoreland of the Connecticut River, Nathan Pond, and Dummer Pond, and a small amount of trenching and a jacking pit at the Connecticut River. All appropriate BMPs, including erosions and sedimentation controls, careful handling of excavated materials and groundwater, and HDD surface water protection practices will be employed to avoid impacts to aquatic habitat and water quality, and on-site environmental monitors will be present during construction. In my opinion, due to the limited nature of permanent impacts and protective measures proposed to minimize temporary impacts, Project construction and operation will not have a substantial negative effect on the protected shoreland of waterbodies in the Project area.

<u>Aquatic Resources</u>

Q. Please describe Normandeau's study of potential impacts to aquatic resources.

A. Normandeau studied potential Project impacts to state or federally listed fish and aquatic invertebrates, cold water fisheries, and Essential Fish Habitat ("EFH"). Fisheries and mussel survey work plans were developed by Normandeau in consultation with state and federal biologists, and an EFH assessment was conducted following standard protocols developed by the National Marine Fisheries Service. The results of this study are set forth in the *Fisheries and Aquatic Invertebrates Resource Report and Impact Analysis*, found at Appendix 33.

Three fish species are listed by New Hampshire as being endangered or threatened, including the state endangered, federally threatened shortnose sturgeon, state endangered American brook lamprey, and the state threatened bridle shiner. NHFG found a bridle shiner in the Lamprey River about 2 miles downstream of the project in 2010, but as there are no known occurrences in the Project area and no instream work planned, surveys were not specifically conducted for rare fish species, and Project-related impacts are not expected.

A review of the EFH data for the Project area indicate that the Connecticut, Androscoggin, Merrimack, and Lamprey Rivers, including their tributaries, have been designated as EFH for Atlantic Salmon eggs, larvae, juveniles, adults, and spawning adults. The proposed above-ground ROW crosses the main channels and tributaries of the Merrimack and Lamprey Rivers, and tributaries of the Androscoggin and Connecticut Rivers. The Lamprey River is the only EFH river within the ROW that is currently accessible to Atlantic salmon, as dams on the other waterways prevent access.

Surveys were conducted in 2013 for the state and federal endangered dwarf wedgemussel (*Alasmidonta heterodon*); state endangered brook floater (*Alasmidonta varicosa*); and state species of special concern eastern pearlshell (*Margaritifera margaritifera*) in streams determined by desktop review to have suitable habitat and adjacent Project-related earthwork or access road crossings. Six streams were surveyed; the Suncook River, Soucook River, Hayward Brook, Punch Brook, Halls Stream, and the Connecticut River. Mussel surveys were conducted by view tube, snorkel or SCUBA gear, depending on water depth.

Q. What are the results of that study?

A. No new permanent culverts, bridges, or stream relocations are planned. As a result, tree canopy removal is expected to be the only activity likely to have any more than a temporary effect on cold-water fisheries in the project area. The Project area contains 282 perennial rivers and streams more than one foot wide, and all were assessed for potential impacts to water temperatures through modeling except for the 69 streams within the underground route between Bethlehem and Bridgewater, where no vegetation clearing is expected. The Stream Segment Temperature Model ("SSTEMP") was used to predict the likelihood of impacts to cold water fisheries (using brook trout temperature tolerances as reported in the USFWS Brook Trout Habitat Suitability Index) from proposed vegetation clearing activities in the Project area.

The modeling and analysis revealed that the estimated increase in *mean annual* stream temperature resulting from vegetation clearing was not statistically significant at any of the streams in the Project area, including the northern segment where new ROW would be cleared. The estimated increase in *maximum* July stream temperature resulting from vegetation clearing was significant for five of the streams within Section N1. See *Northern Pass Fisheries and Aquatic Invertebrates Resource Report and Impact Analysis* at Appendix 33.

The results of the modeling and analysis revealed that the estimated increase in mean annual stream temperature resulting from vegetation clearing was not statistically significant at any of the streams in the Project area, including the northern segment where new ROW would be cleared. The estimated increase in maximum July stream temperature resulting from vegetation clearing was significant for five of the streams within Section N1, where there is currently no maintained ROW. For one of these un-named streams in Dixville (DX243s), the study suggests that maximum stream temperature may temporarily (episodically) exceed the tolerance level for brook trout, an important cold water species in New Hampshire, during the warmest period of the year, which would potentially increase trout avoidance of the stream segment directly within the ROW, assuming no vegetation cover remains at all. Typically, low shrubs develop along ROW streams over time and provide partial shade, which could mitigate the slight impact.

The potential for temporary construction related effects on Atlantic Salmon EFH was considered. Since only the Lamprey River is currently accessible to Atlantic salmon, it was determined that construction activities near the Lamprey River that occur between October and June could have the potential for minor effects on Atlantic salmon. However, construction access paths were modified to avoid crossing this waterbody, tree clearing near the stream will be along the ROW margins only and done with all BMPs in place, and the closest earthwork will now be over 200 feet from the stream. Therefore, no bank or channel disturbance will occur, and the potential for sedimentation impacts to the Lamprey River and its EFH will be negligible.

No listed mussels were observed in 2013, only the common eastern elliptio (*Elliptio complanata*) was observed, which is found in a variety of habitats. However, the DEIS reported brook floater and eastern pearlshell mussels in the Soucook River Project area, and this was confirmed by a return visit in 2015 by the Normandeau expert. One brook floater and one eastern pearlshell were observed in the Soucook River along with many common elliptios. The potential for temporary construction related effects on rare mussels was considered. A structure will be installed within 20 feet of the edge of the Soucook River in the existing ROW. Given the geometry of the River in this location, it was not possible to move the structure further away. The soils in this area are Windsor loamy fine sands in a low runoff class, which reduces potential construction-related sedimentation and water quality concerns. Nevertheless, this site and all BMPs will be carefully monitored during construction, and to the extent practicable, this structure installation will be performed during low flow or winter conditions.

<u>Conclusions</u>

Q. In your opinion will this Project have a substantial negative impact on wetland resources?

A. No. The Project has been designed to avoid and minimize impacts to wetland resources. Approximately 30% of the line (60 miles) will be buried in existing roads/shoulders, with no additional impacts to wetland resources. An additional 34% (66 miles) will be located in existing transmission ROW where many wetlands, streams and vernal pools will be spanned overhead, and some wetland and/or terrain modification has already occurred. Temporarily impacted areas will be restored, and BMPs will be employed during construction. Unavoidable direct impacts to wetlands are small. These unavoidable impacts, as well as secondary wetland impacts and impacts to wildlife resources, will be more than adequately addressed in a compensatory mitigation package that proposes preservation, an ARM fund payment, and funding of other natural resource programs and projects in New Hampshire. The Project has satisfied all regulatory requirements, including filing state and federal wetlands applications that, in my view, address all requirements. For these reasons, I believe that the Project will not have a substantial negative impact on wetlands, streams, or vernal pools.

Q. In your opinion will this Project have an unreasonable adverse effect on water quality? Please explain.

A. No, the Project will not have an unreasonable adverse effect on water quality. I based this opinion on my own analysis of the potential effects on wetlands, aquatic resources and shoreland resources. I also based my opinion on the expert testimony of Jake Tinus on surface water quality and related information included in the Project's SEC application.

Further, all state and federal wetlands and water quality permit requirements will be satisfied. (The applications for all such permits are all included in the Project's SEC application, Appendices 2–6). The Project has avoided all but a small quantity of permanent impacts to surface waters and wetlands by its routing decisions. It has also minimized impact to the extent practicable through routing decisions and Project design. As set forth in the Project's Section 401 Water Quality Certificate application, the Project will meet the state's water quality standards. The Project's mitigation proposals more than satisfy regulatory requirements to provide mitigation for unavoidable impacts to wetlands and natural resources.

Q. In your opinion, will the Project have an unreasonable adverse effect on the natural environment?

A. No, the Project will not have an unreasonable adverse effect on the natural environment. I based this opinion on my own analysis of the potential effects wetlands and aquatic resources. I also rely on the assessments and pre-filed testimony of my colleagues at Normandeau Associates on wildlife (by Sarah Barnum) and plant species (Dennis Magee).

Aquatic resources impacts are expected to be virtually non-existent; as stated above, only one un-named stream in northern New Hampshire may exceed a maximum July stream temperature capable of causing brook trout to avoid the portion of the stream in the newly cleared ROW for short periods of time. The overall effects on aquatic resources, including cold water fisheries and EFH, will be minor given NPT's commitment to BMPs and the absence of in-channel work associated with the Project.

As stated above, I have also concluded from our extensive analysis that the permanent impact to wetlands, streams and vernal pools is small, and that any unavoidable impacts will be fully addressed in the Project's mitigation package.

I have also reviewed and considered the expert testimony and related information included in this SEC application on the Project's potential effects on wildlife and rare threatened and endangered ("RTE") plant species and exemplary natural communities. This includes information presented in the *Northern Pass Transmission Project Wildlife Report and Impact Assessment October 2015*, Appendix 36, prepared by Dr. Sarah Barnum, as well as Dr. Barnum's pre-filed testimony in this proceeding, in which she concludes that the Project will not have a substantial negative effect on wildlife and their habitats.

I have also reviewed and considered the expert testimony and related information included in the SEC application on the Project's potential effects on rare, threatened and endangered ("RTE") plant species and exemplary natural communities. This includes information presented in the *Northern Pass Transmission Project; Rare, Threatened, and Endangered Plants and Exemplary Natural Communities* dated October 2015, Appendix 35, and Mr. Magee's pre-filed testimony, in which he concludes that there will not be a substantial negative effect on RTE plants and rare or exemplary natural communities. He notes that no state threatened or endangered plant species will be impacted in the northern segment, and that none of the RTE plant species occurring in the northern segment is regionally rare.

Q. How does the assessment in the DEIS compare to your assessment?

A. The conclusion presented in the DEIS that impacts to water resources would be minimized by implementing BMPs and mitigation is consistent with our findings. However, stream impacts in the DEIS were assessed at a much larger scale (tenths of miles, rather than linear feet), which may be appropriate for alternative comparison purposes, but inflates and generalizes stream impacts, and is therefore unsuitable for permitting and siting. Similarly, although the DEIS does not clearly state the delineation or impact calculation methods used, it appears that direct, temporary and secondary wetland impacts were defined differently and perhaps calculated differently, as the impact numbers in the DEIS are generally higher than the impacts calculated using agency-approved metrics for the permit applications. For example, the DEIS included wetland conversion in their permanent wetland impact calculations, while Northern Pass identifies it as a secondary impact, consistent with the guidance from the New England federal regulators. Also, our field sampling efforts for freshwater mussels were focused on that subset of perennial streams or rivers with expected Project-related access road crossings or tree clearing and known or potential habitat for dwarf wedgemussel (*Alasmidonta heterodon*), brook floater (*Alasmidonta varicosa*), or eastern pearlshell (*Margaritifera margaritifera*). The DOE team sampled in streams crossed by any of the alternatives that were of sufficient size to support mussels, and consequently found more listed species, although there should be no impacts in these locations.

The DEIS does not include a fish survey or model potential increases in water temperature, but acknowledges the potential impacts of vegetation clearing on water temperatures. We concur with the conclusion that implementation of appropriate BMPs to control erosion and sedimentation, restoration of stream crossings, and compliance with applicable federal and state regulations, including the New Hampshire SWQPA, should minimize Project effects on aquatic resources.

In addition, Normandeau scientists had the advantage of conducting vernal pool surveys during the appropriate season, and documented many more pools than are identified in the DEIS.

Q. Does this conclude your pre-filed testimony?

A. Yes, it does.

ATTACHMENT A

LEE E. CARBONNEAU, PWS, NHCWS

Sr. Principal Wetland Scientist/Wildlife Ecologist

Ms. Carbonneau is a wetland scientist and wildlife biologist with over 25 years of experience assessing terrestrial and wetland communities throughout the northeastern United States. As a senior project manager, she is responsible for providing ecological services for clients in the energy, transportation, site remediation, and development sectors, with particular emphasis on large-scale and complex undertakings. Ms. Carbonneau also provides third-party expertise to state and local resource agencies. Her skills include wetland delineation and assessment, mitigation design, wildlife survey, habitat assessment, and state and federal natural resource permitting in both inland and estuarine environments. Ms. Carbonneau is vice-chair of Normandeau's Transmission Client Service Group and supervises the Wildlife Scientist staff assigned to Normandeau's corporate headquarters in New Hampshire.

EDUCATION

M.S. Wildlife Ecology, University of New Hampshire

B.S. Forest Biology, SUNY College of Environmental Science and Forestry, Magna cum laude

PROFESSIONAL EXPERIENCE

1989-Present	Normandeau Associates, Inc.
1986-1989	The Smart Associates
1985-1986	Environmental Consultant
1983-1985	University of New Hampshire
1982	EIP Northeast and The Nature Conservancy
1981	The Nature Conservancy-Lower Hudson Chapter

PROFESSIONAL CERTIFICATIONS

- Professional Wetland Scientist #882
- NH Certified Wetland Scientist #123

PROFESSIONAL AFFILIATIONS

- Society of Wetland Scientists
- New Hampshire Association of Natural Resource Scientists
- Board of Trustees – Five Rivers Conservation Trust (2004-2009)

REPRESENTATIVE PROJECT EXPERIENCE

Northern Pass Transmission Line Project, Eversource Energy, New Hampshire (2010-Present). Northeast Utilities is proposing the Northern Pass Transmission Line, a 180-mile HVDC and AC Transmission project to bring hydropower from Quebec into New Hampshire and the New England region. The project design also includes a converter terminal, transition stations, and substation upgrades. Ms. Carbonneau is responsible for high-level natural resource screening, assisting with field team and subconsultant coordination, resource assessment documentation, State and Federal permitting strategy and agency coordination, Site Evaluation Committee submittals, and mitigation design. Permitting Specialist/Assistant Project Manager.

G-146 Transmission Line Thermal Uprate Project, Eversource Energy (2012-Present). The 115 kV G146 Transmission Line extends 18 miles from Garvins Falls in Bow, New Hampshire to the Deerfield substation. Ms. Carbonneau and her team provided mapping of wetlands, vernal pools, threatened and endangered plants and wildlife, bathymetric surveys, and archeological resource surveys. She was responsible for local, state, and federal agency coordination and permitting. She also managed the construction monitoring for permit compliance. Project Manager.

Industri-Plex Superfund Site Remediation, Industri-plex Site Remedial Trust, Woburn, Massachusetts (1990-1999 and 2009-Present). The Industri-plex Superfund Site was contaminated with arsenic, chromium, and other contaminants associated with its long tanning and manufacturing history. Remediation included sediment capping in wetlands and soil capping in uplands to reduce contaminant exposure for plants and wildlife. Ms. Carbonneau was responsible for wetland project work from pre-design investigations through 100% design and operations and maintenance. She provided wetland/wildlife assessments, wetland restoration and compensatory mitigation design, upland seed mix selection, construction management, agency coordination and Applicable or Relevant and Appropriate Requirements compliance, as well as long term monitoring of vegetation, sediment/water quality, and macroinvertebrates. The 10-acre mitigation package included a surface water-supported compensatory wetland with a low-permeability liner, restored marshes on sediment caps, restored riparian shrub wetlands and buffers, and a wetland enhancement for wildlife. Project Manager.

Public Access Projects, New Hampshire Fish & Game Department (2008-Present). Ms. Carbonneau has assisted NH Fish & Game with development and maintenance of public access boat ramps and related facilities by providing the project team with natural resource surveys, permitting, and environmental assessments, including rare plant surveys. One of these projects, the controversial Lake Sunapee Wild Goose boat ramp, also required public meeting presentations as well as expert testimony before the Wetlands Council. Project Manager.

Dover Landfill Superfund Site Remediation, Dover Landfill Remedial Trust, Dover, New Hampshire (1993-1996 and 2011-Present). The 50-acre Dover Landfill Superfund Site required both sediment and groundwater remediation for arsenic and other contaminants. Ms. Carbonneau managed the Normandeau team providing wetland delineation, habitat evaluation, vernal pool surveys, phased sediment sampling and excavation plans for the Cocheco River and tributary, perimeter ditch evaluation, aquatic macroinvertebrate sampling, and establishment of vegetation plots and piezometers, and long-term monitoring of groundwater extraction effects on wetlands. Ms. Carbonneau was also responsible for restoration strategy, agency coordination, and Applicable or Relevant and Appropriate Requirements compliance. Project Manager.

Shoreline Management and Bald Eagle Monitoring, Public Service of New Hampshire, Penacook to Manchester, New Hampshire (2003 and 2010-Present). PSNH's FERC license for operation of the dams on the Merrimack River includes requirements to protect shoreline resources, including monitoring of winter eagle activities along the 22-mile project area. Ms. Carbonneau has been responsible for developing the eagle roost/perch survey protocols, observation site selection, habitat assessment, state and federal wildlife agency coordination, and management of surveys. She also provides threatened and endangered species surveys, review of river access and dock plans from local residents, and assistance with land conservation projects and FERC deliverables. Project Manager, Wildlife Biologist.

Old-Growth and Exemplary Natural Community Survey, Confidential Client, NH (2014 to Present). Ms. Carbonneau provided expertise in forest habitat evaluation for a recreational developer with a project that potentially affects high value forest communities. She surveyed and evaluated forest habitat in the project area and in a potential mitigation area for old-growth characteristics and exemplary natural community criteria.

D-118 Transmission Line Rebuild Project, Eversource Energy (2011-2015). The 15-mile, 115 kV D118 Transmission Line in Hooksett, Candia and Deerfield, NH is a complete rebuild project with all new structures and conductor. Ms. Carbonneau and her team provided mapping of wetlands, vernal pools, threatened and endangered plants and wildlife, and archeological resources. She was responsible for state and federal agency coordination and permitting, and mitigation. She also managed the construction monitoring for permit compliance. Project Manager.

Hampton Beach Infrastructure Improvements, Town of Hampton, New Hampshire (2004 and 2012-2014). The Town of Hampton needed to replace the old clay sewer pipes and an inadequate stormwater system along the coastal Hampton Beach area. The improvements involved temporary construction in the Hampton Saltmarsh, a Prime Wetland, regionally important habitat and Important Bird Area. Ms. Carbonneau provided the Town with tidal marsh mapping, impact evaluation, restoration design, wetland and shoreland permitting and construction oversight. Project Manager.

Route 1A Bridge Replacement, City of Portsmouth, New Hampshire (2010-2015). The replacement of the red-listed Route 1A bridge over tidal Sagamore Creek required state and local wetland permitting, rare plant surveys, an Essential Fish Habitat assessment, NEPA compliance (Categorical Exclusion), and Coastal Zone Compliance. Ms. Carbonneau provided the field studies, agency coordination, permitting documents, and managed turbidity monitoring and post construction restoration for permit compliance. Project Manager.

326 Transmission Line Thermal Uprate Project, Public Service of New Hampshire (2011-2014). This 18.5-mile, 345 kV transmission line from Londonderry through Hudson and Pelham, NH was uprated, requiring an increase in ground clearances by raising selected structures, grading, and hardware replacement. Ms. Carbonneau provided natural resource mapping, access assessment, permitting, and construction monitoring. Project Manager.

Scobie-Tewksbury Transmission Line Planning, Public Service of New Hampshire, Londonderry to Hudson, New Hampshire (2012-2013). The planning phase for a new 345kV transmission line from southern New Hampshire to central Massachusetts included delineation wetlands and vernal pools along the PSNH-owned portion of the route, and compilation of relevant natural resource data from adjacent transmission lines into a single map set. Ms. Carbonneau led the team of scientists that provided these services to PSNH. Project Manager.

Sewer Stabilization Project, Town of Goffstown, New Hampshire (2011 -2013). The town sewer main is located in a rail trail on a steep embankment above the Piscataquog River. Several years of severe storm events destabilized the embankment, threatening the sewer main, and requiring immediate remedy. Ms. Carbonneau worked with the engineers to design a solution that minimized hard armoring of the riverbank; and was responsible for delineating wetlands, obtaining environmental permits, and restoring the riverbanks and floodplain in the project area. Project Manager.

C-129 Transmission Line Uprate Project, Public Service of New Hampshire (2011). Upgrades to the 18-mile long C129 transmission line through five towns required accessing selected locations and structures to replace hardware and conductor, and obtaining wetland permits and access plans. Ms. Carbonneau was responsible for managing field surveys, mapping, access route selection, and permitting efforts, and helped craft a unique permitting approach that included a combination of utility notifications and a standard permit, and allowed part of the work to be conducted immediately under a previously issued permit for an adjacent project. Ms. Carbonneau also provided agency coordination and surveys for endangered and threatened turtles, snakes and New England Cottontail habitat. Project Manager, Wildlife Biologist.

Ascutney Substation Project, Vermont Transco, LLC, Weathersfield, Vermont (2010-2011). To construct a new 115 kV substation and associated one-mile tie line, VELCO needed wetland permits and approval from the VT Public Siting Board. Ms. Carbonneau managed the wetland, stream, vernal pool and deer wintering habitat mapping, assessment, and natural resource report, and provided Section 248 pre-filed testimony. She also managed preliminary delineation and wildlife assessments on an additional 15 miles of transmission line. Project Manager, Wildlife Biologist.

Tolend Road Mitigation, City of Dover, New Hampshire (2010-2011). A road improvement project in the City of Dover required compensatory wetland mitigation, and the City wanted to meet the mitigation requirements by placing a deed restriction on a parcel the city already owned. Ms. Carbonneau evaluated city-owned parcels in the affected watershed, provided wetland delineation and assessment on the preferred parcel, and prepared the necessary documentation, and local, state and federal agency coordination for approval. Project Manager.

L175 Transmission Line Rebuild Project, Public Service of New Hampshire (2009-2011). The 115kV L175 transmission line passes through six southern New Hampshire towns, and was in need of rebuilding. Ms. Carbonneau provided wetland delineation and evaluation, local, state and federal permitting, and construction monitoring for this 13.5-mile corridor. Working with state resource agencies, she identified task scheduling and work practices that met the project schedule while protecting habitat for threatened and endangered species, including New England cottontail, Blanding's and spotted turtles, and black racers. Project Manager, Wildlife Biologist.

Municipal Wetland Consulting Services, New Hampshire (2006-2011). Ms. Carbonneau has provided expert, scientific assistance to various municipalities for review of state permit applications, wetland delineations by homeowners and other consultants, wildlife habitat assessments, and local permit applications, such as Conditional Use Permits. She has provided such services for the Towns of Hudson, Strafford, Merrimack, and others. Wetland Scientist.

Pilot Instream Flow Studies, New Hampshire Department of Environmental Services (2005-2011). The New Hampshire Department of Environmental Services wanted to devise a standard method for identifying the instream flows necessary to maintain the ecological integrity and public uses of rivers designated under the Rivers Management and Protection Act. Ms. Carbonneau studied seasonal water flow dependency of rare, threatened, and endangered wildlife, plants, and riparian communities on the designated reaches of Souhegan and Lamprey Rivers to complement fisheries and other studies conducted by the team. Her responsibilities included field studies, literature research, aerial stereo-photo interpretation, reports, and presentations to the Technical Advisory Committee and the public. Project Ecologist.

Coal Tar Remediation, Westfield Gas and Electric Company, Westfield Massachusetts (2005-2011). Site remediation of this gas manufacturing site on the Westfield River included the excavation of contaminated soils in the floodplain. Ms. Carbonneau was responsible for the delineation of wetlands, Massachusetts Simplified and Detailed Wildlife Habitat Evaluation, WEThings evaluation, agency coordination, preparation of the Massachusetts Notice of Intent and 401 Water Quality applications, floodplain and wetland restoration design plans, and restoration monitoring. Wildlife Biologist, Project Manager.

New Castle Avenue Seawall Reconstruction, City of Portsmouth, New Hampshire (2001-2011). Route 1B and the adjacent seawall in the City of Portsmouth, a popular auto, pedestrian and biking route, was deteriorating and in need of replacement, requiring excavation and restoration of the salt marsh adjacent to the seawall. Ms. Carbonneau provided natural resource surveys, state and federal regulatory analysis and permitting, Essential Fish Habitat assessment, Categorical Exclusion documentation, and salt marsh restoration design/construction oversight. A compensatory mitigation area was also constructed in a nearby tidal pond with harvested peat blocks. Both successful mitigation areas were monitored for five years. Project Manager.

Littleton-Waterford 115 kV Line and Substation Expansion, Public Service of New Hampshire (2009). PSNH proposed an expansion of its Foster Hill Road substation in Littleton, NH and the one-mile 115kV transmission line from the substation to the transmission system in Vermont. Ms. Carbonneau managed the Normandeau team that provided natural resource site investigations, including wetland delineations and endangered and threatened species surveys. The project area included a Rich Mesic Forest Exemplary Natural Community, a State-threatened plant, and wetlands, streams, and vernal pools. Project Manager.

Manchester Airport Access Project, New Hampshire Department of Transportation, Manchester to Litchfield, New Hampshire (1997-2001 and 2005-2009). This major highway and bridge construction project included an EIS addressing multiple alternative access roads to the expanding regional airport. Ms. Carbonneau provided wintering Bald Eagle surveys for the Draft EIS, as well as the bald eagle protection components of the final project mitigation package in the Final EIS. Ms. Carbonneau was responsible for developing and implementing the mitigation plan, which included several years of wintering eagle monitoring, an eagle habitat management plan, GIS property ownership mapping, a river ice aerial mapping/assessment , and construction of an alternative nest, which successfully attracted a nesting pair of eagles. Wildlife Biologist, Project Manager

Mount Washington Resort Expansion, Carroll, New Hampshire (2007-2008). The planned expansion of the Mount Washington Resort included the 199-unit, 185-acre Dartmouth Brook development, expansion of an existing golf course, and planned development of the Bretton Woods Ski Area. Ms. Carbonneau provided wetland/stream delineation and assessment; Canada Lynx and American Marten habitat assessment; breeding bird and vernal pool surveys, and state and federal permitting. Project Manager.

Granite Reliable Power Windpark, **Noble Power, Millsfield and Dixville, New Hampshire (2007-2008)**. Resource surveys for siting 33 Granite Reliable Power wind turbines and access roads along 31 miles of back-country logging roads and ridge-top forestland required a team effort. Ms. Carbonneau was responsible for managing a portion of the field team that delineated wetlands, streams and vernal pools in remote Coos County in northern New Hampshire. Field Team Co-Coordinator.

Metal Recycling Yard Improvements, Schnitzer Steel, Concord, Claremont and Madbury New Hampshire (2007-2008). Ms. Carbonneau provided wetland delineation and permitting services for three metal recycling facilities around the state in preparation for stormwater and drainage improvements. She also designed a stormwater treatment wetland at one of the sites, and oversaw the construction. Project Manager.

Shaffer Landfill Superfund Site Remediation, Shaffer Landfill Remedial Trust, Billerica, Massachusetts (2001-2008). The Shaffer Landfill Superfund Site Closure project included mitigation design and a *Phragmites* control plan for 2.8 acres of shallow and deep marsh creation, restoration and enhancement to compensate for wetland impacts associated with landfill closure operations. Ms.

Carbonneau was responsible for managing the mitigation construction work, acting as liaison between the contractors, engineers and US EPA, and providing five years of post-construction monitoring. Project Manager.

CSO Outfall Reconstruction City of Nashua, New Hampshire (2006-2007). A Combined Sewer Overflow (CSO) on the bank of the Merrimack River was failing, and the eroding bank was threatening the stability of a railroad and critical fiber-optic cables. In addition, the State and EPA required the City to reduce CSO discharges. Ms. Carbonneau delineated wetlands, prepared an Essential Fish Habitat (EFH) assessment for Atlantic salmon; coordinated with NH Fish and Game and the USFWS regarding bald eagle habitat, migratory fish, and rare mussels; prepared bank restoration plans; and assisted the City in obtaining local, State and Federal permits to restructure the outfall system and stabilize the bank. Project Manager.

Manufactured Gas Plant Site Remediation, Concord, New Hampshire, (2005-2007). The remediation of a coal tar site in Concord NH culminated in the restoration of a silver maple floodplain forest and oxbow wetland. Ms. Carbonneau, as project manager and lead ecologist, studied the adjacent floodplain communities and developed a restoration grading and planting plan to replicate the plant communities at their appropriate elevations. She also provided restoration oversight for the successful project. Project Manager.

Blackburn & Union Privileges Superfund Site Remediation and EcoRisk Support, Walpole, Massachusetts (1991-1997; 2000-2001; 2006). This Superfund Site on the Neponset River was contaminated with asbestos, volatile and semi-volatile organics, pesticides, metals, phenolics, cyanides, and petroleum hydrocarbons. Ms. Carbonneau, familiar with the site during decades of remediation support, provided pre-design resource surveys; mitigation design and construction; ecological risk assessment receptor surveys, including bird and stream macroinvertebrate inventories; and wetland restoration feasibility studies for downstream impacts. Project Manager, Wildlife Ecologist.

Water Supply Improvement Projects, Pennichuck Water Works, Nashua and Merrimack, New Hampshire (2004–2006). The proposed installation of aerators, flow-routing baffles, and intake facility improvements in three ponds on Pennichuck Brook would achieve improvements to raw water quality for drinking and native biota. Ms. Carbonneau was responsible for wetland delineation and natural resource permitting for the improvements. Project Manager.

Tidewater Farm Habitat Assessment, Bateman Partners LLC, Falmouth, Maine (2005). Tidewater Farm is a residential and land conservation development on an approximately 10 acre property on the Presumpscot River estuary. Planning for the development included habitat survey/mapping and evaluation. Ms. Carbonneau recorded physical characteristics (slopes, soils, hydrology etc.), vegetation (species, structure), and wildlife sign survey (browse, trails, scat, dens, etc.) within each of the dominant cover types. Of critical importance was a survey for the state-endangered New England Cottontail. Wildlife Biologist.

Yadkin River Reservoir FERC Relicensing, Alcoa Power Generating, North Carolina (2004-2005). The Yadkin Project consisted of a four-dam system of hydrogeneration facilities and reservoirs located on the Yadkin River in North Carolina. Ms. Carbonneau provided aerial photo interpretation and field investigations for the evaluation of reservoir control alternatives on wetlands and rare, threatened and endangered species in the reservoirs for incorporation into the relicensing application. Staff Ecologist.

Wildlife Studies for Base Closure, South Shore Tri-Town Development Corporation, South Weymouth, Massachusetts (2002-2004). Ms. Carbonneau participated in vernal pool studies, bird inventories, and turtle (box and spotted) trapping and radiotelemetry tracking conducted at the former South Weymouth Naval Air Station to support the post-closure development planning process. Staff Ecologist.

Site Remediation, Ward Products Corporation, Amsterdam, New York (2000-2004). An industrial site near the Mohawk River with a 16 year history of metal finishing processes was placed on the State list of Inactive Hazardous Waste Sites and field studies under an Order on Consent were conducted to determine the potential for on-site and off-site migration of hazardous/industrial wastes. Ms. Carbonneau conducted a potential receptor survey using the NY Department of Environmental Protection Fish and Wildlife Impact Analysis (FWIA) protocol, and provided coordination with multiple state and federal agencies. Wildlife Ecologist.

Reservoir Operation Programmatic EIS, Tennessee Valley Authority (TVA) (2002-2003). Seven alternative reservoir operations were evaluated for the 35 dams and reservoirs of the TVA system, which operates throughout Alabama, Georgia, Kentucky, Mississippi, North Carolina and Tennessee. Ms. Carbonneau identified managed areas and ecologically significant sites around the TVA reservoir system with TVA ecologists and assessed potential effects of multiple management alternatives for the Programmatic EIS. Staff Ecologist.

Chase Brass and Copper Site Bioengineering and Habitat Restoration, Waterbury, Connecticut (2001–2003). The remediation of the Chase Brass Superfund Site called for the concentration and containment on-site of soil-bound contaminants located within the Naugatuck River floodway and three tributary streams. Under a USEPA START contract, Ms. Carbonneau was responsible for mitigating the effect of a heavy riprap application with biological elements to improve wildlife habitat. Her designed improvements included in-channel tree root wads and boulder shelters for fish and other aquatic organisms; cairns as a shelter for small mammals and snakes; and planting of emergents, vines and woody and herbaceous plants in soil pockets. Project Manager.

Southern New Jersey Light Rail Transit System Design-Build-Operate-Maintain Project, New Jersey Transit Corporation (2000-2002). Three mitigation projects were designed to compensate for impacts to State- and Federally-regulated wetlands and open waters along a 34-mile long rail corridor in New Jersey. Ms. Carbonneau was responsible for grading and planting plans for one of these sites, a 3.25-acre freshwater tidal marsh restoration project in an area choked with a dense monotypic stand of invasive common reed. Wetland Scientist.

Industrial Site Ecological Risk Assessments, United Technologies, Connecticut (2000-2001). Ms. Carbonneau provided field support for ecological risk assessments at three contaminated industrial sites on rivers in several Connecticut towns targeted for voluntary cleanup efforts. She was responsible for surveys of grassland birds, rare plants, and raptors, and also provided ecological site characterizations, conceptual site models, receptor species lists and exposure pathways for ecological risk assessments. Project Ecologist.

Fayscott Remediation Site, Fayscott Corp., Dexter, Maine (1998-2001). To assist with the permitting of remedial activities at this uncontrolled hazardous waste site on Fay Scott Bog (East Branch of the Sebasticook River), Ms. Carbonneau provided a wildlife habitat inventory, addressing Candidate Significant Wildlife

Habitats (Waterfowl and Wading Bird habitat and a Deer Wintering Area), Essential Wildlife Habitat (bald eagle nest BE 275 A), fisheries, reptile and amphibian habitat. She provided cover type mapping, wetland delineation, bird surveys, and permitting assistance. Project Manager, Principal Ecologist.

Coakley Landfill Superfund Site, North Hampton, New Hampshire (1992-2000). This contaminated landfill was remediated through the Superfund process. Ms. Carbonneau provided wetland delineation and assessment, sediment sampling and remedial/restoration design for remedial impacts. Her responsibilities included permit equivalency and compliance with Applicable or Relevant and Appropriate Requirements, development of wetland restoration plans, restoration oversight, and long-term monitoring. Project Manager.

Energy Site Redevelopment Project, PECO Energy Company, Chester, Pennsylvania (1998-1999). Site constraints for the redevelopment of a brownfield site in Chester, PA were identified by Ms. Carbonneau through endangered species investigations (including Peregrine Falcon) and wildlife habitat evaluation using the Modified Pennsylvania Habitat Evaluation Procedures (PAM HEP) for selected birds and mammals. Botanist/Wildlife Biologist.

Newington-Dover Environmental Assessment, New Hampshire Department of Transportation (1990-1991). Ms. Carbonneau provided preliminary ecological studies and constraints mapping for the upgrade of the Spaulding Turnpike near the Piscataqua River and Great Bay. Sensitive resources in this project area included estuarine wetlands, freshwater wetlands, protected plant species, fisheries habitat, and important farmlands. Project Manager.

Groundwood Pulp and Light Weight Coated Paper Mill Siting Project, Great Northern Nekoosa, Millinocket, Maine (1989-1990). Ms. Carbonneau was responsible for wetland and wildlife habitat inventories and bird surveys on hundreds of acres of undeveloped forestland in northern Maine, as part of the site selection process for a new pulp mill. She co-authored the supporting documentation for the Site Location of Development, Natural Resource Protection Act, Section 404 and NEPA-related approvals. Wetland Scientist/Wildlife Biologist.

REPRESENTATIVE PUBLICATIONS AND PRESENTATIONS

Carbonneau, L.E. 1986. Old Growth Forests -Forest Notes, Winter 1986. Society for the Protection of New Hampshire Forests. 5 pp.

Carbonneau, L.E. 1986. Old Growth Forests in New Hampshire - A Preliminary Investigation. M.S. Thesis, University of New Hampshire. 124 pp.

Miller, D., L. Gradischer (Carbonneau), J. Orzel, W. Leak, and E. Miller. 1987. Changes in vegetation and breeding bird use of an Atlantic white cedar swamp from 1951 to 1984. pp. 229-231 in A.D. Laderman, ed. Atlantic White Cedar Wetlands. Westview Press, Boulder, CO.

Ecological restoration at hazardous waste sites; Session Chair; 1994 New England Environmental Exposition, Boston MA.

Allen, S.D., L.E. Carbonneau, R.R. Bryan, and D. Scott. 1994. Assessing woody plant condition during mitigation site construction and monitoring. Society of Wetland Scientists 1994 annual meeting, Portland, OR.

Carbonneau, L.E. and S.D. Allen. 1995. Botanical reconnaissance of the Bowl Research Natural Area. USDA Forest Service, Northeastern Forest Experiment Station. General Technical Report NE-189. 26 pp. (also presented as a poster session at the 1993 Natural Areas Conference, Orono, ME).

Carbonneau, L. E. 2000. Wetland restoration at the Industri-plex Superfund Site. EnviroExpo, Boston, Massachusetts. May 10, 2000.

Masters, R. A., C.W. Helm, A. Mardirossian, B. Colvin, L.E. Carbonneau, and J.S. Simmons. 2001. Innovative Tidal Wetlands Mitigation for a Light Rail Design-Build-Operate-Maintain (DBOM) Project in New Jersey. Proceedings of the American Society of Civil Engineers Wetlands Engineering and River Restoration Conference, Reno NV.

Masters, R. A., C.W. Helm, A. Magliaro, B. Colvin, L.E. Carbonneau, and J.S. Simmons. 2002. Rising Tide. Civil Engineering. February 2002. Vol. 72 (2): 44-49.

Habitat Restoration on Conservation Lands – Special Places Conference Presentation, Hopkinton, NH 2004.

SPECIAL TRAINING

SCUBA Certified

First Aid and CPR Certified

OSHA HAZWOPER and Site Supervisor Training

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF SARAH A. BARNUM

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name and business address.

A. My name is Sarah A. Barnum. My business address is 25 Nashua Road, Bedford, New Hampshire 03110.

Q. Who is your current employer and what position do you hold?

A. I am employed by Normandeau Associates Inc., as a Senior Wildlife Ecologist in the Wetland/Terrestrial Group.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide my assessment of potential impacts of the Northern Pass Transmission Project ("Northern Pass" or the "Project") as proposed by Northern Pass Transmission LLC ("NPT") on wildlife species. I conclude with my opinion that the Project will not have a substantial negative effect on wildlife.

Q. Please describe your background and qualifications?

A. I have been working as a wildlife biologist for my entire professional career. I received my BS in Wildlife Biology from the University of Vermont in 1988, my MS in Wildlife Biology from Utah State University in 1994, and my Ph.D. in Planning from the University of Colorado at Denver in 2003. My thesis research examined nest-site selection by American coots, and my dissertation research evaluated the habitat and roadway variables associated with wildlife highway-crossing locations. My professional experience has included working on the Deer Project for VT Fish and Wildlife, working for a variety of environmental consulting firms, working as an environmental planner for the Colorado Department of Transportation, and as the Vice President of Conservation for New Hampshire Audubon.

I have been at Normandeau since 2007 in the Terrestrial/Wetlands Group, where I have provided a range of wildlife and habitat services, including field and desktop habitat assessment for wildlife species, avian surveys, tracking surveys, amphibian surveys, and reptile surveys, in addition to survey design, project planning, and project management. I am a Certified Wildlife Biologist® by the Wildlife Society, I have served on the Conservation Commission in the Town of Epsom NH since 2007, and I am the Town's liaison to Bear-Paw Regional Greenways where I sit on the Land Protection Committee. A copy of my resume is included as Attachment A.

Q. How are you familiar with the Project?

A. I am very familiar with Northern Pass and the lands which it crosses. I have flown the entire ROW, including proposed locations for transition stations, existing substations and the proposed converter terminal by helicopter, walked the majority of the route, including some access roads—some sections multiple times—driven along or across the ROW in many locations, and spent many hours working with aerial photography and other GIS-based data of the Project area.[1] I have also examined the proposed Project plan sheets and I have reviewed extensively the U.S. Department of Energy's July 2015 draft Environmental Impact Statement.

Q. Did you and your colleagues at Normandeau perform an assessment of RTE wildlife species?

A. Yes, we prepared an assessment that is set forth in a report entitled *Northern Pass Transmission Project Wildlife Report and Impact Assessment October 2015*, which is included as Appendix 36.

Q. What was your role in preparing that report?

A. I was the sole author. In addition to my own work and analysis, I relied on the wildlife survey results performed by other biologists at Normandeau under my supervision. Additionally, I wrote or coordinated the writing of all the individual survey results reports, the findings of which are summarized in the final report.

Wildlife and Avian Studies

Q. Did any government agencies have input regarding Normandeau's work?

A. Yes. New Hampshire Fish and Game ("NHFG") biologists, the White Mountain National Forest ("WMNF") Forest Supervisor, and Endangered Species Biologists from the New England Field Office of the US Fish and Wildlife Service ("USFWS") all had input on the wildlife work conducted for the Project. I had numerous in-person conversations and phone conversations with NHFG biologists, and exchanged e-mails wherein NHFG made requests for specific resources to be considered, and/or commented on Normandeau's proposed study methodology. However, with the exception of the winter tracking survey, NHFG did not request

[1] "Project area" as used in this testimony means the Project transmission line corridor, some consideration of the buffer along the corridor, the location of the so-called fixed facilities -- converter terminal, transition stations, and substation upgrades -- and access roads and lay down areas.

that work plans be submitted to them prior to conducting surveys. Normandeau's Task Managers for the Project met with the WMNF Forest Supervisor in June, 2010 to brief him on the Project, and subsequently received resource-specific guidance on multiple occasions from the Forest Resource Specialists, regarding the resources to be evaluated in the WMNF portion of the Project. Normandeau's permitting lead, Lee Carbonneau, and I had multiple phone conversations with USFWS Endangered Species Biologists, regarding the resources to be evaluated, as well as some general discussion of methods to be used. A tabulation of these consultations is included in Appendix 48.

Q. Please describe Normandeau's studies.

A. Normandeau evaluated the potential impacts to wildlife resources as a result of the Project, and recommended impact avoidance, minimization and mitigation measures. The resources considered were based on agency requests, and included specific habitats and species present or likely to use the Project area, in addition to an analysis of the general wildlife habitat and species likely to be present. Between January, 2011 and August, 2015 Normandeau designed and conducted a variety of desktop and field studies to evaluate the wildlife and habitat resources in the Project area. The results of this work are contained in the Wildlife Report and Impact Assessment found at Appendix 36.

In conformance with requests by NHFG, USFWS, and/or USFS guidance, all state-listed wildlife species (State Threatened, State Endangered), federally listed wildlife species (Federally Threatened, Federally Endangered), and WMNF Forest Service Sensitive species were initially screened for their potential to be present. NHFG also requested that the Project evaluate distribution of three high-value habitat types, Deer Wintering Areas, Moose Concentration Areas, and high value mast areas (forest stands with nut or fruit trees). Additionally, we considered forest nesting birds as a group at the request of the USFWS and all species listed as Species of Special Concern by the State of New Hampshire.

There was general agreement from the agencies on the methodology and approach used to evaluate each resource, but with the exception of the winter snow tracking methods for lynx, the agencies did not request to review or provide comments on resource-specific work plans. Some species were assumed to be present in the Project area, based on existing information from the various agencies on their known distribution and records of occurrence held by the New

Hampshire Natural Heritage Bureau. For the other species, potential presence within the Project area was evaluated using desktop analyses, direct surveys, snow tracking surveys, targeted habitat surveys, general habitat surveys, and/or incidental observations. Assessment of habitat suitability and potential presence in the Project area for some State-listed species was restricted to desktop analysis, based on their known rarity and low potential to encounter them during field surveys. Targeted surveys for State-listed species known to be present in the vicinity of the Project area, but with little to no suitable habitat within the Project area itself, were not conducted. Instead, incidental observations of these species or locations of with potentially suitable habitat were also noted during other surveys.

Direct surveys were used for species that have a good likelihood of being detected if present, using appropriate survey methods and that could reasonably be expected to be in a specific, identifiable location within the Project area (Bicknell's thrush, common nighthawk). Snow tracking surveys were used for Canada lynx and American Marten. Targeted habitat surveys consisted of desktop analysis to identify specific locations likely to host resources of interest (turtle nesting habitat, lynx denning habitat, wild lupine), followed by field observations in the specific location identified. General habitat observations were made as a part of all wildlife fieldwork; general habitat conditions and the presence of specific habitat resources (potential bat roosting habitat, high value mast areas) were routinely noted.

The site-specific methodologies designed to evaluate the Project resources were tailored to meet the needs of the Project, based on accepted practice. All desktop analyses were based on the best available information at the time of the analysis, and included NHFG Wildlife Action Plan data resources, current aerial photography, and current information from the New Hampshire Natural Heritage Bureau regarding the known distribution of wildlife species. The Bicknell's thrush and common nighthawk surveys were based on published species-specific point count methods developed for these species. The northern black racer survey was designed in cooperation with NHFG biologists engaged in a multi-year, ongoing study of this species. The methods for the snow tracking survey were based on lynx occupancy survey methods developed by the US Forest Service, and were approved by NHFG. For targeted habitat surveys, the approach used to identify and survey for turtle nesting habitat was approved by NHFG.

Q. Please describe the steps that NPT is taking to minimize impacts to wildlife species, including special status species, known or likely to be present in the Project area.

A. NPT emphasized the need to avoid and minimize potential impacts to wildlife throughout the course of route selection, siting, and design, which included undergrounding just over 60 miles of the Project. The Project has developed extensive wildlife impact avoidance and minimization measures, as set forth in the *Natural Resources Mitigation Report* (Appendix 32), and will comply with any additional permit conditions. These measures and conditions will be included in the Project plans and construction management plans. The Project's environmental monitors will be responsible for ensuring that construction contractors abide by these measures and conditions.

Impacts during construction will be minimized by instituting best management practices (BMPs) to limit temporary impacts to all habitat types. An environmental monitor will review implementation of all BMPs on-site to ensure compliance. BMPs will include the following: movement of heavy equipment and construction activities will be limited to marked access roads and construction pads, access roads and construction pads will avoid sensitive habitats to the extent practicable, and silt fencing and other erosion control methods will be used to protect sensitive habitats. Searches to find and remove protected reptiles from the active construction zone will be conducted prior to initiating construction. Construction personnel will be provided training to familiarize them with the locations and species requiring special consideration, and to assist them to recognize protected reptile and other species in the field.

For clearing of vegetation, the following impact avoidance and minimization measures will be applied during construction of the Project. Clearing of trees and other vegetation will be the minimum necessary to satisfy the electrical safety clearance requirements, and will take place in fall and winter to the extent practicable, to minimize impacts to nesting migratory birds. If tree clearing in or adjacent to Deer Wintering Areas and Moose Concentration Areas must be conducted in the winter during deep or crusted snow conditions, brush and small branches will be left in upland locations at the edge of the ROW for browse. A seasonal restriction will be placed on clearing trees where Northern Long-eared Bats have not been determined to be absent through acoustic survey.

The primary impact to most avian species likely to occur as a result of the Project is disturbance during construction, and conversion of habitat where forest clearing is required. The Project has been designed to minimize the width of the cleared corridor to the extent practicable. Northern Pass will incorporate industry best practices to reduce the risk of avian collisions with power lines, which are consistent with Avian Power Line Interaction Committee's ("APLIC") 2012 guidelines. The Project corridor will be resurveyed by helicopter for raptor nests prior to construction to identify any raptor nests in or near the transmission corridor, so that these may be removed or replaced (with permits) prior to the nesting season, or avoided as needed. If an area of high avian collision is identified post construction, line markers will be installed on the power lines in that portion of the Project.

Unavoidable impacts to habitat resources will be mitigated through habitat restoration, conservation, and protection. Northern Pass is proposing to place parcels with wildlife habitat value under conservation easements. These easements will ensure they are preserved and managed to maintain or enhance their habitat value. The proposed mitigation package includes the preservation of 1,668 acres of land in Pittsburg, Clarksville, Stewartstown, Dixville, Columbia, Concord, Pembroke and New Hampton. These parcels are generally over 100 acres in size. These proposed easement areas consist of a variety of upland forests types including some high elevation areas, and mapped Deer Wintering Areas. A variety of wetland types and some open old-field habitats are also included. NPT is also in the process of securing property or easement rights for the preservation and habitat enhancement of approximately of pine-barrens habitat in Concord, New Hampshire for mitigation of impacts to wild lupine and Karner blue butterfly.

The Project continues working to identify one or more conservation easement holders. Through consultation with state and federal wildlife agencies, it was determined that additional funding for wildlife habitat management of compensatory mitigation parcels will be an important part of the mitigation package. The Project will work with the agencies to identify the appropriate funding commitment and mechanism for parcel management.

Q. Please describe the result of the assessment of general wildlife habitat for the Project area.

A. The Project area extends for 192 miles, roughly north to south across New Hampshire from Pittsburg to Deerfield, which includes approximately 8 miles of underground line installation in public roads in Pittsburgh and Clarksville and approximately 52 miles of underground line installation in public roads from Bethlehem southwards to Bridgewater. The 32 miles of new ROW from Pittsburg to Dummer encompass a variety of elevations and northern forest types. In general, the habitat across this portion of the Project area was unexceptional in that it consists of the type and variety of habitats expected to be present in this region of the state, in the proportions expected to be present. This includes some areas with above average habitat value, including forested wetlands, and limited areas of over-mature second growth forests, low density beech areas, Deer Wintering Areas, and Moose Concentration Areas. The existing ROW from Dummer to Deerfield also passes through a variety of elevations and habitats, and forest types. The existing ROW is itself maintained as grassy or shrubby vegetation. The habitats that the existing ROW passes through are unexceptional in that they consist of the type and variety of habitats expected to be present throughout the portion of the state that the ROW passes through, in the proportions expected to be present. This includes some areas of higher value habitat, including forested wetlands, and limited low density beech areas and Deer Wintering Areas.

A variety of commonly occurring bird, mammal, amphibian and reptile species were incidentally observed during the various species- and resource-specific surveys conducted for the Project. The number and variety of incidentally observed species were typical of the habitats in the regions of the State where they were observed, and are an indication of the good-quality general wildlife habitat that much of the proposed ROW, existing ROW, and surrounding area provide.

Q. Please explain the resource-specific results of your studies, starting with reptiles.

A. The listed wildlife species and specific habitats determined to be present or to have some potential to be present in the Project area, as well as their assessment method and results of the assessment are summarized in Table 2 of the *Wildlife Report and Impact*

Assessment, Appendix 36. These results and the anticipated impacts to wildlife resources as a result of the Project are presented in detail in Sections 3 through 15 of the Report, and proposed mitigation for the impacts are detailed in Section 16. These results are summarized below.

The existing ROW provides good habitat for a variety of listed and unlisted reptiles because the lack of canopy allows for sunny basking habitat. The State-endangered eastern hognose snake is known to be present in the Project area in Pembroke, State-threatened northern black racers were observed during species-specific surveys in Allenstown, and state-endangered Blanding’s turtles were observed incidentally on three occasions from Concord south. Direct surveys for suitable nesting habitat for turtles from Canterbury south did not yield any highly suitable habitat, but all the listed turtle species (Blandings, spotted, and wood turtle) may use the marginal habitats observed on occasion, or pass through the Project area while feeding on land or traveling between other suitable habitats.

The primary impact to all reptiles, including the listed species, that will occur as a result of the Project is disturbance during initial construction and during maintenance when the Project is in operation. Because the existing ROW has the potential to provide important habitat (basking, denning, nesting) for most reptiles, including the listed species mentioned above, the Project’s impact will be mitigated by implementing BMPs and construction timing restrictions during construction and subsequent maintenance activities specifically to minimize disturbance and subsequent impacts to these species.

On the other hand, habitat conversion from forest to grassy or shrubby vegetation will provide benefit to reptiles by increasing the amount of ground receiving direct sunshine.

Q. Please address the results of your studies with respect to bird species.

A. Many different types of birds were observed in and around the Project area during the field surveys, including shrub-nesting species within the cleared ROW, and forest-nesting species in the forest adjacent to the cleared ROW and in the uncleared portion of the ROW. Some wetland-nesting species were observed in and around some of the larger wetlands. Only a limited number of listed species were observed. Common nighthawks were observed on multiple occasions in multiple locations in Concord during direct surveys. American kestrels were observed incidentally in Stark and New Hampton, and a rusty blackbird was observed incidentally in Millsfield. No raptor nests were observed on existing structures in an April 2014 aerial survey of the existing ROW.

The primary impact to most avian species that is likely to occur as a result of the Project is disturbance during construction, and conversion of habitat where forest clearing is required. Clearing forest and creating open or shrubby habitats will result in a minor loss of habitat for forest-nesting species, but compared to the total amount of forest habitat that will remain available in the surrounding landscape, this impact is not significant. Clearing forest and creating open or shrubby habitats will benefit shrub-nesting species. Impacts to wetland-nesting species are expected to be minimal and temporary as impacts to wetlands will be minimized to the extent practicable and subject to restoration as part of the overall mitigation package for the Project.

The USFWS also asked that the effect of forest fragmentation on forest-nesting birds be addressed in relationship to the clearing of the new ROW. An analysis of this impact indicated that the addition of the new ROW to the forested landscape which it passes through creates additional forest edge but creates only a small increase in fragmentation. This change to the forested landscape is expected to have only a small impact.

Q. Now please address insect species.

A. The Concord Pine Barrens is the only location in the Project area that provides suitable habitat for listed insect species. Based on the known distribution of four listed species and the habitat suitability for them in the Project area in Concord, these four species are known or presumed to be present in the Project area. The pine pinion moth feeds on various red pine species, which are distributed throughout the Concord Pine Barrens section of the ROW. Surveys for wild lupine, the sole or primary larval plant for Karner blue butterfly, frosted elfin, and the Persius duskywing skipper, were conducted within the Project footprint as a surrogate to determine the likely distribution of these species. Patches of wild lupine were confirmed in the Project area in Concord and Pembroke.

Impacts to these four insect species will occur as a result of the Project, including direct mortality during construction and habitat loss to the footprint of the power line structures. To address these impacts, a species protection plan focused to benefit the Karner blue butterfly and that will also benefit the other three special status insect species will be implemented. An egg survey for the Karner blue butterfly was conducted in July of 2015 to provide a basis for estimating impacts to this species as a result of construction. This approach was approved by the USFWS and NHFG. The measures to benefit the Karner blue are expected to also benefit the other three special status insect species because they depend on the same habitat type. Maintenance activities within the ROW after the project enters the operational phase directly maintains suitable habitat for all these species, and all maintenance activities in this part of the ROW will be designed to maximize the benefit to these species. Habitat restoration will be implemented through revegetation to rapidly re-create suitable habitat when construction is complete and off-site habitat protection, restoration and/or creation will also be used to provide a net benefit to these species.

Q. Last, would you please describe your study results as to mammals?

A. The listed mammal species likely to be present within the Project area are all forest-dependent species. Snow tracking surveys yielded one set of Canada lynx tracks in Whitefield, and multiple sets of American marten tracks in Whitefield, Lancaster, Northumberland, and Dixville. Suitable roosting habitat for Northern Long-eared Bats was observed throughout the Project area, and a limited amount of suitable roosting habitat was observed for eastern small-footed bats, primarily from New Hampton southwards. An acoustic survey for both species was conducted in those locations within the Project area where suitable roosting habitat is likely to be affected by construction. For the small-footed bat, this consisted of three discrete locations, and it was detected in one of these locations. For the Northern Long-eared Bat, the survey covered essentially the entire ROW, and it was confirmed in one location and could not be ruled out at 13 additional locations. Conversion of forest habitat will have some effect on all of these forest mammals, as will disturbance during construction. However, given the abundance of forest around the Project area and the high mobility of marten, lynx and bats, these impacts are expected to be minimal.

To address a request of the NHFG, we have specifically addressed Deer Wintering Yards, Moose Concentration areas, and mast trees stands. The Project area intersects 17 Deer Wintering Areas, all of which have been previously mapped by NHFG. In most cases, the ROW passes through an edge or lobe of the Deer Wintering Area, rather than right through the middle. Moose Concentration Areas were identified in two areas in Dixville, two areas in Millsfield and one area in Dummer.

Discrete, definable areas of trees that provide important food resources, known as mast trees are uncommon. In New Hampshire, mast trees are generally either oaks or beech. Oaks in the forest cover adjacent to the existing ROW in the Project area from Ashland south are essentially ubiquitous, and in many locations are the dominant species. Beech trees are not abundant in the Project area, either in the uncleared portion of the proposed ROW, or adjacent to the cleared portion of the existing ROW. The only notable area of beech along the cleared potion of the ROW is in New Hampton, and in the new ROW, beech generally comprised about 1-3% of the overstory.

Less than one percent of the mapped Deer Wintering Areas intersected by the Project footprint will be cleared, and the impact of this relatively small amount habitat removal should be minimal. Estimating the relative impact of the Project on either Moose Concentration Areas or significant mast stands is difficult as these resources are not mapped. From our observations in and adjacent to the new ROW, however, there is no reason to believe that Moose Concentration Areas or mast stands are more common within the Project footprint than in the adjacent forest cover.

Q. Is there new information in the DEIS that has affected your review of potential wildlife impacts?

A. The DEIS and my wildlife report considered essentially the same information, drawn from existing, publically available resources and the results of our respective field investigations. Based on these similar information sources, my report and the DEIS draw essentially the same conclusions regarding the impact of the Project on wildlife resources.

<u>Conclusions</u>

Q. In your opinion will this Project have any substantial negative effects on wildlife resources?

A. No. Based on the studies conducted by the Project and the information presented in the Wildlife Resources Report, the Project will not have a substantial negative effect on wildlife and their habitats. From the known biology of the species present in and around the Project area, I conclude that impacts resulting from the Project will be minor. Additionally, as described above, NPT has integrated natural resource issues into planning and design, undergrounding just over 60 miles of the Project, and minimizing the impacts of construction, operations, and maintenance. In general, while construction of the Project may cause temporary or permanent displacement or mortality of some individual animals in the Project area, it is not expected to have a long-term, population level effect on the species known to be present in the Project area, with one exception. The one exception to this could be the Karner blue butterfly. For that species, NPT will implement an agency approved avoidance, minimization and mitigation plan.

In the new ROW, the amount of habitat being converted from working forest to shrub cover is small, compared to the amount of forest that is available in the surrounding landscapes. The wildlife species observed or likely to occur in the Project area are adapted to the mosaic forest age-classes currently present in the surrounding landscape due to historic and on-going logging, and will use the shrub cover created as part of that mosaic. The construction-related and operations-related impacts associated with the Project are expected to have only an insignificant effect on the habitat value of this part of the Project area for the wildlife species known or likely to be present. The habitat conversion may create a small benefit for shrub land species.

In the existing ROW, the incremental widening in some locations will convert a minimal amount of forest to shrub habitat, but the effect on either shrub land species using the existing ROW, or forest species using the adjacent habitat is expect to be negligible. Periodic mowing will continue to maintain the ROW as shrub land, maintaining suitable conditions for shrub land species that currently use the ROW.

Q. Does this conclude your pre-filed testimony?

A. Yes.

NORMANDEAU ASSOCIATES
Environmental Consultants

ATTACHMENT A

SARAH A. BARNUM, CWB®

Senior Wildlife Ecologist

Dr. Barnum is a Senior Wildlife Ecologist at Normandeau with nearly 20 years of professional experience. Her background includes providing expertise to the transportation and energy sectors, as well as a variety of general development projects. She has hands-on experience with a with a wide range of species including forest birds, waterfowl, raptors, small mammals, large mammals, amphibians, and reptiles. Dr. Barnum's projects have emphasized examining habitat relationships, impact assessment for threatened and endangered species, mitigation planning, and Federal ESA compliance. Dr. Barnum also has extensive experience in project planning, project management, experimental design, and data analysis.

EDUCATION

Ph.D., Conservation Planning, University of Colorado
M.S., Wildlife Biology, Utah State University
B.S., (cum laude) Wildlife Biology, University of Vermont

PROFESSIONAL EXPERIENCE

2007-Present	Normandeau Associates
2005-2007	New Hampshire Audubon, Concord, NH
2004-2005	Baystate Environmental Consultants, East Longmeadow, MA
2001-2003	Environmental Planning and Policy Unit, Colorado DOT, Denver, CO
1998-2000	Office of Environmental Services, Colorado DOT, Denver, CO
1996-1998	Dames & Moore, Denver, CO
1993-1994	Bio-Resources, Inc., Logan, UT

PROFESSIONAL CERTIFICATIONS

- Certified Wildlife Biologist
- AAE's Airport Wildlife Manager's Course
- AAAE's Airport Wildlife Management Techniques Course

PROFESSIONAL AFFILIATIONS

- The Wildlife Society
- New Hampshire Association of Natural Resource Scientists
- Epsom, NH Conservation Commission
- BearPaw Regional Greenways Land Conservation Committee

REPRESENTATIVE PROJECT EXPERIENCE

Gull Dissuasion Study, Boston Convention and Events Center, Boston, Massachusetts (2014-Present). Conducting surveys of gull activities on the BCEC roof, designing dissuasion approach and evaluating results. Project Manager and Avian Biologist.

Northern Pass Transmission Project, Eversource Energy, Canadian Border to Deerfield, New Hampshire (2010-Present). Conducting wildlife assessments, impact analysis, and mitigation planning in support of state and federal permitting for installation of a new, 200-mile long HVDC line in New Hampshire. Tasks include consultation with state and federal agencies (ESA, NEPA), desktop analysis, and design and coordination of field surveys. Focal species include Canada lynx, American marten, bats, raptors, song birds, turtles, snakes, and lepidopterans. Wildlife Task Manager.

Fowler's Toad Study, TransCanada Hydro Dam Relicensing, Connecticut River, New Hampshire & Vermont (2013-2014). Designed and conducted habitat suitability evaluation and toad survey; reporting. Task Manager and Amphibian Biologist.

Loon Mountain Ski Area Expansion Biological Evaluation, US Forest Service, White Mountain National Forest, New Hampshire (2013-2014). Conducted habitat suitability assessment for Canada lynx, forest roosting bats, and black bear and wrote the Biological Evaluation. Wildlife Task Manager and Mammal Biologist.

New England Cottontail Permitting, Tidewater Landing, LLC, Wells, Maine (2013). Wrote the New England cottontail related permitting documents for the Tidewater Landing sub-division. Assessed habitat suitability and negotiated with MDIFW. Wrote the Habitat Management Plan and Incidental Take Plan required for the project permit. Project Manager and NEC Biologist.

Waterville Valley Ski Area Expansion Biological Evaluation, US Forest Service, White Mountain National Forest, New Hampshire (2012-2013). Conducted habitat suitability assessment for Canada lynx, forest roosting bats, and black bear, and wrote the Biological Evaluation. Wildlife Task Manager and Mammal Biologist.

Rare Species Surveys, Tennessee Gas Pipeline Co., various locations in Massachusetts and Connecticut (2012 - 2013). Rare species surveys in support of pipeline repair activities. Various surveys for rare turtles and rare plants prior to pipeline repair projects. Project Manager and Turtle Biologist.

Winthrop Beach Piping Plover Management Plan, MA Department of Conservation and Recreation, Winthrop, Massachusetts (2012). Designed and wrote the piping plover management plan required as part of the permitting effort for the Winthrop Beach re-nourishment project. Project Manager and Avian Biologist.

Roseate Tern Expert Testimony, Entergy Nuclear Generation Company, Plymouth, Massachusetts (2012). Provided expert testimony summarizing potential impacts of relicensing of Pilgrim Nuclear Power Station in Plymouth, MA on roseate terns. Avian Biologist.

The Effect of Roadside Mowing Practices on Deer-Vehicle Collision Rates, Federal Highway Administration (2009-2012). Conducted literature review and interviews with State DOT personnel to summarize any known effects of roadside mowing regimes on DVC rates, followed by a quantitative analysis of DVC rates as a function of mowing regime. Project responsibilities include acquiring data from State DOTs, data management and analysis, and report writing. Data Analysis Task Manager.

Madaket Wind Permitting Assessment, Town of Nantucket, Nantucket, Massachusetts (2010-2011). Assessed avian and T&E resources in the proposed project area to determine potential impacts and permitting requirements for 1-3 utility scale wind turbines on Nantucket DPW lands. Focal species included long-tailed duck, northern harrier, and night migrants (birds and bats). Work includes both desktop and field assessment. Project Manager, Wildlife Biologist.

Post-Construction Mortality Monitoring, First Wind, Stetson Wind Power Facility, Washington County, Maine (2010-2011). Managed personnel to search turbines for bird and bat fatalities, spring through fall and estimate fatality rates. Coordinated searcher efficiency trials and scavenger trials to estimate true number of fatalities; supervised and quality-checked fatality estimation and report writing. Project Manager.

Analysis of Methods to Identify Deer-Vehicle Collision Hotspot, Federal Highway Administration (2009-2011). Compared qualitative and quantitative methods to identify DVC hotspots, based on data needs, ease of implementation, expertise required, and relevancy to solving safety and ecological issues. Project responsibilities included review of methods through literature review and interviews with DOT staff, creating and implementing comparison protocols, staff management and report writing. Principle Investigator and Project Manager.

Brimfield Wind Avian and Bat Surveys, First Wind, Brimfield, Massachusetts (2009-2010). Avian and acoustic bat surveys to support environmental permitting for a proposed 20 MW project in southwestern MA. Avian surveys include raptor surveys and breeding bird surveys. Project Manager and Avian Biologist.

Avian Impact Assessment, Town of Saugus, Saugus, Massachusetts (2009-2010). Desktop analysis of biological and permitting issues associated with a proposed municipal, utility-scale wind development on the abandoned I-95 road bed Saugus, MA. Species of interest include neotropical migrants, wintering ducks, terns, and other shore birds. Project Manager and Avian Biologist.

Mitigation Wetland Functional Assessment, Federal Highway Administration, various nationwide locations (2008-2010). Wetlands constructed to mitigate for highway project-related impacts and reference wetlands were surveyed, and levels of invasive cover and wildlife functions compared. Project responsibilities included interviewing state DOT staff to identify and select study sites, conducting surveys, semi-quantitative analysis, report writing, and managing staff. Project Manager.

Seabrook Nuclear Facility Relicensing, Florida Power and Light, Seabrook, New Hampshire (2008-2010). Reviewed and summarized all terrestrial ecology issues associates with facility construction and operations with a focus on threatened and endangered species, and impact assessment; results presented in a NRC compliant Environmental Report format to support relicensing. Task Manager.

Nine Mile Point Nuclear Facility Expansion, Constellation Energy, Scriba, New York (2007-2010). Wildlife studies to support expansion of an energy facility in Oswego NY. Tasks included field review of the site, evaluation of the habitat's ability to support potential threatened and endangered species, and impact assessment; results presented in a NRC compliant Environmental Report format to support licensing. Wildlife Task Manager.

Deer Wintering Habitat Assessment, Waste Management, Crossroads Landfill, Norridgewock, Maine (2008). Surveyed deer wintering areas associated with the Crossroads landfill to determine value of habitat. Compiled results in letter report suitable for reference in future expansion planning and permitting. Senior Wildlife Ecologist.

Mount Snow Resort Snow Making Upgrade Biological Evaluation, US Forest Service, Green Mountain National Forest, Vermont (2008). Review all threatened and endangered species issues associated with a snow making upgrade; analyzed impacts and summarize results in a Forest Service Biological Assessment and a NEPA Environmental Assessment. Senior Wildlife Ecologist.

Casco Bay Fuel Line Removal, U.S. Navy, in Brunswick and Harpswell, Maine (2008). Wildlife studies to support Corps 404 and Maine NRPA permitting. Conducted habitat survey of project area, mapped wildlife habitat, and assessed impacts, with a focus suitable habitat for and presence of species listed by the State of Maine and /or USFWS. Compiled results in a report to support all local and federal permitting efforts. Senior Wildlife Ecologist.

Canada Lynx and American Marten Habitat Assessment, Mount Washington Resort, Bretton Woods, New Hampshire (2007-2008). Provided expert opinion regarding the suitability of the resort's property for Canada lynx and American marten. Tasks included field assessment of the property, review of current literature, producing a written report detailing analysis approach and findings, and ongoing consultation with regulating agencies. Senior Wildlife Ecologist.

NH Route 2 Wildlife Crossing Investigation, New Hampshire Audubon, Jefferson and Randolph, New Hampshire (2005-2007). Designed, implement and managed a tracking study to identify the locations where wildlife crossed the highway, and to determine the characteristics of preferred crossing locations. Tasks included extensive quantitative and qualitative analysis of GIS based data sets. Principle Investigator and Project Manager.

Runway Expansion Feasibility Study, Town of Montague Airport Commission, Montague, Massachusetts (2004-2005). Analyses of potential impacts to birds, sensitive habitats, and special status species including grasshopper sparrows, box turtles, rare plants, and pine-barrens associated insects present in the project area Tasks included field surveys, literature reviews, report writing and general project management. Project Manager.

Runway Expansion Feasibility Study, Martha's Vineyard Airport Commission, West Tisbury, Massachusetts (2004-2005). Conducted analyses and mitigation planning for potential impacts to birds, sensitive habitats, and special status species, including grasshopper sparrows, rare plants, and pine-barrens associated insects. Tasks included consultations with NHESP, field surveys, impact assessments, mitigation planning, literature reviews, report writing and general project management. Project Manager.

Programmatic Section 7 Consultation Regarding Impacts to Canada Lynx, Colorado Department of Transportation (2001-2002). Researched and wrote the document that served as the basis for a programmatic agreement between the USFWS and CDOT. Tasks included analysis of habitat and highway conflicts, analysis of likely impacts to lynx resulting from highway projects, development of a formalized impact assessment procedure, and literature review. Environmental Planner.

US 40 Rabbit Ears Pass Upgrade, Colorado Department of Transportation, Grand and Jackson Counties, Colorado (2001). Assessed project area for wildlife corridors and use by Canada lynx and large ungulates. Worked with project engineers and USFS to develop design recommendations, including locations for potential under passes, to improve motorist safety, reduce wildlife mortality and provides habitat connectivity. Environmental Planner.

US 9 Upgrade, Colorado Department of Transportation, Silverthorne, Colorado (1999-2000). Assessed project area for wildlife corridors and use by Canada lynx and large ungulates. Developed recommendation to improve motorist safety, reduce wildlife mortality and provides habitat connectivity. Worked with project engineers and designers to design and locate two wildlife underpasses. Endangered Species Specialist.

US 40 Berthoud Pass Upgrade, Colorado Department of Transportation, Clear Creek and Grand Counties, Colorado (1997-1998). Habitat assessment at the local and landscape scale to determine the best locations for wildlife underpasses to benefit mule deer, elk, Canada lynx and other species. Coordinated with project planners and designers to design underpasses that were appropriate for the target species and that provided engineering feasibility. Endangered Species Specialist.

REPRESENTATIVE PRESENTATIONS

Barnum, S. A., Alt, G. 2013. The effect of reduced mowing on rate of deer-vehicle collisions. 2013 Transportation Research Board Annual Meeting. Washington, D.C.

Barnum, S. A., Gray, M. 2011. A comparison of methods to identify deer-vehicle crash hotspots. 2011 Transportation Research Board Annual Meeting. Washington, D.C.

Barnum, S. A. 2008. Habitat, highway features, and animal-vehicle collision locations as indicators of wildlife crossing hotspots *in* Proceedings of the 2007 International Conference on Ecology and Transportation. Center for Transportation and the Environment, North Carolina State University.

Barnum, S. A. 2007. Habitat, highway features, and animal-vehicle collision locations as indicators of wildlife crossing hotspots. 2007 International Conference on Ecology and Transportation. Little Rock, AR.

Barnum, S. A. 2003. Identifying the best locations to provide safe highway crossing opportunities for wildlife. Society for Conservation Biology 17th Annual Meeting. Duluth, MN.

Barnum, S. A. 2001. Preliminary analysis of locations where wildlife crosses highways in the Southern Rocky Mountains 2001 International Conference on Ecology and Transportation. Keystone, CO.

Barnum, S. A. 2001. Preliminary analysis of locations where wildlife crosses highways in the Southern Rocky Mountains *in* Proceedings of the 2001 International Conference on Ecology and Transportation. Center for Transportation and the Environment, North Carolina State University.

Barnum, S. A. 1999. A programmatic approach to minimize highway project impacts on Canada Lynx (Lynx Canadensis) in Colorado. Third International Conference on Wildlife Ecology and Transportation. Missoula, MT.

REPRESENTATIVE PEER-REVIEWED ARTICLES AND PUBLICATIONS

Barnum, S. A. 2003. Identifying the best locations along highways for wildlife under- and overpasses: a handbook for highway planners and designers. Colorado Department of Transportation Research Report 2003-9.

Barnum, S. A., C. J. Mannville, J. R. Tester, and W. J. Carmen. 1992. Path selection by *Peromyscus leucopus novaboracensis* in the presence and absence of vegetative cover. J. Mammal. 74:797-801.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF DENNIS W. MAGEE

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name and business address.

A. My name is Dennis W. Magee. My business address is 25 Nashua Road, Bedford, NH, 03110

Q. Who is your current employer and what position do you hold?

A. I am employed by Normandeau Associates, Inc., as a Senior Principal Scientist/Senior Consultant in the Wetlands/Terrestrial Group.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide my assessment of potential impacts of the Northern Pass Project ("Northern Pass" or the "Project") as proposed by Northern Pass Transmission LLC ("NPT") on rare plants and rare or exemplary natural communities. I conclude with my opinion that the Project will not have a substantial negative effect on rare plants and rare or exemplary natural communities.

Q. Please describe your background and qualifications?

A. I have been working as a botanist for my more than 40 year professional career. I received my BS in Wildlife Biology in 1968 and my MS in Forestry in 1971, both from the University of Massachusetts. I worked as an environmental consultant for Jason Cortell Associates and then for Interdisciplinary Environmental Planning (now part of AECOM) for several years prior to joining Normandeau's Terrestrial/Wetlands group in 1978. During 1978-2005 at Normandeau I was head of the Terrestrial/Wetlands Group and a company Vice President.

Throughout my career I have been a principal investigator or program manager on several hundred projects occurring in offshore coastal, intertidal, riverine, lacustrine, freshwater wetland and terrestrial environments. I have conducted searches for rare plants and exemplary communities on hundreds of projects throughout the eastern half of the U.S., including many in the State of New Hampshire. In 2011 I was one of 30 botanists contracted by the U.S. Army Corps of Engineers for the updating process for preparing the draft federal National Wetland Plant List.

My research work has focused on the vegetation and wetlands of the Northeast. This research has culminated in the publication of four widely used reference books: *Freshwater*

Wetlands 1981, *Flora of the Northeast* (First Edition 1999 and Second Edition 2007) and *Grasses of the Northeast* 2014. For the past 30 years I have taught courses and workshops on identification of grasses and grass-like plants and woody plants in winter for various natural resource organizations throughout New England and in New York. I am currently affiliated as faculty with the Humboldt Field Research Institute, Eagle Hill, Maine, and New England Wildflower Society, Framingham, Massachusetts.

A copy of my CV is attached as Attachment A.

Q. How are you familiar with the Project that is the subject of this application?

A. I was involved in preparing the survey work plan for botanical resources and in reviewing plans, aerial photos and various GIS-based data for the Project area. I have examined the proposed Project route in leading teams of botanists doing searches for rare plants and rare or exemplary natural communities in the field and in driving along or across the Project ROW. I provided senior level review of the finished report, reviewing in detail the *Northern Pass Transmission Project; Rare, Threatened, and Endangered Plants and Exemplary Natural Communities* dated October 2015, Appendix 35, providing comments and final approval. I have reviewed the draft Environmental Impact Statement ("DEIS") issued by the United States Department of Energy ("DOE"). I also reviewed, provided comments on, and gave final approval for the *Vegetation and Ecological Communities Report*, Appendix 34.

Q. Please describe the Normandeau studies.

A. Normandeau was contracted to evaluate botanical resources present in the Project area (specifically rare, threatened, and endangered plants and rare or exemplary natural communities), estimate potential impacts, and recommend avoidance and minimization/mitigation measures. The Project area, for purposes of my testimony, includes the existing and proposed ROW, off-ROW access roads, transition stations, substation expansion areas, and proposed converter terminal site. State watch or indeterminate species in the Project area have been assessed as well, even though the Rare Plant List for New Hampshire does not include them.

Occurrences of rare, threatened and endangered plant species, state watch or indeterminate plant species (collectively, "RTE plant species") are tracked at the state level by the New Hampshire Natural Heritage Bureau ("NHB") and at the federal level by the U.S.

Forest Service ("USFS"). The NHB also tracks Exemplary Natural Communities, which are rare natural community types and high quality examples of more common community types.

Prior to undertaking field searches, desktop analysis was performed to focus the searches in relevant Project locations. This was done using the most recent information available. This analysis included reviewing a summary of vegetation and ecological communities identified by Normandeau, and compiling database information from NHB for documented occurrences of RTE species and exemplary natural communities within a mile of the Project area for state-listed plants and natural communities and within five miles for federally listed plants, as set forth in our agency-approved work plans. This was done to establish survey locations, habitat requirements and best timing for identification. Updated NHB data have been requested annually to ensure that any new Element Occurrences (EOs; or areas of land and/or water in which a listed species or natural community is, or was, present) are considered, and new field visits completed as needed (most recently in 2015).

A list of species for evaluation in the White Mountain National Forest ("WMNF") was obtained from the USFS. Aerial photographs, U.S. Geological Survey ("USGS") topographic data, bedrock maps, soils data, wildlife habitat maps from the New Hampshire Wildlife Action Plan, and NHB natural community and natural community system classifications were also used to help select survey locations.

As part of this desktop analysis Normandeau botanists also evaluated field data from wetland delineation work by Normandeau wetland scientists to help focus the searches. The information developed in the desktop analysis provided the basis for completion of the work plan and execution of the field research at focused locations having potential for the occurrence of these natural resources. On June 23, 2010, a meeting was held with the USFS and protocols were provided for work on USFS lands. The April, 2011 work plan was approved by NHB, USFWS and USFS; and the May, 2014 addenda to the work plan were approved by NHB. (See a tabulation of agency consultation at Appendix 48).

From 2010 to 2015 Normandeau botanists searched the existing and proposed ROW, facility sites, and off-ROW access road locations from the U.S./Canada border in Pittsburg to Scobie Pond Substation in Londonderry, NH for RTE plant species and exemplary natural communities as described in the work plans. In addition to known locations for RTE species and exemplary communities, high search priority was also given to calcium-rich bedrock locations, cedar swamps, pine barrens, and other specific habitat or soil types with the potential for rare plant occurrences. The Project corridor was also reviewed for the occurrence of plant communities ranked as S3, defined by NHB as "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." Protocols for field and survey methodology, as documented in work plans that reflect the input and concurrence of NHB, USFWS and USFS, were followed to locate new or extant populations of RTE species.

Throughout the work, quality assurance and quality control protocols were implemented to ensure accurate and consistent collection of data. Search priorities of high, medium, or low were given depending on whether habitat requirements occur within the ROW or an exemplary community has the potential to enter into the ROW. The boundaries of any RTE species were located using Global Positioning System ("GPS") equipment. Locations of any state-watch and indeterminate species were also recorded. Exemplary or S3 natural communities were identified and their boundaries located using GPS or aerial photos. In the event that a natural community was identified outside the Project area aerial photos were used to document the occurrence. Rare Species Occurrence Record field forms and Exemplary Natural Community Reporting forms were completed for each new occurrence and submitted to NHB for inclusion in their database.

Q. Please explain the results of Normandeau's studies.

A. No federally-listed threatened or endangered plant species were found within the Project area. For state-level designations in the northern segment of the route (Pittsburg to Dummer), nine state watch species, one state indeterminate species, one exemplary natural community system, and four potential exemplary natural communities were identified. Eight of the nine state watch species will be affected by tree clearing in the northern segment of the ROW, although one of these species is currently located in an area with a mostly open canopy and is known to occur in clearings. Population level impacts to state threatened or endangered species are not expected. The state exemplary natural community system, a *Moderate Gradient Sandy-cobbly Riverbank System*, will not be impacted by the Project. One of the potentially exemplary natural communities is state-ranked as S3 and was identified as a *Northern Hardwood Seepage Forest* based on consultation with NHB. Approximately 24% of the known area of this community will be impacted, directly and indirectly, by tree clearing (643,393 feet or 14.8 acres), although the full extent of this community has not been delineated. Total direct impacts to this community will occur entirely within the area of tree clearing and will affect an estimated 9% (239,098 square feet or 5.5 acres) of the community. The three other potentially exemplary natural communities in the Project area are *Northern White Cedar – Balsam Fir Swamps*, which are state-ranked as S2. One of these communities, located in Dummer, has been heavily logged and disturbed. Approximately 26% of the area of this community will be affected, directly and indirectly, by tree clearing. Total direct impacts, which will occur within the area of tree clearing will affect approximately 5% of this community or 3,848 square feet (0.09 acre). The other two *Northern White Cedar – Balsam Fir Swamps* occur near the edge of roads in Stewartstown. Total direct and indirect impacts to these communities will be minor, affecting 6% (1,922 square feet) of the area of one of the communities and 0.01% (43 square feet) of the area of the other.

Several S3-ranked natural communities, including *Lowland Spruce-fir Forest, Rich Mesic Forest*, *Northern Hardwood* **-** *Black Ash Conifer Swamp, Boulder – Cobble River Channel*, and additional areas of *Northern Hardwood Seepage Forest* will also be affected by forest clearing. These communities are common in the general area, have been subject to forest management activities in the past, and did not appear to meet criteria for designation as exemplary, although a final determination can only be made by NHB.

In the portion of the route from Dummer to Londonderry, one exemplary natural community system, six state endangered species, and two state threatened species were identified, as well as three state watch species and three state indeterminate species. The endangered species include Spiked Needle Grass (*Aristida longespica var geniculata)*, Licorice Goldenrod *(Solidago odora)*, Hairy Thoroughwort *(Eupatorium pubescens)*, Butterfly Milkweed (*Asclepias tuberosa*), and two sensitive endangered species (no names identified here because of a confidential agreement with NHB). The two threatened species are Wild Lupine *(Lupinus perennis)* and Blunt-leaved Milkweed *(Asclepias amplexicaulis)*. Of the state threatened and endangered species, four will be impacted by the Project: Spiked Needle Grass, Licorice Goldenrod, Wild Lupine, and Butterfly Milkweed. One additional state endangered species, Wiegand's sedge (*Carex wiegandii*), was observed in the WMNF, but is avoided by the project route change in this area. A single Butterfly Milkweed plant occurs in the Project area and will be impacted. However, the specimen observed is believed to be an introduced garden plant, a remnant of plantings conducted by NH Fish and Game to enhance habitat for the state and federally endangered Karner blue butterfly.

There are no exemplary natural communities or systems impacted in this segment of the ROW. An exemplary *Pitch Pine – Scrub Oak Woodland* is mapped as partially within the ROW corridor in Concord. However, the portion within the ROW corridor consists of maintained ROW rather than a "natural" community. Therefore, the project impacts within the ROW are not considered impacts to a natural community. The vegetation maintenance in the ROW creates habitat favorable to the RTE species associated with this natural community. An exemplary *Medium Level Fen System* and an exemplary *Poor Level Fen/bog System* are mapped in the Project ROW in the WMNF. However, these communities are avoided by the new route through the WMNF. An exemplary *Poor Level Fen/bog System* is mapped partly within the Project ROW in Derry. This area was visited by a Normandeau botanist in 2014. The portion of the community mapped within the Project ROW was observed to be a disturbed *Sweet Gale – Meadowsweet – Tussock Sedge Fen* (state ranked as S4: widespread and apparently secure) and is unlikely to qualify as exemplary. Normandeau submitted an Exemplary Natural Community Reporting form to NHB to document this community within the ROW.

Impacts to the state endangered and state threatened species and to the potential state exemplary natural community described above were assessed based on a number of conservation factors, including a rarity rating and estimated viability of populations of each of the seven species, number of populations recorded in the state, abundance trends at the national or global level and threats to each species.

Q. What steps has Northern Pass taken to avoid, minimize and mitigate the impact of the Project on these natural resources?

A. Normandeau staff accompanied Project engineers on site visits along the ROW to provide input on sensitive resources, including RTE species and exemplary natural communities. Recommendations were made (and followed to the extent practicable) for design alternatives that will avoid direct impacts to these resources. For example, in Dixville, where tree clearing for new ROW will occur, a potential natural community and several state watch species were documented. To reduce impacts to these resources Normandeau evaluated two route alternatives, selecting the one that would result in lesser impacts. In addition, a rare plant was observed on a proposed off-ROW access road, and this road was eliminated from consideration for project purposes.

Proposed impact avoidance, minimization and mitigation measures were developed with input from NHB for state threatened and endangered plant species and the potentially exemplary natural communities to ensure the Project will not result in unreasonable adverse impacts. Various measures will be used to minimize impacts to state threatened and endangered species and the potential exemplary natural communities. These include avoidance to the extent practicable, flagging populations/sensitive areas prior to work and fencing off RTE habitat areas adjacent to impact areas as needed to prevent impacts beyond the permitted work zone, a construction management plan for implementing protective measures at each RTE species location, a contractor training program prior to familiarize construction crews with locations and species, presence of an environmental monitor for all construction activities where RTE species and communities are present, performing construction during winter where possible, the use of mats to minimize disturbance, and possibly transplantation of plants and/or collection and sowing of seed to re-establish affected populations. A compensatory mitigation plan will be developed if and as needed with input from NHB to address unavoidable impacts to these resources.

Conclusions

Q. In your opinion will the Project have a substantial negative effect on these natural resources?

A. No. The work plan and protocols for this work were discussed with and agreed to by the natural resource agencies, and great care and thoroughness was used by highly competent botanists in carrying out the work. Approximately 31% of the route (60 miles) avoids any impact on RTE plants by using public roadways. The northern 17% of the Project route (32 miles) will be overhead line that traverses northern forest typical of northern New Hampshire, where forest management and timber cutting regularly occur. The remaining 52% of the route (100 miles) follows existing transmission line ROW that is regularly maintained as grassy or shrubby vegetation. Results of the Normandeau study show that temporary and permanent impacts to RTE species, S3 communities, and exemplary natural communities will be low due to Project avoidance and minimization. Mitigation measures will be taken as needed to address the small unavoidable impacts that occur.

Much of the northern segment of the Project has been partially logged in recent years, although there are some areas of intact forest within the proposed ROW. Tree clearing for the ROW in the northern segment will affect four potentially exemplary natural communities.

In the portion of the route from Dummer to Londonderry the four state-listed species that will be impacted by the Project are normally found in locations with an open canopy and require or tolerate a disturbance regime for maintenance of ideal habitat conditions. Maintenance activities in the existing and proposed new ROW, including mowing or cutting in the course of regular vegetation management, favor these habitat conditions. It is anticipated that these species (with the exception of one (Butterfly Milkweed), which is believed to be of non-native origin and potentially presents a threat to the native strain of this species) will become reestablished in temporarily impacted areas following construction, given the impact minimization measures that will be implemented. Permanently impacted areas within the existing ROW due to proposed structures occupy a very small area within the ROW and would cause a minor loss of habitat to the impacted state endangered and threatened species.

The proposed underground route between Bethlehem and Bridgewater will avoid impacts to two exemplary natural community systems, one population of a state endangered plant species, two populations of a state watch plant species, and one population of a state indeterminate plant species.

It is my opinion that, based on the foregoing information, the Project will not have a substantial negative effect on rare plants and rare or exemplary natural communities. No state threatened or endangered plant species will be impacted in the northern segment, and none of the RTE plant species occurring in the northern segment are regionally rare.

The potentially exemplary natural community types that will be impacted are fairly common in the general area. Approximately 24% of the known area of a potentially exemplary *Northern Hardwood Seepage Forest* will be affected by tree clearing. The full boundaries of this area were not determined, so the impacts are likely overestimated. The three potentially exemplary *Northern White Cedar - Balsam Fir Swamps* that will be impacted are either located along a road or are heavily disturbed by logging. The greatest impacts (from tree clearing) will occur to a cedar swamp that is currently heavily disturbed and in poor condition. Impacts to the other two cedar swamps will be very minor, with permanent tree clearing affecting 6% of one community and temporary disturbance affecting 0.01% of the other community.

The State threatened and endangered species documented between Dummer and Deerfield are dependent upon open canopy conditions and the disturbance regime associated with vegetation management. Project impacts will be temporary for the most part; the extent of permanent impacts from loss of habitat will be minor (with the exception of some loss of some potentially exemplary natural community habitat in the northern portion of the Project). Following construction, vegetation management in the ROW will continue to favor the native endangered and state threatened species, which are adapted to open canopy conditions and periodic disturbance.

The minor work on the existing transmission corridor between Deerfield and Scobie Pond substations will have no impact on rare, threatened or endangered plants or exemplary natural communities.

Q. Does this conclude your pre-filed testimony?

A. Yes.

ATTACHMENT A

DENNIS W. MAGEE

Senior Principal Scientist

Mr. Magee has over 40 years of experience as an environmental consultant. He has been a principal investigator or program manager on several hundred projects occurring in offshore coastal, intertidal, riverine, lacustrine, freshwater wetland and terrestrial environments. Mr. Magee's primary areas of technical expertise are project scoping and management, vascular plant taxonomy, wetlands assessment and mitigation, vegetation and wildlife investigations and rare plant searches. Throughout his career, Mr. Magee's research interests have been focused on the vegetation and wetlands of the Northeast. This research has culminated in the publication of four reference books *Freshwater Wetlands* 1981, *Flora of the Northeast* (First Edition 1999 and Second Edition 2007) and *Grasses of the Northeast* 2014. He recently retired as a Vice President at Normandeau Associates and currently works as a senior consultant on special projects.

EDUCATION

M.S.	1970, Forest Ecology & Botany, University of Massachusetts
B.S.	1968, Wildlife Biology & Zoology, University of Massachusetts

PROFESSIONAL EXPERIENCE

1977-Ptesent	Normandeau Associates
1975 - 1978	Interdisciplinary Environmental Planning (now AE Com.)
1971-1975	Jason M. Cortell and Associates

PROFESSIONAL AFFILIATIONS

- Humboldt Field Research Institute, Eagle Hill, ME
- New England Wildflower Society

PROFESSIONAL ACTIVITIES

Instructor for courses in grass identification for Humboldt Field Research Institute, Eagle Hill (ME) and in winter botany and grass and sedge identification for New England Wildflower Society (MA),New Hampshire Association of Natural Resource Scientists, Maine Association of Wetland Scientists, Massachusetts Association of Conservation Commissions, and New York Flora Association.

One of 30 contracted external botanists used in the updating process for preparing the draft federal National Wetland Plant List. http://wetland plants.usace.army.mil

Research Associate on an expedition to the Amazon River and other remote jungle areas in Colombia, South America, to obtain botanical specimens for research and museum collections.

Research Associate on an expedition to Devon Island, in the Canadian Northwest Territories, to investigate impacts of resource exploration and extraction on high arctic plant communities and winter feeding ecology of musk oxen.

Member of a national committee established to prepare a nationwide guidebook for a hydrogeomorphic procedure for assessing functional capacity of depressional wetlands.

Member of a national committee established to prepare a draft hydrogeomorphic procedure for assessing functional capacity of slope wetlands.

Assisted in the development of MADEP policy for evaluating and replicating wildlife habitat under the MA Wetlands Protection Act.

Assisted USEPA in providing provisional guidance for agency 404 personnel to determine the effectiveness of requiring wetland creation or restoration to compensate for permitted wetland alteration.

Served as technical advisor to Maine Chamber of Commerce and Industry in drafting new wetlands legislation for the State of Maine.

Provided testimony as a professional botanist in support of an act to establish an official rare plant list in Maine before the Joint Committee on Energy and Natural Resources.

Co-presented a series of training workshops on the Hollands-Magee wetland assessment method to state and Federal agency staff.

Presented papers, chaired sessions and participated in discussion panels in conferences, expositions, and workshops involving status of current knowledge in wetland delineation, assessment of wetland functions, and wetland creation and reclamation. Served on thesis committees for a Ph.D. candidate and two masters' degree candidates at Cleveland State University (OH) and two masters' degree candidates at Antioch Graduate School (NH).

EXPERT TESTIMONY

Presented testimony and served as an expert witness in over a dozen hearings and adjudicatory proceedings related to the FERC Exhibit E Process, NEPA, Section 404, and under the regulations of various states

SELECTED PROJECT EXPERIENCE

Northern Pass Transmission Project (2011, 2015) – Central and Northern New Hampshire. Mr. Magee conducted investigations of rare plant species and communities along the proposed transmission corridor and reviewed vegetation technical reports.

Confidential Wind Power Project (2008) - Mountains of Western Maine. Mr. Magee conducted investigations of rare plant species and communities for the ridgeline development area, access roads, staging areas and transmission lines.

Maine Turnpike Authority (2005)-Mr. Magee managed the environmental assessment for the widening of the Turnpike. This involved issues of threatened and endangered species, wetlands, aquatic impacts, runoff and mitigation. Mitigation included wetland creation, preserving habitat and moving plant species. Section 404 Permit and NRPA Permits were prepared. Project Manager.

NH Department of Transportation (2005)-Mr. Magee managed a mitigation design for the widening of the Spaulding Turnpike in NH for the NHDOT. The work included wetland delineation, functional assessment, wetland mitigation design and final design specifications. Project Manager.

Alcoa Power Generating, Inc. (2005)-Hydroelectric project relicensing (NC). Mr. Magee conducted an assessment of riparian resources baseline characterization and impacts. The project included coordination with experts on the ESA species both terrestrial and aquatic. Project Manager.

Tennessee Valley Authority (2004)-Mr. Magee managed the natural resources portions of a major EIS evaluating impacts of current system operations and proposed alternate operations. He oversaw and evaluated potential impacts to: endangered species, farmland, shore land erosion, wildlife, wetlands, and aquatic resources. The system encompasses 49 dams and over 40,000 square miles of watershed. Extensive public and agency interaction was required. Project Manager.

NH Department of Transportation (2004)-Mr. Magee supervised the development of preliminary and final design plans for the Keene-Swanzey improvement project proposed by NH DOT. The final wetland mitigation design involved flood plain wetland resources. Project Manager.

Massachusetts Highway Department (2003)-For the Route 3 Widening. Mr. Magee led a team of scientists to delineate, conduct a functional assessment, and develop a wetland mitigation design for a design build project in Massachusetts. Project Manager.

Alcoa Power Generating, Inc. (2001)-Hydroelectric project relicensing (TN). Mr. Magee conducted an assessment of riparian resources baseline characterization and impacts. The project included coordination with experts on the ESA species both terrestrial and aquatic. Project Manager.

Federal Emergency Management Agency (through DMJM/ICF Kaiser). 1999. Hurricanes Floyd and Dennis Environmental Response (NC). Mr. Magee provided on-site support in reviewing the potential environmental implications of projects for which FEMA funding was requested. He assisted in developing guidelines for the assessment of projects relative to the replacement and improvement of culverts. He evaluated these projects in relation to NEPA, the Clean Water Act and the Endangered Species Act among other regulations.

Sugarbush Resort {1999)-Trail expansion and snowmaking ponds (EIS). Supervised field delineation of wetland boundaries at Sugarbush Resort along ski trails proposed for widening and proposed pipeline routes, and at sites of proposed snowmaking ponds. The work was performed based on the protocols in the U.S. Army Corps of Engineers delineation manual. Key ESA species critical to the project were Bicknells Thrush and the Northern Goshawk. Project Manager.

US ACOE,WES {1997)- Mr. Magee developed a rapid procedure for assessing wetland functional capacity based on hydrogeomorphic classification. He coordinated with wetland assessment experts in various regions throughout the country and was principal of a procedure for assessing functional capacity of freshwater wetlands for the glaciated northeast and mid-west. He oversaw the production of the assessment procedure document. Project Manager.

Maine Department of Transportation {1997)- Sears Island Marine Dry Cargo Terminal (ME),SEIS; Project Manager Mr. Magee supervised preparation of technical reports on existing environment, project impacts and mitigation measures for wetlands, plant and wildlife resources and marine resources. Project Manager.

BHP International {1996)- Exploration Mine, Jackman (ME).. Mr. Magee managed an assessment of wetlands, vegetation, wildlife and aquatic communities for siting project facilities, including alternative locations for tailings pond. Project Manager.

Wisconsin Valley Improvement Company {1996)- Hydroelectric Project Relicensing (WI). Project Manager.

Great Northern Paper Company {1993)- Hydroelectric project relicensing (ME) Mr. Magee supervised all of the environmental studies in support of a FERC Exhibit E application for relicense to operate a 32 megawatt hydropower dam. Studies performed included geology, water quality, aquatic ecology, vegetation and wildlife. Project Manager.

NASA, Stennis Space Center (MS) {1993)- This project required the assessment and development of a unique wetland Mitigation for Rocket Testing Facility Expansion. Mr. Magee developed the design and oversaw the entire project. Project Manager.

Metropolitan District Commission {1992)- (MA) Mr. Magee supervised water quality, hydrology, aquatic communities, wetlands, vegetation and wildlife investigations to determine impacts of interbasin transfer of water supplies in eastern and western Massachusetts. Project Manager.

Great Northern Paper Company {1986)- Big "A" Hydroelectric Development Project (ME);Assessment of existing natural resources and feasibility study. Project Manager.

Signal Companies {1986)- Peat wet-harvesting project, Milford (ME). Natural resource investigation on a 700 acre peat bog and feasibility study. Project Manager.

Maine Department of Transportation {1985)- Waterville/Winslow Bridge (ME), EA. Supervised geology, soils, water quality, aquatic ecology, wetlands, vegetation and wildlife, and air/noise investigations to determine impacts of new bridge and alternative roadway alignments. Project Manager.

Exxon Minerals Company {1983) - Zinc-Copper Mine, Crandon (WI); Mr. Magee supervised wetlands mapping, functional evaluation and biological inventories in 165 wetlands. Wetlands' evaluations provided the information needed for siting project facilities assessing impacts, and fulfilling requirements of the Wisconsin DNR permit application for wetlands alteration. Project Manager.

Pyramid Development Corporation (1983)- Environmental Assessment for Shopping mall, Attleboro (MA). Project Manager.

Maine Department of Transportation (1982} -1-395 Extension, Bangor/Brewer (ME), EIS. Supervised water quality, aquatic ecology, vegetation and wildlife investigations to determine short term and long-term impacts of alternatives for a proposed highway extension. Assessment of impacts in relation to crossing the Penobscot River, tributary streams and terrestrial and wetland environments. Project Manager.

City of Manchester (1981)- Industrial Park Development (NH); Project Manager.

Minneapolis/St. Paul Regional Airport Commission (1980) - Environmental Impact Report for Major Airport Expansion (MN); Project Manager. Mr. Magee managed the natural resource assessment.

SPECIAL TRAINING

Eighteen credits of post-master's degree study in plant taxonomy and ecology, University of Massachusetts. Certification training in U.S. Fish and Wildlife Service Habitat Evaluation Procedure (HEP),Workshop, Falmouth, Massachusetts.

Management Development Program, jointly sponsored by Normandeau Associates and the Center for Management Development, Rivier College (Nashua, NH).

BOOKS

Magee, D.W. *Grasses of the Northeast.* 2014. *A Manual of the Grasses of New England and adjacent New York* with CD ROM. Univ. of Mass. Press. 254 pp.

Magee, D.W. and H.E. Ahles. 2007. *Flora of the Northeast: A Manual of the Vascular Flora of New England and Adjacent New York*. Second Edition with CD ROM and color photographs. Univ. of Mass. Press. 1253 pp.

Magee, D.W. 2005. *A Primer on Wetland Ecology, Chapter 2*. In: Wetlands Law and Policy. The American Bar Association. 27-57 pp.

Magee, D.W. and H.E. Ahles. 1999. *Flora of the Northeast: A Manual of the Vascular Flora of New England and Adjacent New York*. Univ. of Mass. Press. 1243 pp.

Magee, D.W. 1981. *Freshwater Wetlands: A Guide to Common Indicator Plants of the Northeast.* Univ. of Mass. Press. 245 pp.

SPECIAL PUBLICATION

Magee, D.W. and G.G. Hollands. 1998. A Rapid Procedure for Assessing Wetland Functional Capacity Based on Hydrogeomorphic (HGM) Classification. The Association of State Wetland Managers. Berne, NY. 190 pp.

PAPERS IN PROFESSIONAL JOURNALS

Wolfe, Y.; P.A. Palmiotto and D.W. Magee. 2009. The Ram's Head Lady's Slipper *(Cypripedium arietinum):* A Primer for Wetland Preservation in the Carney Fen Wetland Complex, Carney, MI. The Michigan Botanist, Vol. 48 pp. 83-93.

Jog, S.; J.R. Johansen; M.K. Delong; and Dennis Magee. 2006. Plant Communities of Highland Heights Community Park, Cuyahoga County, Ohio. The Ohio Journal of Science, Vol. 106, No.5 pp. 174-180.

Magee, D.W. 1996. The Hydrogeomorphic Approach: A Different Perspective. Society of Wetland Scientists Bulletin. Vol. 13, No. 2.

Taylor, W. and D.W. Magee. 1992. Should All Wetlands Be Subject to the Same Regulation? Natural Resources and Environment. Section of Natural Resources, Energy and Environmental Law. American Bar Association. V. 7, No. 1, Summer.

Grubb, M.M. and D.W. Magee. 1980. Importance of Bottomland Hardwoods as Wildlife Habitat in an Urban Environment. Trans. 45th N. Amer. Wild. and Nat. Res. Cont. Wildlife Management Institute, Wash., D.C. pp. 428-434.

PAPERS IN CONFERENCE PROCEEDINGS

Magee, D.W. and M.C. Michener. 1987. The Normandeau Approach; Computerization Index. Proc. Assn. State Wetland Mgrs. ,Lake George, NY.

Hollands, G.G. and D.W. Magee. 1985. A Method for Assessing the Functions of Wetlands. pp 108-118. in Kusler, J. and P. Riexinger. eds. Proceedings of the National Wetland Assessment Symposium. Portland, Maine. June 1985.

Magee, D.W. 1985. Assessing Project Impacts on Peatlands. pp 198-201. in Kusler, J. and P. Riexinger. eds. Proceedings of the National Wetland Assessment Symposium. Portland, Maine, June 1985.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF DR. WILLIAM H. BAILEY

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name and business address.

A. My name is William H. Bailey. I am employed by Exponent, Inc. (Exponent), a scientific and engineering firm, in an office located in the Maryland Science and Technology Center at 17000 Science Drive, Suite 200, Bowie, Maryland, 20715.

Q. What is your position at Exponent?

A. I am a Principal Scientist in the Center for Occupational and Environmental Health Risk Assessment in Exponent's Health Sciences Practice.

Q. Please describe your current responsibilities.

A. My practice specializes in the health sciences and, more specifically, in human exposure and risk assessment. My work involves reviewing, analyzing, and conducting health research. Much of my work relates to the exposures and potential biological, environmental, and health effects associated with electrical facilities, such as transmission lines and substations, and with electrified railroad lines, including the possible effects of electric and magnetic fields ("EMF"). In the course of this work, I work with and supervise professionals in diverse health, engineering, and environmental practices, mentor junior scientists and engineers, and direct scientific research and data collection.

Q. Please summarize your education and academic research and teaching experience.

A. I earned a Ph.D. in neuropsychology from the City University of New York in 1975. My education includes a BA from Dartmouth College, awarded in 1966, and an MBA from the University of Chicago, awarded in 1969. With the support of the U.S. National Institutes of Health I received two years of additional postdoctoral training in neurochemistry at The Rockefeller University in New York City. After this training I conducted research for seven years as an Assistant Professor at The Rockefeller University in the field of neurochemistry. Since 1986, I have been a visiting research scientist at the Cornell University Weill Medical College. I also have been a visiting lecturer at Rutgers University, the University of Texas (San Antonio), and the Harvard School of Public Health. From 1983 through 1987, I was head of the Laboratory of Neuropharmacology and Environmental Toxicology at the New York State Institute for Basic Research.

Q. Are you a member of any professional organizations?

A. I am a member of the Rockefeller University Chapter of Sigma XI, a national scientific honor society; the Health Physics Society; the International Committee on Electromagnetic Safety, Subcommittees 3 and 4 – Safety Levels with Respect to Human Exposure to Fields; the Bioelectromagnetics Society; the Engineering in Medicine and Biology Society of the Institute of Electrical and Electronics Engineers ("IEEE"); the Conseil International des Grands Réseaux Électriques; the American Association for the Advancement of Science; the New York Academy of Sciences; the Society for Neuroscience; the Air & Waste Management Association; the Society for Risk Analysis; and the International Society for Exposure Analysis.

Q. Have you served as a reviewer and scientific advisor on health-related issues for state and federal agencies or scientific organizations?

A. Yes. I have reviewed research for the National Institutes of Health, the National Science Foundation, and other government agencies. Specifically regarding transmission lines, I served on a Scientific Advisory Panel convened by the Minnesota Environmental Quality Board to review the health and safety aspects of a high-voltage transmission line. In addition, I served as a consultant on transmission line health and safety issues to the Vermont Department of Public Service, the New York State Department of Environmental Conservation, and the staffs of the Maryland Public Service Commission and the Maryland Department of Natural Resources.

I have worked with the National Institute of Occupational Safety and Health, the Oak Ridge National Laboratories, the U.S. Department of Energy, and the Federal Railroad Administration to review and evaluate health issues related to EMF from other sources. I also assisted the U.S. EMF Research and Policy Information Dissemination ("RAPID") program to evaluate biological and exposure research as part of its overall risk assessment process.

I worked with scientists from 10 countries to evaluate possible hazards from exposures to static and extremely low frequency ("ELF") EMF[1] for the International Agency for Research in Cancer ("IARC"), a division of the World Health Organization ("WHO") located in Lyon, France. I also was an invited participant in the workshop convened by the International

---

[1] ELF EMF also is referred to as power frequency EMF or simply EMF.

Committee on Non-Ionizing Radiation Protection ("ICNIRP") to update guidelines for human exposures to alternating current ("AC") EMF. I have reviewed ICNIRP's draft guidelines for direct current ("DC") and AC magnetic fields as well.

Most recently, I have served as an advisor to government agencies in Canada and the Netherlands on topics relating to scientific research on EMF health and safety.

Q. Have you published or presented your research in bioelectromagnetics and other areas to the scientific community?

A. I have published or presented more than 50 scientific papers on this and related subjects. These publications and presentations are listed in my *curriculum vitae*, attached as Attachment A.

Q. What is the purpose of your direct testimony?

A. The purpose of my testimony is to summarize my human health and safety assessment of the EMF associated with the operation of the Northern Pass Transmission Project ("Northern Pass" or the "Project") proposed by Northern Pass Transmission, LLC ("NPT"), and to assess whether EMF associated with the Project would result in an unreasonable adverse effect on public health and safety.

Q. What is the scope of your assessment?

A. I evaluated the potential effects of the proposed Northern Pass lines on humans, livestock, wildlife, and plants. My assessment included an analysis of the entire Project, including the ±320-kilovolt (kV) DC transmission line from the Québec/New Hampshire border to the DC/AC converter terminal in Franklin, New Hampshire; and (2) the 345-kV AC transmission line between the Franklin converter terminal and the substation in Deerfield, New Hampshire, and the existing 115-kV AC transmission lines or lower voltage distribution lines along the Project route. My evaluation focused on the magnetic fields, electric fields, and electric charges in the air (space charge) associated with the operation of these facilities. The calculated values of their levels and distribution around the Project are provided in the pre-filed testimony of Dr. Gary Johnson and the technical report he is sponsoring. See Appendix #38.

My evaluation of these calculated exposures and the current scientific knowledge about their potential to affect human health and the biological environment is contained in Appendix 37 of the application and is summarized below.

Methods for Assessment

Q. What do scientists know about these exposures?

A. First, we know a great deal about these exposures because they are found everywhere in our everyday environment. Static (i.e., DC) fields and charges have always been a part of our natural environment. AC fields, like those associated with portions of the Project, have been a part of our environment since the early 20th century when the use of electricity came into common use.

Second, we also know how fields and electric charges interact with objects in the environment and this knowledge is a key component of assessing potential effects.

Finally, because research on the potential effects of electrical exposures on humans, animals, and plants has been conducted for over a century, there is a wealth of knowledge about the potential biological and health effects of these exposures.

Q. What criteria did you use to assess potential Project effects?

A. My assessment of the potential effects of the Project on public health and safety is based on current scientific knowledge as summarized in published research, scientific reviews by national and international agencies, and specifically the guidelines and standards established by these agencies. These guidelines and standards serve as criteria for the assessment of AC and static electric fields, as well as AC and static magnetic fields. No such established criterion for the assessment of space charge was identified.

Q. What were the steps in your assessment?

A. My assessment took into account multiple sources of information. First, I reviewed previous assessments of the scientific research conducted by scientists for both scientific and government agencies, and the relevant standards and guidelines for exposure. Next, I compared the effect of the Project on the potential exposure of adjacent populations and the environment as compared to their background exposure levels derived from other sources. Finally, I searched and reviewed the scientific literature to identify new relevant research that might shed light on potential mechanisms of interaction with organisms and effects on their biology, health, and behavior to assess the cumulative weight of the evidence, as is customarily done for health risk assessments.

<u>Summary of Assessment Relevant to Proposed AC Transmission Lines</u>

Q. How do AC electric fields interact with organisms?

A. While an AC electric field can oscillate charges on the surface of the body, the inside of the body is significantly shielded from external AC electric fields because of the high conductivity of the tissues. Thus, the electric field inside the body is roughly 1,000,000 times weaker than an external electric field.

Q. How do AC magnetic fields interact with organisms?

A. AC magnetic fields are not perturbed by the presence of a conducting body; therefore, the field inside of the body is the same as on the outside. The presence of AC magnetic fields can induce weak electric fields and currents in the body.

Q. What are the potential effects of surface charges and internal electric fields?

A. Charges accumulated on the body surface may discharge to lower potential, grounded objects and may be perceived as micro-shocks (similar in nature to carpet shocks). Internal electric fields and current densities, at high levels, may result in stimulation of excitable tissues, such as nerve and muscle. These effects may occur at very high field levels and are immediate and reversible.

Q. Are there any standards or guidelines for AC electric and magnetic fields?

A. There are no federal standards in the United States or Canada for 60-Hertz (Hz) EMF exposures. There is no guideline limiting levels of EMF from transmission lines in New Hampshire.

There are guidelines, however, developed by international scientific agencies to protect the public and workers from established biological effects of these fields. There are two internationally recognized agencies that develop guidelines for these fields: ICNIRP and the International Committee for Electromagnetic Safety ("ICES"), a committee of the IEEE. To set exposure guidelines, both of these organizations first carefully reviewed the relevant scientific literature to identify any potential adverse effects and the exposure levels where these effects may be observed. Then, they set exposure limits well below the exposure levels at which adverse effects were identified. The number they used to reduce the adverse effect level to an acceptable exposure limit is called a safety factor and was used to account for scientific uncertainty and variability and for a potentially higher sensitivity of some subgroups of the human population.

ICNIRP published updated limits in 2010. For the general population, the Basic Restriction or ceiling limit on the electric field induced in the central nervous system of the head by a 60-Hz electric field or magnetic field is 0.024 volts per meter (V/m). ICES has recommended a Basic Restriction of 0.0178 V/m in the head for exposure to 60-Hz magnetic or electric fields.[2]

The exposures to EMF that are calculated to produce internal electric fields equal to the most conservative Basic Restriction, the ICES limit, are 9,146 milligauss (mG)[3] and 26.8 kilovolts per meter (kV/m) (Kavet et al., 2010).

Q. How do the AC electric and magnetic fields calculated for the project compare to the basic restrictions in these guidelines?

A. The magnetic field at the full-rating of the proposed 345-kV AC line and the electric field at a 5% overvoltage of these conductors for all segments of the proposed route are well below the ICNIRP and ICES Basic Restrictions as described above. The magnetic field at the edges of the right-of-way ("ROW") along the route will vary between 0.1 mG and 92 mG except for an approximately 2000-foot segment where the magnetic field on one side of the ROW is calculated to be 127 mG. The electric field at the edges of the ROW will vary between 0.0 to 1.7 kV/m except for the approximately 2000-foot segment where the maximum electric field on one ROW edge will be 2.7 kV/m.

Q. Have potential long-term effects of AC EMF been studied and considered as well?

A. Yes. Since the 1970s, numerous scientific studies have examined the potential for long- term effects of exposure to EMF. These studies include studies of human populations, that is, epidemiologic studies, and laboratory studies of animals, tissues, and cells. These scientific

---

[2] Despite the widespread description of ICNIRP's reference values or ICES's maximum permissible exposure values as exposure limits, they are just screening values. Measured values below these screening values are specified as complying with the Basic Restrictions, but higher exposures are permitted if it can be shown that the electric field *in situ* does not exceed the Basic Restrictions identified above.

[3] One milligauss (mG) = 0.001 Gauss (G).

investigations examined the potential link of both cancer and non-cancer outcomes among children and adults with occupational and residential exposures.

To evaluate whether the scientific evidence overall suggests the existence of any potential long-term effects, the relevant scientific literature needs to be evaluated in its entirety. Individual studies may be subject to chance variation, potential biases, and confounding due to limitations in the study design, conduct of the study, or in the analyses and interpretation of the results. Thus, scientifically valid conclusions about potential effects may not be drawn from individual studies. An overall assessment of the evidence for scientific and health agencies is done by multi-disciplinary scientific panels, due to the large number and complexity of these scientific studies.

Q. What reviews of EMF research have been performed and what are their conclusions regarding human health?

A. A number of expert panels convened on behalf of scientific, health, and government agencies have evaluated the available scientific literature on potential EMF effects. These agencies include the U.S. National Institute for Environmental Health Sciences ("NIEHS") in 1998, the IARC in 2002, the National Radiological Protection Board of Great Britain in 2004, the WHO in 2007, ICNIRP in 2010, and the European Commission's Scientific Committee on Emerging and Newly Identified Health Risks ("SCENIHR") in 2015. None of these agencies concluded that the evidence, overall, suggests the existence of any adverse health effects in association with environmental exposure to EMF below scientifically-established exposure guidelines. While these agencies recognized the limited evidence based on a statistical association in some of the childhood leukemia epidemiologic studies, they point out that other factors such as chance, bias, and confounding could not be excluded as an explanation for the association. These agencies also concluded that the association is not supported by the results of lifetime exposure studies of laboratory animals that have not identified excess cancer of any type related to the level of exposure to magnetic fields. In addition, there is currently no known biophysical mechanism that would explain a potential carcinogenic effect of EMF.

With respect to the overall evidence on potential long-term effects, the WHO currently states on its website that "[b]ased on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields."[4] ICNIRP has also considered the scientific literature on potential long-term effects and stated that "[i]t is the view of ICNIRP that the currently existing scientific evidence that prolonged exposure to low frequency magnetic fields is causally related with an increased risk of childhood leukemia is too weak to form the basis for exposure guidelines. In particular, if the relationship is not causal, then no benefit to health will accrue from reducing exposure" (ICNIRP, 2010, p. 824).

Q. Have potential AC EMF effects on animals been investigated?

A. Yes. As part of the human health effects research, a large number of studies have been conducted using various laboratory animal species, most commonly rodents, such as rats and mice. No consistent or convincing evidence has emerged from these studies to support the existence of any health effects. Overall, the WHO classified evidence from laboratory animal studies as "inadequate" for any potential health effects. These findings, similar to the way they were used in human health risk assessments, may be extrapolated to other animal species, such as domestic animals and wildlife, thus providing no support for any potential effects.

A considerable amount of scientific research has been conducted involving livestock, although in a less systematic manner. Both observational and experimental studies on livestock were conducted, mostly prompted by economic considerations, and these studies primarily investigated outcomes of reproduction, milk production, and growth. The most commonly-studied species included cattle, sheep, and swine. Among farm animals, the most systematic research program studied behavioral, reproductive, and productivity parameters in dairy cattle at McGill University in Québec, Canada. These studies exposed dairy cattle to AC electric fields (up to 10 kV/m) and AC magnetic fields (up to 300 mG) separately and in combination. While some of the studies reported small differences in some of the investigated parameters, these differences were within physiological ranges and showed no consistent pattern. Overall, no consistent or convincing evidence has emerged to support any adverse effects in livestock.

Studies conducted in the 1980s with commercial honeybees reported reduced hive weight and increased mortality among bees exposed to electric fields above 4.1 kV/m. Later studies, however, demonstrated that these results were due to indirect effects, attributable to small shocks

---

[4] http://who.int/peh-emf/about/WhatisEMF/en/index1.html

induced by the electric fields on the metallic components of the hives and not direct effects of the electric fields on bees themselves. These indirect effects may be easily prevented by shielding the hives with a grounded metallic cover over the hives or by using hives without metallic components. More recent studies of native bees in AC transmission line corridors indicated no adverse effects of EMF on bee abundance, diversity, larval development, or behavior such as floral visitation and pollination success. There were also more spatially and numerically rare species and richer bee communities in AC transmission line corridors than at the grassy fields away from transmission lines.

Q. Were potential AC EMF effects on plants investigated?

A. Yes. Both laboratory and field studies have been conducted to examine potential effect of EMF from transmission lines on plants, including agricultural crops and trees, and forest and woodland vegetation. These investigations include studies of seed germination, seedling emergence and growth, leaf area per plant, flowering, seed production, longevity, and biomass production. While the results were variable, no consistent pattern for potential effects were observed. Overall, no confirmed adverse effects on plants were reported due to EMF exposure at levels that could be expected in the vicinity of the proposed transmission lines.

Summary of Assessment Relevant to the Proposed DC Transmission Line

Q. What are the conclusions of health and scientific agencies regarding static magnetic and electric fields and space charge?

A. None of the reviews conducted by the following agencies concluded that exposure to static electric and magnetic fields and space charge at levels associated with the proposed project would pose a likely health threat to the public.

- International Agency for Research on Cancer (IARC)
- International Commission on Nonionizing Radiation Protection (ICNIRP)
- International Committee on Electromagnetic Safety (ICES)
- National Radiological Protection Board (NRPB)
- Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)
- U.S. Food and Drug Administration (FDA)
- World Health Organization (WHO)

Q. Are the projected levels of static electric and magnetic fields from the Northern Pass DC line below recommended limits on human exposure in guidelines?

A. Yes. Neither the U.S. federal government nor any state has proposed standards or guidelines for static electric fields and space charge. ICNIRP (2009) and the FDA (2003) have limits on exposure to static magnetic fields. For the general public the ICNIRP limit is 4,000 Gauss (G). The exposure limits for adults and children to static magnetic fields from magnetic resonance (MRI) imaging scanners are 40,000 G and 80,000 G, respectively. The NRPB (2004) noted that static electric-field exposures above 25 kV/m were associated with annoyance from perception of surface charge on the skin. The maximum levels of the static electric and magnetic fields on the Project's ROW and beyond are below the exposure levels recommended by these agencies and organizations.

Q. Even if the static electric and magnetic fields from the Northern Pass DC line are below levels cited by the agencies referenced above, are they outside the range of our common exposures?

A. No. We all experience a naturally-occurring static electric field of about 0.13 kV/m under normal atmospheric conditions; as storm fronts approach, this can increase to 20 – 40 kV/m. Static electric fields are also found in offices and homes—such as the static charges that occur when walking across a carpet and the static charges on clothing; these indoor sources of static electric fields are closer and stronger sources of electric-field exposures (100 – 500 kV/m). In contrast, the calculated maximum static electric field at the edge of the right-of-way in fair weather is ≤5.7 kV/m, and will increase to ≤8.8 kV/m during foul weather.

The earth is the dominant source of a naturally-occurring static magnetic field, which causes a compass needle to point to the magnetic north pole. The intensity of this geomagnetic field in New Hampshire is approximately 530 mG. Other common sources of static magnetic fields in the range of 3,000 – 10,000 mG include permanent magnets (which are found in appliances, toys, and medical devices) and battery-powered appliances. Lower static magnetic fields < 3,000 mG are associated with DC-powered electrified railway systems. Far higher magnetic fields are produced by MRI scanners and certain industrial processes. The maximum calculated static magnetic field contributed by the DC line at full-rated loading at the edge of the right-of-way is calculated to be ≤79 mG for the overhead portion of the route and ≤58 mG at

25 feet from the centerline for portions of the underground route. Thus, the magnetic field from the line is lower here and away from the line than that of the earth; however, depending upon the orientation of the Project's DC line with respect to the earth's magnetic field, the magnetic field from the line can either add to the earth's field or partially cancel the earth's field.

Q. How do static magnetic fields interact with organisms and what are their effects?

A. Static magnetic fields at very high intensities are known to interact with tissue by several mechanisms. None of these mechanisms, however, predict harm from exposures at the low intensities of static magnetic fields associated with the earth's geomagnetic field or the proposed DC transmission line. Reviews by several scientific and health agencies do not report that static magnetic fields have adverse effects at environmental levels. Even exposures to magnetic fields from conventional MRI scanners and experimental MRI scanners at levels 15,000 times greater than static magnetic fields from the earth or the Project's DC line are reported to have few direct effects in short-term studies. Even higher intensity static magnetic fields have been tested on animals and for longer durations. In general, biological effects were most clearly elicited by static magnetic fields at intensities above 1 Tesla (T) (10,000 G).

Q. How do static electric fields interact with organisms and what are their effects?

A. Static electric fields affect the distribution of surface charge on the body, but do not enter it to any significant degree. At sufficiently high levels the field can be perceived by the movement of hair on the body such as that produced by a very faint breeze. The electric field from the Project's DC line would be too weak to be easily detected by most people even under the line. If a person contacts a large vehicle (e.g., a tractor trailer), under the line that is very well insulated from ground, he or she might perceive a microshock, similar to what a person might experience after shuffling across a carpet and touching a metal object. Published studies of static electric fields on experimental animals were reviewed, but it cannot be concluded from these studies that any observed biological effects from single studies were due to direct biological effects of the field at levels relevant to those of the project. Indirect effects resulting from stimulation of body fur are the most plausible explanation for responses reported above 30 kV/m.

Q. Are the space charge levels from the Project's DC line outside the range of common experience?

A. No. The levels of air ions calculated at the edge of the ROW of the DC line are within the range of levels that can be encountered in the environment naturally and from varying technologies.

Electrical charges in the air are formed by many natural energy sources. These sources include charges formed by the earth and its atmosphere as well as energy released by evaporation (e.g., boiling water in a tea kettle, which produces 1,000,000 – 10,000,000 ions per cubic centimeter [cm^3]), friction from blowing dust or snow, flames, and weather events. These positive and negative charges on gas molecules are quickly surrounded by clusters of water molecules and do not persist very long (i.e., tens of seconds) before they are neutralized by molecules carrying the opposite charge or when the charge is transferred to microscopic solid or liquid particles in the air (aerosols). Together, air ions and charged aerosols are referred to as space charge. Positive air ions and aerosols result from air molecules or particles that have lost electrons; negative air ions or aerosols are air molecules and particles that have picked up the excess electrons.

Air ions are present everywhere in our environment. For example, clean rural air typically contains about 500 to 2,000 small positive air ions/cm^3 and slightly fewer small negative air ions; negative ion levels can rise to 5,000 – 20,000 ions/cm^3 near waterfalls. In large towns, levels up to 80,000 air ions/cm^3 have been measured. The presence of raindrops, insects, and other material on the DC transmission line and the 345-kV AC transmission line conductors will accelerate corona activity and space charge production. Corona only occurs if the gradient of the electric field at the conductor surface exceeds a certain threshold or onset value. During fair weather, the corona activity on the proposed line will be sporadic, but will be fairly continuous in foul weather. While corona is present on conductors of both DC and AC transmission lines, corona activity leads to negligible levels of space charge from AC transmission lines because, once created, most all air ions are attracted back to the conductor when its polarity changes during each cycle.

Q. Has much research has been done on space charge?

A. Yes, many studies have been done, mostly to investigate possible therapeutic applications to favorably affect mood and respiratory conditions. No scientific or regulatory agency has determined that space charge poses a threat to health or the environment. No mechanism has been confirmed by which air ions or the charge on aerosols would have direct effects on the body, but like static electric fields, space charge at very high levels can be perceived by hair stimulation.

Two recent comprehensive reviews of human subject studies, including meta-analyses of similar studies, have reported on these topics—neither found consistent evidence for effects of either positive or negative ions, except for the possible reduction in indicators of depression at levels more than 10 – 20 fold greater than the maximum levels calculated to be associated with Northern Pass. This response, however, was not related to the duration of exposure. To complement these reviews of human studies, a comprehensive review of more than 50 animal studies in 9 different topic areas was performed. Altogether, the research provided no consistent or reliable evidence that air ions or associated charged aerosols caused any biological responses or adverse effects on the health of the animals. Many of the studies suffer from various reporting and methodological deficiencies.

A potential mechanism for an indirect effect of air ions was evaluated. If air ions were to sufficiently charge passing aerosols, then a small increase in the deposition of aerosols in the respiratory tract might be predicted. The prevalence of electric charges on aerosol particles, however, is similar across a wide range of environments, including around DC and AC transmission lines, and the number of charges per particle calculated or measured around higher voltage DC lines is too low to enhance deposition of aerosols in the respiratory tract.

The Ministry of Health of the Russian Federation has recommended that air ions be increased in indoor environments up to 50,000 ions/cm^3, but the basis for this recommendation, except to improve air quality, was not provided.

Q. Has research been done on potential effects of static electric and magnetic fields and space charge on livestock, wild animals, and plants?

A. Yes. Comprehensive experimental field studies around DC transmission lines operating at ±400 kV and ±500 kV have not reported adverse effects on cattle or crops. A systematic assessment of plants and animals around a ±400 kV DC transmission line reported increases and decreases in some populations, but was unable to conclude from this assessment whether the observations reflected a change in the physical habitat or the electrical environment. Other laboratory studies do not indicate that the weak magnetic field from the DC line would adversely affect species that can make use of the geomagnetic field for orientation or navigation. Field and laboratory studies do not indicate that the electric field from the line would be high enough to affect plants and the beneficial effects on plant growth suggested by some studies of magnetic fields only appeared at levels thousands of times greater than would be produced by the Project's DC line.

Conclusion

Q. On the basis of your assessment, please summarize your conclusions and assess the potential for health effects from the Project.

A. My evaluation considered exposures to electric and magnetic fields, static electric and magnetic fields, and space charge that will be associated with the operation of the Project and existing transmission and distribution lines. At the edges of the ROW and beyond, these exposures are within the ranges commonly encountered from other sources. The levels of fields from the Project's 345 kV AC transmission line and the DC line, and space charge from the latter, are all below applicable limits in guidelines designed to protect public health. My evaluation additionally considered the mechanisms by which these exposures may interact with organisms and involved the review of the scientific studies of humans, experimental animals, livestock, wild animals, and plants. Neither this review nor the reviews of the literature performed for scientific and health agencies identified mechanisms of interaction or exposures at the levels associated with the electrical environment of the Project that would predict any likely harm to public health or the environment. The mostly likely effect, if it occurs at all, would be non-adverse perception of electric fields.

Q. Is it your testimony that the Project's AC and DC lines would not pose an unreasonable adverse effect on public health and safety?

A. Yes, in my judgement the weight of the scientific evidence clearly supports that conclusion that the Project would not pose an unreasonable adverse effect to public health and safety. Moreover, that judgement is shared by scientific and health agencies that also have reviewed the scientific evidence.

Q. Have you seen the draft environmental impact statement released by the department of energy for the project?

A. Yes. The findings are consistent with my testimony.

Q. Does this conclude your testimony?

A. Yes, it does.

Exponent
17000 Science Drive
Suite 200
Bowie, Maryland 20715

telephone 301-291-2500
facsimile 301-291-2599
www.exponent.com

ATTACHMENT A

William H. Bailey, Ph.D.

Principal Scientist

Professional Profile

Dr. William H. Bailey is a Principal Scientist in Exponent's Health Sciences practice. Dr. Bailey specializes in applying state-of-the-art assessment methods to environmental and occupational health issues. His 30 years of training and experience include laboratory and epidemiologic research, health risk assessment, and comprehensive exposure analysis.
Dr. Bailey has investigated exposures to alternating current, direct current, and radiofrequency electromagnetic fields, 'stray voltage', and electrical shock, as well as to a variety of chemical agents and air pollutants. He is particularly well known for his research on potential health effects of electromagnetic fields and has served as an advisor to numerous state, federal, and international agencies. Currently, he is involved in research on exposures to marine life from submarine cables and respiratory exposures to ultrafine- and nanoparticles. Dr. Bailey is a visiting scientist at the Cornell University Medical College and has lectured at Rutgers University, the University of Texas (San Antonio), and the Harvard School of Public Health. He was formerly Head of the Laboratory of Neuropharmacology and Environmental Toxicology at the New York State Institute for Basic Research, Staten Island, New York, and an Assistant Professor and NIH postdoctoral fellow in Neurochemistry at The Rockefeller University in New York.

Academic Credentials and Professional Honors

Ph.D., Neuropsychology, City University of New York, 1975

M.B.A., University of Chicago, 1969

B.A., Dartmouth College, 1966

Sigma Xi; The Institute of Electrical and Electronics Engineers/International Committee on Electromagnetic Safety (Subcommitee 3, Safety Levels with Respect to Human Exposure to Fields (0 to –3 kHz) and Subcommittee 4, Safety Levels with Respect to Human Exposure to Radiofrequency Fields (3 kHz to 3 GHz); Elected member of the Committee on Man and Radiation (COMAR) of the IEEE Engineering in Medicine and Biology Society, 1998–2001

Publications

Chang ET, Adami H-O, Bailey WH, Boffetta P, Krieger RI, Moolgavkar SH, Mandel JS. Validity of geographically modeled environmental exposure estimates. Crit Rev Toxicol 2014 May; 44:450–466. doi: 10.3109/10408444.2014.902029.

Alexander DD, Bailey WH, Perez V, Mitchell ME, Su S. Air ions and respiratory function outcomes: A comprehensive review. J Negat Results Biomed 2013 Sep 9; 12(1):14. doi: 10.1186/1477-5751-12-14.

Perez V, Alexander DD, Bailey WH. Air ions and mood outcomes: A review and meta-analysis. BMC Psychiatry 2013 Jan 15; 13(1):29. doi: 10.1186/1471-244X-13-29.

Bailey WH, Johnson GB, Bishop J, Hetrick T, Su S. Measurements of charged aerosols near ±500 kV DC transmission lines and in other environments. IEEE Transactions on Power Delivery 2012; 27:371–379.

Shkolnikov YP, Bailey WH. Electromagnetic interference and exposure from household wireless networks. 2011 IEEE Symposium on Product Compliance Engineering (PSES), October 1–5, 2011.

Kavet R, Bailey WH, Bracken TD, Patterson RM. Recent advances in research relevant to electric and magnetic field exposure guidelines. Bioelectromagnetics 2008; 29:499–526.

Bailey WH, Wagner M. IARC evaluation of ELF magnetic fields: Public understanding of the 0.4μT exposure metric. Journal of Exposure Science and Environmental Epidemiology 2008; 18:233–235.

Bailey WH, Erdreich L. Accounting for human variability and sensitivity in setting standards for electromagnetic fields. Health Physics 2007; 92:649–657.

Bailey WH, Nyenhuis JA. Thresholds for 60-Hz magnetic field stimulation of peripheral nerves in human subjects. Bioelectromagnetics 2005; 26:462–468.

Bracken TD, Senior RS, Bailey WH. DC electric fields from corona-generated space charge near AC transmission lines. IEEE Transactions on Power Delivery 2005; 20:1692–1702.

Bailey WH. Dealing with uncertainty in formulating occupational and public exposure limits. Health Physics 2002; 83:402–408.

Bailey WH. Health effects relevant to the setting of EMF exposure limits. Health Physics 2002; 83:376–386.

Kavet R, Stuchly MA, Bailey WH, Bracken TD. Evaluation of biological effects, dosimetric models, and exposure assessment related to ELF electric- and magnetic-field guidelines. Applied Occupational and Environmental Hygiene 2001; 16:1118–1138.

Bailey WH. ICNIRP recommendation for limiting public exposure to 4 Hz–1 kHz electric and magnetic fields. Health Physics1999; 77:97–98.

Bailey WH. Principles of risk assessment with application to current EMF risk communication issues. In: EMF Risk Perception and Communication. Repacholi MH, Muc AM (eds), World Health Organization, Geneva, 1999.

De Santo RS, Bailey WH. Environmental justice tools and assessment practices. Proceedings, American Public Transit Association, 1999.

Bailey WH, Su SH, Bracken TD. Probabilistic approach to ranking sources of uncertainty in ELF magnetic field exposure limits. Health Physics 1999; 77:282–290.

Bailey WH. Field parameters. Proceedings, EMF Engineering Review Symposium, Status and Summary of EMF Engineering Research. Bracken TD and Montgomery JH (eds), Oak Ridge National Laboratory, Oak Ridge, TN, April 28–29, 1998.

Bailey WH. Policy implications. Proceedings, EMF Engineering Review Symposium, Status and Summary of EMF Engineering Research. Bracken TD and Montgomery JH (eds), Oak Ridge National Laboratory, Oak Ridge, TN, April 28–29, 1998.

Bailey WH. Probabilistic approaches to deriving risk-based exposure guidelines: Application to extremely low frequency magnetic fields. In: Non-Ionising Radiation. Dennis JA and Stather JW (eds), Special Issue of Radiation Protection Dosimetry 1997; 72:327–336.

Bailey WH, Su SH, Bracken TD, Kavet R. Summary and evaluation of guidelines for occupational exposure to power frequency electric and magnetic fields. Health Physics 1997; 73:433–453.

Bracken TD, Senior RS, Rankin RF, Bailey WH, Kavet R. Magnetic field exposures in the electric utility industry relevant to occupational guideline levels. Applied Occupational and Environmental Hygiene 1997; 12:756–768.

Blondin J-P, Nguyen D-H, Sbeghen J, Goulet D, Cardinal C, Maruvada P-S, Plante M, and Bailey WH. Human perception of electric fields and ion currents associated with high voltage DC transmission lines. Bioelectromagnetics 1996; 17:230–241.

Bailey WH, Charry JM. Acute exposure of rats to air ions: Effects on the regional concentration and utilization of serotonin in brain. Bioelectromagnetics 1987; 8:173–181.

Bailey WH, Charry JM. Measurement of neurotransmitter release and utilization in selected brain regions of rats exposed to dc electric fields and atmospheric space charge. Proceedings, 23rd Hanford Life Sciences Symposium, Interaction of Biological Systems with Static and ELF Electric and Magnetic Fields, 1987.

Pavildes C, Aoki C, Chen J-S, Bailey WH, Winson J. Differential glucose utilization in the parafascicular region during slow-wave sleep, the still-alert state and locomotion. Brain Research 1987; 423:399–402.

Bailey WH, Charry JM. Behavioral monitoring of rats during exposure to air ions and DC electric fields. Bioelectromagnetics 1986; 7:329–339.

Charry JM, Shapiro MH, Bailey WH, Weiss JM. Ion-exposure chambers for small animals. Bioelectromagnetics 1986; 7:1–11.

Charry JM, Bailey WH. Regional turnover of norepinephrine and dopamine in rat brain following acute exposure to air ions. Bioelectromagnetics 1985; 6:415–425.

Bracken TD, Bailey WH, Charry JM. Evaluation of the DC electrical environment in proximity to VDTs. Journal of Environmental Science and Health Part A 1985; 20:745–780.

Gross SS, Levi R, Bailey WH, Chenouda AA. Histamine modulation of cardiac sympathetic responses: A physiological role. Federation Proceedings 1984; 43:458.

Gross SS, Guo ZG, Levi R, Bailey WH, Chenouda AA. 1984. Release of histamine by sympathetic nerve stimulation in the guinea pig heart and modulation of adrenergic responses. Circulation Research 1984; 54:516–526.

Dahl D, Bailey WH, Winson J. Effect of norepinephrine depletion of hippocampus on neuronal transmission from perforant pathway through dentate gyrus. Journal of Neurophysiology 1983; 49:123–135.

Guo ZG, Gross SS, Levi R, Bailey WH. Histamine: Modulation of norepinephrine release from sympathetic nerves in guinea pig heart. Federation Proceedings 1983; 42:907.

Bailey WH. Biological effects of air ions on serotonin metabolism: Fact and fancy. pp. 90–120. In: Conference on Environmental Ions and Related Biological Effects. Charry JM (ed), American Institute of Medical Climatology, Philadelphia, PA, 1982.

Weiss JM, Goodman PA, Losito BG, Corrigan S, Charry JM, Bailey WH. Behavioral depression produced by an uncontrollable stressor: Relationship to norepinephrine, dopamine, and serotonin levels in various regions of rat brain. Brain Research Reviews 1981; 3:167–205.

Bailey WH. Ion-exchange chromatography of creatine kinase isoenzymes: A method with improved specificity and sensitivity. Biochemical Medicine 1980; 24:300–313.

Bailey WH, Weiss JM. Evaluation of a 'memory deficit' in vasopressin-deficient rats. Brain Research 1979; 162:174–178.

Bailey WH, Weiss JM. Effect of ACTH 4-10 on passive avoidance of rats lacking vasopressin (Brattleboro strain). Hormones and Behavior 1978; 10:22–29.

Pohorecky LA, Newman B, Sun J, Bailey WH. Acute and chronic ethanol injection and serotonin metabolism in rat brain. Journal of Pharmacology and Experimental Therapeutics 1978; 204:424–432.

Koh SD, Vernon M, Bailey WH. Free-recall learning of word lists by prelingual deaf subjects. Journal of Verbal Learning and Verbal Behavior 1971; 10:542–574.

Book Chapters

Bailey WH. Principles of risk assessment and their limitations. In: Risk Perception, Risk Communication and its Application to EMF Exposure. Matthes R, Bernhardt JH, Repacholi MH (eds), International Commission on Non-Ionizing Radiation Protection, Oberschleißheim, Germany, 1998.

Bailey WH. Biological responses to air ions: Is there a role for serotonin? pp. 151–160. In: Air Ions: Physical and Biological Aspects. Charry JM and Kavet R (eds), CRC Press, Boca Raton, FL, 1987.

Weiss JM, Bailey WH, Goodman PA, Hoffman LJ, Ambrose MJ, Salman S, Charry JM. A model for neurochemical study of depression. pp. 195–223. In: Behavioral Models and the Analysis of Drug Action. Spiegelstein MY, Levy A (eds), Elsevier Scientific, Amsterdam, 1982.

Bailey WH. Mnemonic significance of neurohypophyseal peptides. pp. 787–804. In: Changing Concepts of the Nervous System. Morrison AR, Strick PL (eds), Academic Press, New York, NY, 1981.

Bailey WH, Weiss, JM. Avoidance conditioning and endocrine function in Brattleboro rats. Pp 371–395. In: Endogenous Peptides and Learning and Memory Process. Martinez JL, Jensen RA, Messing RB, Rigter H, McGaugh JL (eds), Academic Press, New York, NY, 1981.

Weiss JM, Glazer H, Pohorecky LA, Bailey WH, Schneider L. Coping behavior and stress-induced behavioral depression: Studies of the role of brain catecholamines. pp. 125–160. In: The Psychobiology of the Depressive Disorders: Implications for the Effects of Stress. Depue R (ed), Academic Press, New York, NY, 1979.

Technical Reports

Normandeau, Exponent, Tricas T, Gill A. Effects of EMFs from undersea power cables on elasmobranchs and other marine species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09, May 2011.

Jardini JA, et al. Electric field and ion current environment of HVDC overhead transmission lines. Report of Joint Working Group B4/C3/B2.50, CIGRĖ, August 2011.

Johnson GB, Bracken TD, Bailey WH. Charging and transport of aerosols near AC transmission lines: A literature review. EPRI, Palo Alto, CA, 2003.

Bailey WH. Probabilistic approach to ranking sources of uncertainty in ELF magnetic-field exposure limits. In: Evaluation of Occupational Magnetic Exposure Guidelines, Interim Report, EPRI Report TR-111501, 1998.

Bracken TD, Bailey WH, Su SH, Senior RS, Rankin RF. Evaluation of occupational magnetic-field exposure guidelines; Interim Report. EPRI Report TR-108113, 1997.

Bailey WH, Weil DE, Stewart JR. HVDC Power Transmission Environmental Issues Review. Oak Ridge National Laboratory, Oak Ridge, TN, 1996.

Bailey WH. Melatonin responses to EMF. Proceedings, Health Implications of EMF Neural Effects Workshop, Report TR-104327s, EPRI, 1994.

Bailey WH. Recent neurobiological and behavioral research: Overview of the New York State powerlines project. In: Power-Frequency Electric and Magnetic Field Research, EPRI, 1989.

Bailey WH, Bissell M, Dorn CR, Hoppel WA, Sheppard AR, Stebbings, JH. Comments of the MEQB Science Advisors on Electrical Environment Outside the Right of Way of CU-TR-1, Report 5. Science Advisor Reports to the Minnesota Environmental Quality Board, 1986.

Bailey WH, Bissell M, Brambl RM, Dorn CR, Hoppel WA, Sheppard AR, Stebbings JH. A health and safety evaluation of the +/- 400 KV powerline. Science Advisor's Report to the Minnesota Environmental Quality Board, 1982.

Charry JM, Bailey WH, Weiss JM. Critical annotated bibliographical review of air ion effects on biology and behavior. Rockefeller University, New York, NY, 1982.

Bailey WH. Avoidance behavior in rats with hereditary hypothalamic diabetes insipidus. Dissertation, City University of New York, 1975.

Selected Invited Presentations

Bailey WH. Measurements of charged aerosols around DC transmission lines and other locations. International Committee on Electromagnetic Safety TC95/ Subcommittee 3: Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 – 3 kHz, December 2011.

Bailey WH, Erdreich LS. Human sensitivity and variability in response to electromagnetic fields: Implications for standard setting. International Workshop on EMF Dosimetry and Biophysical Aspects Relevant to Setting Exposure Guidelines. International Commission on Non-Ionizing Radiation Protection, Berlin, March 2006.

Bailey WH. Research-based approach to setting electric and magnetic field exposure guidelines (0-3000 Hz). IEEE Committee on Electromagnetic Safety, December 2005.

Bailey WH. Conference Keynote Presentation. Research supporting 50/60 Hz electric and magnetic field exposure guidelines. Canadian Radiation Protection Association, Annual Conference, Winnipeg, June 2005.

Bailey WH. Scientific methodology for assessing public health issues: A case study of EMF. Canadian Radiation Protection Association, Annual Conference, Public Information for Teachers, Winnipeg, June 2005.

Bailey WH. Assessment of potential environmental effects of electromagnetic fields from submarine cables. Connecticut Academy of Science and Engineering, Long Island Sound Bottomlands Symposium: Study of Benthic Habitats, July 2004.

De Santo RS, Coe M, Bailey WH. Environmental justice assessment and the use of GIS tools and methods. National Association of Environmental Professionals, 27th Annual Conference, Dearborn, MI, June 2002.

Bailey WH. Applications to enhance safety: Research to understand and control potential risks. Human Factors and Safety Research, Volpe National Transportation Systems Center/Dutch Ministry of Transport, Cambridge, MA, November 2000.

Bailey WH. EMF health effects review. EMF Exposure Guideline Workshop, Brussels Belgium, June 2000.

Bailey WH. Dealing with uncertainty when formulating guidelines. EMF Exposure Guideline Workshop, Brussels Belgium, June 2000.

Bailey WH. Field parameters: Policy implications. EMF Engineering Review Symposium, Status and Summary of EMF Engineering Research, Charleston, SC, April 1998.

Bailey WH. Principles of risk assessment: Application to current issues. Symposium on EMF Risk Perception and Communication, World Health Organization, Ottawa, Canada, August 1998.

Bailey WH. Current guidelines for occupational exposure to power frequency magnetic fields. EPRI EMF Seminar, New Research Horizons, March 1997.

Bailey WH. Methods to assess potential health risks of cell telephone electromagnetic fields. IBC Conference—Cell Telephones: Is there a Health Risk? Washington, DC, June 1997.

Bailey WH. Principles of risk assessment and their limitations. Symposium on Risk Perception, Risk Communication and its Application to EMF Exposure, International Commission on Non-Ionizing Radiation Protection, Vienna, Austria, October 1997.

Bailey WH. Probabilistic approach for setting guidelines to limit induction effects. IEEE Standards Coordinating Committee 28: Non-Ionizing Radiation, Subcommittee 3 (0–3 kHz), June 1997.

Bailey WH. Power frequency field exposure guidelines. IEEE Standards Coordinating Committee 28: Non-Ionizing Radiation, Subcommittee 3 (0–3 kHz), June 1996.

Bailey WH. Epidemiology and experimental studies. American Industrial Hygiene Conference, Washington, DC, May 1996.

Bailey WH. Review of 60 Hz epidemiology studies. EMF Workshop, Canadian Radiation Protection Association, Ontario, Canada, June 1993.

Bailey WH. Biological and health research on electric and magnetic fields. American Industrial Hygiene Association, Fredrickton, New Brunswick, Canada, October 1992.

Bailey WH. Electromagnetic fields and health. Institute of Electrical and Electronics Engineers, Bethlehem, PA, January 1992.

Bailey WH, Weiss JM. Psychological factors in experimental heart pathology. Visiting Scholar Presentation, National Heart Lung and Blood Institute, March 1977.

Presentations

Williams AI, Bailey WH. Toxicologic assessment of air ion exposures in laboratory animals. Poster presentation at 53rd Annual Meeting of the Society of Toxicology, Phoenix, AZ, March 26, 2014.

Perez V, Alexander DD, Bailey WH. Air ions and mood outcomes: A review and meta-analysis. Poster presentation at the American College of Epidemiology, Chicago, IL, September 8–11, 2012.

Shkolnikov Y, Bailey WH. Electromagnetic interference and exposure from household wireless networks. Product Safety Engineering Society Meeting, San Diego, CA October 2011.

Nestler E, Trichas T, Pembroke A, Bailey W. Will undersea power cables from offshore wind projects affect sharks? North American Offshore Wind Conference & Exhibition, Atlantic City, NJ, October 2010.

Nestler E, Pembroke A, Bailey W. Effects of EMFs from undersea power lines on marine species. Energy Ocean International, Ft. Lauderdale, FL, June 2010.

Pembroke A, Bailey W. Effects of EMFs from undersea power cables on elasmobranchs and other marine species. Windpower 2010 Conference and Exhibition, Dallas, TX, 2010.

Bailey WH. Clarifying the neurological basis for ELF guidelines. Workshop on Practical Implementation of ELF and RF Guidelines. The Bioelectromagnetics Society 29th Annual Meeting, Kanazawa, Japan, June 2007.

Sun B, Urban B, Bailey W. AERMOD simulation of near-field dispersion of natural gas plume from accidental pipeline rupture. Air and Waste Management Association: Health Environments: Rebirth and Renewal, New Orleans, LA, June 2006.

Bailey WH, Johnson G, Bracken TD. Method for measuring charge on aerosol particles near AC transmission lines. Joint Meeting of The Biolectromagnetics Society and The European BioElectromagnetics Association, Dublin Ireland, June 2005.

Bailey WH, Bracken TD, Senior RS. Long-term monitoring of static electric field and space charge near AC transmission Lines. The Bioelectromagnetics Society, 26th Annual Meeting, Washington, DC, June 2004.

Bailey WH, Erdreich L, Waller L, Mariano K. Childhood leukemia in relation to 25-Hz and 60-Hz magnetic fields along the Washington DC—Boston rail line. Society for Epidemiologic Research, 35th Annual Meeting, Palm Desert CA, June 2002. American Journal of Epidemiology 2002; 155:S38.

Erdreich L, Klauenberg BJ, Bailey WH, Murphy MR. Comparing radiofrequency standards around the world. Health Physics Society 43rd Annual Meeting, Minneapolis, MN, July 1998.

Bracken TD, Senior RS, Rankin RF, Bailey WH, Kavet R. Relevance of occupational guidelines to utility worker magnetic-field exposures. Second World Congress for Electricity and Magnetism in Biology and Medicine, Bologna, Italy, June 1997.

Weil DE, Erdreich LS, Bailey WH. Are 60-Hz magnetic fields cancer causing agents? Mechanisms and Prevention of Environmentally Caused Cancers, The Lovelace Institutes 1995 Annual Symposium, La Fonda, Santa Fe, NM, October 1995.

Bailey WH. Neurobiological research on extremely-low-frequency electric and magnetic fields: A review to guide future research. Sixteenth Annual Meeting of the Bioelectromagnetics Society, Copenhagen, Denmark, June 1994.

Blondin J-P, Nguyen D-H, Sbeghen J, Maruvada PS, Plante M, Bailey WH, Goulet D. The perception of DC electric fields and ion currents in human observers. Annual Meeting of the Canadian Psychological Association, Penticton, British Columbia, Canada, June 1994.

Erdreich LS, Bailey WH, Weil DE. Science, standards and public policy challenges for ELF fields. American Public Health Association 122nd Annual Meeting, Washington, DC, October 1994.

Bailey WH, Charry JM. Particle deposition on simulated VDT operators: Influence of DC electric fields. 10th Annual Meeting of the Bioelectromagnetics Society, June 1988.

Charry JM, Bailey WH. Contribution of charge on VDTs and simulated VDT operators to DC electric fields at facial surfaces. 10th Annual Meeting of the Bioelectromagnetics Society, June 1988.

Bailey WH, Charry, JM. Dosimetric response of rats to small air ions: Importance of relative humidity. EPRI/DOE Contractors Review, November 1986. Charry JM, Bailey WH, Bracken TD (eds). DC electric fields, air ions and respirable particulate levels in proximity to VDTs. International Conference on VDTs and Health, Stockholm, Sweden, June 12–15 1986.

Charry JM, Bailey WH. Air ion and DC field strengths at 10^4 ions/cm^3 in the Rockefeller University Small Animal Exposure Chambers. EPRI/DOE Contractors Review, November 1985.

Charry JM, Bailey WH. DC Electrical environment in proximity to VDTs. 7th Annual Meeting of the Bioelectromagnetics Society, June 1985.

Bailey WH, Collins RL, Lahita RG. Cerebral lateralization: Association with serum antibodies to DNA in selected bred mouse lines. Society for Neuroscience, 1985.

Kavet R, Bailey WH, Charry JM. Respiratory neuroendocrine cells: A plausible site for air ion effects. Seventh Annual Meeting of The Bioelectromagnetics Society, June 1985.

Bailey WH, Charry JM. Measurement of neurotransmitter release and utilization in selected brain regions of rats exposed to DC electric fields and atmospheric space charge. 23rd Hanford Life Sciences Symposium, Richland, WA, October 1984.

Bailey WH, Charry JM, Weiss JM, Cardle K, Shapiro M. Regional analysis of biogenic amine turnover in rat brain after exposure to electrically charged air molecules (air ions). Society for Neuroscience, 1983.

Bailey WH. Biological effects of air ions: Fact and fancy. American Institute of Medical Climatology Conference on Environmental Ions and Related Biological Effects, October 1982.

Goodman PA, Weiss JM, Hoffman LJ, Ambrose MJ, Bailey WH, Charry, JM. Reversal of behavioral depression by infusion of an A2 adrenergic agonist into the locus coeruleus. Society for Neuroscience, November 1982.

Charry JM, Bailey WH. Biochemical and behavioral effects of small air ions. Electric Power Research Institute Workshop, April 1981.

Bailey WH, Alsonso DR, Weiss JM, Chin S. Predictability: A psychologic/ behavioral variable affecting stress-induced myocardial pathology in the rat. Society for Neuroscience, November 1980.

Salman SL, Weiss JM, Bailey WH, Joh TH. Relationship between endogenous brain tyrosine hydroxylase and social behavior of rats. Society of Neuroscience, November 1980.

Bailey WH, Maclusky S. Appearance of creatine kinase isoenzymes in rat plasma following myocardial injury produced by isoproterenol. Fed Assoc Soc Exp Biol, April 1978.

Bailey WH, Maclusky S. Appearance of creatine kinase isoenzymes in rat plasma following myocardial injury by isoproterenol. Fed Proc 1978; 37:889.

Bailey WH, Weiss JM. Effect of ACTH 4-10 on passive avoidance of rats lacking vasopressin (Brattleboro strain). Eastern Psychological Association, April 1976.

Prior Experience

President, Bailey Research Associates, Inc., 1991–2000
Vice President, Environmental Research Information, Inc., 1987–1990

Head of Laboratory of Environmental Toxicology and Neuropharmacology, New York State Institute for Basic Research, 1983–1987

Assistant Professor, The Rockefeller University, 1976–1983

Academic Appointment

- Visiting Fellow, Department of Pharmacology, Cornell University Medical College, New York, NY, 1986–present

Prior Academic Appointments

- Visiting Scientist, The Jackson Laboratory, Bar Harbor, ME, 1984–1985
- Head, Laboratory of Neuropharmacology and Environmental Toxicology, NYS Institute for Basic Research in Developmental Disabilities, Staten Island, NY, 1983–1987
- Assistant Professor, The Rockefeller University, New York, NY, 1976–1983
- Postdoctoral Fellow, Neurochemistry, The Rockefeller University, New York, NY, 1974–1976
- Dissertation Research, The Rockefeller University, New York, NY, 1972–1974
- CUNY Research Fellow, Dept. of Psychology, Queens College, City University of New York, Flushing, NY, 1969–1971
- Clinical Research Assistant, Department of Psychiatry, University of Chicago; Psychiatric Psychosomatic Inst., Michael Reese Hospital, and Illinois State Psychiatric Inst, Chicago, IL, 1968–1969

Teaching Appointments

- Lecturer, University of Texas Health Science Center, Center for Environmental Radiation Toxicology, San Antonio, TX, 1998
- Lecturer, Harvard School of Public Health, Office of Continuing Education, Boston, MA, 1995, 1997
- Lecturer, Rutgers University, Office of Continuing Education, New Brunswick, NJ, 1991–1995
- Adjunct Assistant Professor, Queens College, CUNY, Flushing, NY, 1978
- Lecturer, Queens College, CUNY, Flushing, NY, 1969–1974

Editorship

- Associate Editor, Non-Ionizing Radiation, *Health Physics*, 1996–present

Advisory Positions

- RWTH Aachen University. Workshop on human perception thresholds in static electric fields from high-voltage direct current (HVDC) transmission lines, 2015
- ZonMw – Netherlands Organization for Health Research and Development, 2012; 2007-2008, reviewer for National Programme on EMF and Health
- US Bureau of Ocean Energy Management, Regulation and Enforcement, 2009–2010
- Canadian National Collaborating Centre for Environmental Health, reviewer of Centre reports, 2008
- Island Regulatory and Appeals Commission, province of Prince Edward Island, Canada, 2008
- National Institute of Environmental Health Sciences/ National Institutes of Health, Review Committee, Neurotoxicology, Superfund Hazardous Substances Basic Research and Training Program, 2004

- National Institute of Environmental Health Sciences, Review Committee Role of Air Pollutants in Cardiovascular Disease, 2004
- Working Group on Non-Ionizing Radiation, Static and Extremely Low-Frequency Electromagnetic Fields, International Agency for Research on Cancer, 2000–2002
- Working Group, EMF Risk Perception and Communication, World Health Organization, 1998–2005
- Member, International Committee on Electromagnetic Safety, Subcommittee 3 - Safety Levels with Respect to Human Exposure to Fields (0 to 3 kHz) and Subcommitee 4 - Safety Levels with Respect to Human Exposure (3kHz to 3GHz) Institute of Electrical and Electronics Engineers (IEEE), 1996–present
- Invited participant, National Institute of Environmental Health Sciences EMF Science Review Symposium: Clinical and In Vivo Laboratory Findings, 1998
- Working Group, EMF Risk Perception and Communication, International Commission on Non-Ionizing Radiation Protection, 1997
- U.S. Department of Energy, RAPID EMF Engineering Review, 1997
- Oak Ridge National Laboratory, 1996
- American Arbitration Association International Center for Dispute Resolution, 1995–1996
- U.S. Department of Energy, 1995
- National Institute for Occupational Safety and Health, 1994–1995
- Federal Rail Administration, 1993–1996
- U.S. Forest Service, 1993
- New York State Department of Environmental Conservation, 1993
- National Science Foundation
- National Institutes of Health, Special Study Section—Electromagnetics, 1991–1993
- Maryland Public Service Commission and Maryland Department of Natural Resources, Scientific Advisor on health issues pertaining to HVAC Transmission Lines, 1988–1989

- Scientific advisor on biological aspects of electromagnetic fields, Electric Power Research Institute, Palo Alto, CA, 1985–1989
- U.S. Public Health Service, NIMH: Psychopharmacology and Neuropsychology Review Committee, 1984
- Consultant on biochemical analysis, Colgan Institute of Nutritional Science, Carlsbad, CA, 1982–1983
- Behavioral Medicine Abstracts, Editor, animal behavior and physiology, 1981–1983
- Consultant on biological and behavioral effects of high-voltage DC transmission lines, Vermont Department of Public Service, Montpelier, VT, 1981–1982
- Scientific advisory committee on health and safety effects of a high-voltage DC transmission line, Minnesota Environmental Quality Board, St. Paul, MN, 1981–1982
- Consultant on biochemical diagnostics, Biokinetix Corp., Stamford, CT, 1978–1980

Professional Affiliations

- The Health Physics Society (Affiliate of the International Radiation Protection Society)
- Society for Risk Analysis
- International Society of Exposure Analysis
- New York Academy of Sciences
- American Association for the Advancement of Science
- Air and Waste Management Association
- Society for Neuroscience/International Brain Research Organization
- Bioelectromagnetics Society
- The Institute of Electrical and Electronics Engineers/Engineering in Medicine and Biology Society
- Conseil International des Grands Réseaux Électriques

THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2015- 06

PRE-FILED DIRECT TESTIMONY OF GARY B. JOHNSON, Ph.D.

**IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW
HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN
NEW HAMPSHIRE**

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name and business address.

A. My name is Gary B. Johnson. My business address is Exponent, 4580 Weaver Parkway, Suite 100, Warrenville, IL 60555.

Q. What is your position at Exponent?

A. I am a Senior Managing Engineer in Exponent's Electrical Engineering and Computer Science Practice.

Q. Please describe your current responsibilities and professional experience.

A. Exponent is an engineering and scientific consulting firm engaged in a broad spectrum of activities in science and technology. My work in this practice relates to electrical issues particularly involving the electrical environment of power systems. I have extensive experience in modeling and measuring extremely low frequency electric and magnetic fields ("EMF") from transmission and distribution systems as well as the audible noise ("AN"), radio noise ("RN"), and other phenomena associated with high voltage power systems. Among the projects that I have managed are those relating to the measurement and calculation of the electrical environment around direct current ("DC") and alternating current ("AC") transmission lines.

Q. Please summarize your education and research experience.

A. I obtained my Ph.D. in Electrical Engineering from the University of Illinois in 1979. I have a M.S. degree in Physics and a B.S. degree in Engineering Physics, also from the University of Illinois. From 1979 to 1996, I was employed at the High Voltage Transmission Research Center in Lenox, Massachusetts, where I performed research, measurements, and studies related to high voltage power lines and power systems. General Electric and the Electric Power Research Institute (EPRI) primarily operated the Center and performed studies for a number of clients, including utilities and state and federal agencies. Since 1996, I have been involved in a variety of power line studies involving measurements, modeling, and calculations related to the performance of power lines related to EMF, AN, RN, nuisance and ground currents, and stray voltage, initially as head of Power Research Engineering, and since 2001 as part of Exponent's Electrical Engineering and Computer Science Practice.

Q. Please outline your engineering and research experience concerning electric and magnetic fields and other electrical phenomena.

A. I have made measurements and performed investigations of the electrical and magnetic performance of power lines and power systems for over 30 years. My research has included measurements, modeling, and calculations of the electrical characteristics of AC and DC power lines, including electric and magnetic fields, AN, RN, and air ions.

Q. In the course of your investigations have you had the occasion to evaluate potential safety risks from transmission lines and other electrical sources?

A. Yes. I have evaluated power lines for their compliance with the National Electric Safety Code ("NESC"), estimated the levels of currents and voltages coupled onto vehicles near power lines, determined the probable cause and origin of injuries to persons and animals from contact with electrical facilities, and investigated electrical fires and their probable causes.

Q. Have you served as a technical advisor or researcher to government agencies?

A. Yes. I worked for the Vermont Department of Public Service performing tests and measurements on a proposed high voltage DC transmission line. I have worked for the U.S. Department of Energy performing research on DC transmission lines, and also assisted the U.S. EMF Research and Policy Information Dissemination (RAPID) Program in the identification and evaluation of engineering issues related to EMF as part of its overall risk assessment program.

Q. Have you published any of the results of your research in engineering journals?

A. I have published or presented more than 35 papers on this and related subjects.

Q. Are you a member of any professional organizations?

A. Yes. I am a member of the IEEE Power Engineering Society, the American Association for the Advancement of Science, the Bioelectromagnetics Society, and Tau Beta Pi, a national engineering honor society.

Q. Is your educational and professional experience summarized elsewhere?

A. Yes. Additional details of my educational and professional experience are summarized in my *curriculum vitae*, which is Attachment A.

Q. Have you ever appeared as a witness before regulatory agencies?

A. Yes. I have testified in regulatory proceedings before public utility commissions and state and provincial siting boards on behalf of public service commissions as well as project applicants.

Q. What is the purpose of your Testimony?

A. I explain the calculations of the electrical environment associated with the operation of both the DC and AC portions of the Northern Pass transmission project ("Northern Pass" or the "Project") proposed by Northern Pass Transmission, LLC ("NPT"). The results of these calculations are summarized below and the details are included in Appendix 38 of the application. I then provided my calculations to Dr. William Bailey, for his evaluation of the potential effects of EMF and space charge on public health and safety. In addition, I analyzed the AN and RN from the Project.

Electrical Environment

Q. What is the electrical environment of a power line?

A. A transmission line carrying power from one location to another has the conductors of the power line energized at some voltage and those conductors carry electric current. The voltage on the conductors produces electric fields. The voltage on conductors can also produce corona. The current carried by the conductors produces magnetic fields.

Q. What characteristics of the electrical environment of Northern Pass did you calculate?

A. I calculated magnetic fields, electric fields, air ion density, AN, and RN of the Project.

Q. How did you calculate these characteristics associated with the proposed operation of Northern Pass?

A. I used calculation algorithms developed by EPRI at the High Voltage Transmission Research Center and incorporated in the EPRI TL Workstation and by the U.S. Department of Energy, as well as models developed by the Bonneville Power Administration that have been validated and used by engineers and scientists for many years. The inputs to these models are line voltage, load flow, and the physical dimensions of the line (e.g., conductor diameter, spacing, height, etc.). NPT provided information on the design and routing of existing and proposed lines, as well as projections of expected circuit loadings.

Electric and Magnetic Fields

Q. Please describe electric and magnetic fields.

A. Electric and magnetic fields are produced by both natural and man-made sources. These fields describe properties of a location or point in space and its electrical environment, including the forces that would be experienced by a charged body in that space by virtue of its charge or the movement of charges. The voltage can be thought of as the 'pressure,' that moves the electricity through wires. The voltage also produces an electric field in the space surrounding the conductors. The electric current, which is a measure of how much electricity is flowing, produces a magnetic field. Thus, wherever electric current is flowing, there is both an electric field and a magnetic field.

The standard unit for measuring the strength of an electric field is volts per meter, (V/m). The unit in which magnetic-field levels are measured is milligauss (mG). Electric and magnetic fields are characterized by the frequency at which their direction and magnitude oscillate each second.

Q. What frequencies of electric and magnetic fields will be associated with transport of bulk power from Canada over the Project?

A. The proposed Project will be a source of electric and magnetic fields at two power frequencies associated with the bulk transport of electricity. Bulk electricity will be transported from Québec as DC electricity. The northern section of overhead transmission line will be a source of static (constant) electric and magnetic fields which do not oscillate with time (i.e., a frequency of 0 cycles per second or 0 Hertz [Hz]), unlike AC electric and magnetic fields, which have a frequency of 60 Hz in the United States and Canada.

The DC overhead conductors will connect to two underground DC cables for portions of the route between the Canadian border and the Converter Terminal located in Franklin, New Hampshire. No static electric field will be measureable above ground in the underground sections of the Project because the metallic sheaths around the conductors and the earth will block the electric field. A DC magnetic field due to the DC current in the cables will be present above ground since the earth does not readily block magnetic fields.

At the DC/AC converter terminal in Franklin, New Hampshire, DC electricity will be converted to AC electricity that oscillates at a frequency of 60 Hz. A new 345-kilovolt (kV) overhead line will carry this electricity to an existing substation located in Deerfield, New Hampshire, and will be a source of 60-Hz electric and magnetic fields.

Q. Will there be 60-Hz AC electric and magnetic fields along the DC line corridor?

A. Yes. There will be 60-Hz AC electric and magnetic fields along the portions of the DC line's path where it is placed along corridors that already contain AC lines. 60-Hz AC electric and magnetic fields are produced by these existing AC lines.

Q. What are typical sources of static electric and magnetic fields?

A. A static electric field exists naturally due to charge in the air and clouds overhead. This static electric field can have either a positive or negative polarity with intensities ranging from a few hundred volts per meter to several thousand volts per meter or occasionally even tens of thousands of volts per meter (20 kV/m to 40 kV/m) with storm fronts. Fair weather static electric fields often are approximately 130 V/m (0.13 kV/m). The static cling one sometimes feels between the body and clothes is an electric field in the 100 to 500 kV/m range. The earth has a natural static magnetic field that varies between approximately 200 mG to 700 mG going from the equator to the north and south poles. Much higher static magnetic fields in the tens to hundreds of Gauss (i.e., 10,000 to 100,000 mG) are present from common items such as magnets used to hold on name badges, clip notes, and paper to refrigerators or metallic note boards. Even higher static magnetic fields, in the range of 15,000 Gauss (15,000,000 mG) and above, are produced in some medical devices such as magnetic resonance imaging machines.

Q. What are typical sources of 60-Hz EMF?

A. Typical sources of these fields include power lines (both transmission and distribution lines), building wiring, home and office appliances, tools, and electric currents flowing on water pipes. The importance of these sources to overall exposure varies considerably. For example, if a residence is very close to a transmission line or a distribution line (which runs near most residences), these sources could be the dominant, but not necessarily the only, source of magnetic fields in the home. Depending on the circumstances, other sources may be of equal or greater importance. For example, a random survey of 1,000 residences in the

United States reported that electric currents flowing on water pipes and on other components of house grounding systems are twice as likely as outside power lines to be the source of the highest magnetic fields measured in homes (Zaffanella, 1993)**.**

Q. Are cellular phones or their base station antennas sources of 60-Hz EMF?

A. No. Mobile phones do not operate at the power frequency of 60-Hz. They operate in the radiofrequency (RF) range, at approximately 800 million Hz, 1,900 million Hz, or 2,500 million Hz (i.e., 800 megahertz [MHz], 1,900 MHz, or 2,500 MHz). Fields at these high frequencies have different characteristics than 60-Hz fields, which affect their interaction with conductive objects (including biological organisms), and therefore are studied separately with regard to potential health and biological effects.

Q. What factors affect the level of electric and magnetic fields associated with a transmission line?

A. AC electric-field levels depend primarily on the AC line's voltage; the higher the voltage on the line, the higher the electric-field levels associated with that line. Little variation is expected with AC electric-field levels from a power line because the AC line's voltage does not vary significantly. DC electric-field levels (static electric-field levels) depend on both the DC line's voltage and the number of air ions (space charge) that it is producing and which diffuse between the conductors and ground. Although the voltage on the DC line will not vary significantly, the number of air ions produced (corona activity) can vary considerably with weather condition and season and thus the total static electric field can vary considerably. Because of these variations, static electric fields are reported for both fair weather and foul weather conditions during the summer. The highest levels of static electric fields are expected during the summer with levels being higher during foul weather than during fair weather. AC or static electric-field levels decrease rapidly with distance from the transmission line and in addition, conducting objects including fences, shrubbery, and buildings, easily block AC or static electric fields.

AC and static magnetic-field levels depend primarily on the electric current, or load, flowing on the line; as electricity demand increases and the current on the line increases, the magnetic-field levels associated with the line increase. Though not blocked by most everyday objects magnetic-field levels decrease rapidly with distance from a distribution or transmission line.

Q. For what conditions did you calculate the magnetic fields from the Project?

A. The magnetic fields were calculated to predict the typical and maximum values that could be measured near the proposed line, one meter (3.28 feet) above ground, in accordance with IEEE Std. 644-1994. Magnetic-field values are dependent on the orientation of current-carrying conductors and the amount of current they carry. The magnetic-field levels for the Project were calculated for the maximum possible power flow on the Northern Pass lines and associated 115-kV and lower voltage distribution lines under normal operating conditions. In addition, magnetic-field calculations were also performed for reduced power flow cases on the Northern Pass lines or associated 115-kV and lower voltage distribution lines. The calculations used a conservative minimum height of 30 feet above the ground for the overhead conductors of the proposed DC line and minimum heights of 30 and 35 feet for the 115-kV and 345-kV AC transmission lines, respectively. A minimum height of 25 feet was used for the lower voltage distribution lines.

Q. What are the calculated magnetic-field values?

A. The magnetic field is highest under the conductors of the respective lines within the ROW, and decreases with distance from the respective lines. At the edge of the ROW, the static magnetic-field level due to the DC line is calculated to be 79 mG or less along the line route under full loading conditions for the Project. At the edge of the ROW, the AC magnetic-field level due to the AC lines was calculated to vary between 0.1 and 92 mG along the NPT route except for a short distance of ROW, approximately 2000 feet in length, where it will be 127 mG or less under full loading conditions for the Project. Exact details and profiles of the magnetic field for various cross sections along the route are available in Appendix 38 of the application.

Q. For what conditions did you calculate the electric fields from Northern Pass?

A. Electric fields were calculated for the same conductor positions and heights as the magnetic fields at 1 meter (3.28 feet) above ground in accordance with IEEE Std. 644-1994. The voltage of the proposed DC line was set at a 1% overvoltage (±323.2 kV/m). The voltage of AC lines was set at a 5% overvoltage. These voltages are the maximum voltages expected on the lines.

Q. What are the calculated electric-field values?

A. The electric field is highest under the conductors of the respective lines and decreases with distance from the respective lines. At the edge of the ROW and beyond, the static electric-field levels from the DC line are 8.8 kV/m or less in foul weather and 5.7 kV/m or less in fair weather. At the edge of the ROW, the AC electric-field level due to the AC lines is calculated to vary between 0.0 and 1.7 kV/m along the Project's route except for a short distance of ROW, approximately 2,000 feet in length, where it will be 2.7 kV/m or less. Exact details and profiles of the electric field for various cross sections along the route are available in Appendix 38 of the application.

Q. Are the maximum field levels you calculated below the limits for human exposure set by international organizations?

A. Yes. As described in the report of Dr. William H. Bailey in Appendix 37 of the application, the maximum field levels I calculated for the proposed Project and associated existing lines are below the limits set by the International Commission on Nonionizing Radiation Protection and the International Committee on Electromagnetic Safety.

Corona – Air Ions, Audible Noise and Radio Noise

Q. What is corona?

A. Corona is a small electrical discharge (spark) into the air if the voltage on conductor results in a conductor electric field surface gradient sufficient to cause a local breakdown of the air (ionize the air) adjacent to the conductor. Power lines are designed so that their conductor surface gradients are below the level needed produce corona for a smooth clean conductor. The surface gradient at sharp edges or points on water droplets, such as from precipitation, or debris, such as insects, however, can be intensified such that it can ionize the nearby air producing corona.

Q. What is the result of corona?

A. The small electrical discharge (spark) into the air on the surface of the conductor, produces air ions, AN, and RN. These effects are most pronounced directly underneath the line conductors, and decrease with distance from the transmission line. If there is sufficient corona activity, air ions, AN, and RN can be noticeable within a few hundred feet of the transmission line.

Q. Where and when is corona activity more likely to occur?

A. Corona activity depends on a number of factors: altitude, line voltage, conductor size, conductor geometry, and weather conditions. The breakdown strength of air is approximately 30 kilovolts per centimeter (kV/cm) at sea level and decreases with increasing altitude. For a particular altitude, conductor size and line voltage are taken into consideration when designing a transmission line so that the electric fields at the conductor surface do not exceed the breakdown potential of air. Any irregularities on the conductor surface (e.g., nicks, water droplets, or debris), however, may create points where the voltage gradient is intensified sufficiently to produce corona. In foul weather, raindrops or snowflakes accumulating on the conductor surface will also act as points for corona inception. Corona activity is, therefore, most likely to occur on lines at higher altitudes, and is most pronounced during foul weather or when there is surface contamination such as insects or other debris on the conductor.

Q. Is there a difference in the characteristics of the air ions, AN, and RN produced by corona on AC and DC lines?

A. The type of air ions, AN, or RN produced by corona is the same, but they behave differently depending on whether the line is DC or AC. Since the voltage on AC lines oscillates between positive and negative 60 times per second (i.e., a frequency of 60 Hz), the positive air ions produced from corona during the positive voltage portion of the cycle are pulled back into the conductor and neutralized during the negative portion of the voltage cycle on the conductor. The same thing happens to the negative air ions that are produced by corona during the negative portion of the voltage cycle; the negative air ions are pulled back into the conductor during the positive voltage cycle and also neutralized. As a result air ion levels from corona are largely confined to the region immediately around the AC conductor. More corona activity will occur when there are droplets such as from precipitation on the conductor so levels of AN and RN will be higher during foul weather than during fair weather for an AC line.

Air ions produced by corona on a DC line will move out from the conductor towards the opposite polarity conductor or ground where they are collected since the voltage on a DC conductor is constantly the same polarity, positive or negative. Since the air ions are not immediately swept back to the same conductor, as they are for an AC conductor, more are free to diffuse outward from the conductors. This results in air ions from the corona on the conductors being measured at ground. More corona activity will occur when there are droplets such as from precipitation on the conductor so the levels of air ions will be higher during foul weather than during fair weather; however, AN and RN levels from a DC line are lower in foul weather than in fair weather.

Air Ions

Q. What are air ions?

A. Most everyday objects are electrically neutral meaning they have the same number of protons and electrons. An ion is a particle with a charge imbalance (i.e., more electrons than protons or vice-versa) and an air ion is thus a positively or negatively charged air molecule or particle, commonly referred to collectively as space charge.

Q. Under what conditions were air ion levels calculated for this Project?

A. Air ion levels were calculated for a height of one meter (3.28 feet) above ground during hot humid fair-weather and during foul-weather conditions. Air ion levels were calculated at midspan between towers with the lowest anticipated conductor.

Q. What are the calculated air ion levels?

A. At the ROW edge away from other transmission lines, air ion levels are less than 25,500 ions/cm^3 in fair-weather conditions and less than 33,000 ions/cm^3 in foul-weather conditions. Exact details and profiles of the air ion levels for various cross sections along the route are available in Appendix 38 of the application.

Q. Are there limits for air ions?

A. Even though there are no federal limits or state limits in New Hampshire for air ion levels, the Project has been designed in a manner such that the expected air ion levels for the line are similar to or less than the existing DC line in New Hampshire and other DC lines throughout the United States and the world that have been in operation for decades.

Audible Noise

Q. What is audible noise?

A. AN results from corona, the partial electrical breakdown of the air around the conductors of a transmission line that is accompanied by a small audible snapping sound. If there is sufficient corona activity on a high voltage line, many small snaps from corona sources along a conductor may be sufficient, in combination, to produce discernable AN heard as a hissing, crackling sound. The AN from corona on a transmission line decreases with distance from the line.

Q. How is audible noise measured?

A. Sound level is often measured in decibels (dB) referenced to 20 micropascals, which is approximately the threshold of human hearing at 1 kilohertz (kHz). The range of audible frequencies for the human ear is from approximately 20 Hz to 20 kHz, with peak sensitivity near 1 kHz. The change in sensitivity of the human ear with frequency is reflected in measurements by weighting the contribution of sound at different frequencies. The weighting of sound over the frequency spectrum to account for the sensitivity of the human ear is called the A-weighted sound level. When the A-weighting scale is applied to a sound-pressure measurement, the level is often reported as decibels on the A-weighted scale (dBA), referenced to the audible pressure threshold.

Q. What are typical sources of audible noise?

A. Sources of AN are all around us such as wind movement, distant traffic noise, and the activities of insects, birds, and other animals.

Q. What are typical audible noise levels?

A. The sound level of typical human speech is approximately 60 dBA, and background levels of noise in rural and urban environments along the NPT route from 18 dBA to 45 dBA have been measured during fair weather by Douglas Bell and are summarized in Appendix 38 of the application. Specific identifiable noises such as birdcalls, neighborhood activity, and traffic can produce AN levels of 50 to 60 dBA or greater.

Q. Under what conditions was audible noise from Northern Pass calculated?

A. The levels of AN for the proposed line were calculated at a height of 1.5 meters (5 feet) from the ground for hot humid fair-weather and for foul-weather conditions at the highest altitude occurring for each cross section. Overvoltages of 1% on the DC line and 5% on the AC lines as well as the lowest anticipated conductor heights were assumed for the calculation of the AN levels. The highest levels of AN would be expected to occur in these conditions. Lower levels of AN would be expected with normal operation voltage on the line and in seasons other than summer.

Q. What audible noise levels did you calculate?

A. The calculated A-weighted AN level at the edge of the ROW along the DC line route from the Canadian border to the Franklin Converter Terminal is 27 dBA or less in fair-weather conditions and 28 dBA or less in foul-weather conditions. The levels at the ROW edge along the Project's AC line from the Franklin Converter Terminal to the Deerfield Substation are 18 dBA or less in fair weather and 43 dBA or less in foul weather. The AN levels from the lines along the entire Project route fall within the range of background AN that have been measured along the line route by Douglas Bell (Appendix 39 – Report 1).

Q. How do these levels compare to relevant guidelines for audible noise exposure?

A. The AN levels in fair weather along the entire Project route are well below the 55 dBA L_{dn}, outdoor target value published by the Environmental Protection Agency (EPA, 1974) and also below the 40 dBA night time target value at a residence published by the World Health Organization (WHO 1999, 2009). The AN levels in foul weather along the Project route also are well below the EPA guideline and also meet the WHO 40 dBA guideline except for three segments along the Project's AC line route (S1-13, S1-19 and S1-20) between the Franklin Converter Terminal and Deerfield Substation. These levels, however, only occur during foul weather when higher levels of background AN from accompanying rain and wind would be expected to mask the noise and the levels are only a few dB above 40 dBA at the ROW edge; lower levels would be expected at residences, further from the ROW edge.

The AN levels are consistent with the State of New Hampshire Site Evaluation Committee's (SEC) finding in the *Antrim Wind Energy, LLC* case, SEC Docket No. 2012-01, (April 25, 2013) where the SEC relied upon the 2009 WHO Guidelines. The SEC determined that the proposed wind facility would not have an unreasonable adverse effect on public health and safety insofar as sound levels generated by the facility at the outside facades of residences, during daytime, did not exceed 45 dBA or 5 dBA above ambient, whichever is greater, and, at nighttime, did not exceed 40 dBA or 5 dBA above ambient, whichever is greater. Exact details and profiles of the calculated AN for various cross sections along the route are available in Appendix 38 of the application.

Radio Noise

Q. What is radio noise?

A. RN is the hiss or crackle you may hear on your radio. Corona activity produces impulsive currents along a transmission line. These currents cause wide-band RF noise fields that can affect some radio reception. RN from transmission line corona can produce interference to an amplitude-modulated (AM) signal such as that from a commercial AM radio station (520-1720 kHz). Frequency-modulated radio stations are generally not affected by RN from a transmission line. The RN from corona on a transmission line decreases with increasing RF and with distance from the line. The advent and use of digitally encoded radio and television signals (often transmitted at higher frequency) make these signals less susceptible to interference effects from transmission line RN.

Q. How is radio noise measured?

A. RN is measured in units of dB based on its field strength referenced to a signal level of 1 microvolt/meter (μV/m) (IEEE Standard 430-1986).

Q. What are typical sources of radio noise?

A. A common source of RN is electrical activity (lightning) in storm clouds. Other sources of RN can be electrical equipment such as motors, spark plugs in engines, or electric fences such as used for animal confinement.

Q. Under what conditions was radio noise calculated for this Project?

A. The levels of RN for the Project were calculated at 500 kHz and a height of 1 meter (3.28 feet) from the ground for hot humid fair-weather and for foul-weather conditions at the highest altitude occurring for each cross section. Overvoltages of 1% on the DC line and 5% on the AC lines were considered for the calculation of the RN levels as well as the lowest anticipated conductor heights. The highest levels of RN would be expected to occur in these conditions. Lower levels of RN would be expected with normal operation voltage on the line and in seasons other than summer.

Q. What are the calculated radio noise levels?

A. The RN at 50 feet from the nearest conductor along the Project's DC line route from the Canadian Border to Franklin Converter Terminal is 55 dB μV/m or less in fair-weather conditions and 49 dBμV/m or less in foul-weather conditions. RN at 50 feet from the nearest conductor along the Project's AC line from the Franklin Converter Terminal to the Deerfield Substation is 43 dBμV/m or less in fair weather and 60 dBA or less in foul weather. Exact details and profiles of the RN for various cross sections along the route are available in Appendix 38 of the application.

Q. Are there limits for radio noise?

A. NPT will comply with good design practices to minimize RN (IEEE, 1971) and also comply with the applicable Federal Communications Commission Rules and Regulations (Part 15, Section 15.25). Even though there are no state limits in New Hampshire on RN, the proposed line has been designed in a manner consistent with the IEEE Radio Noise Design Guide for High-Voltage Transmission Lines (IEEE, 1971) that suggests 61 dBμV/m at a distance of 50 feet from an outside conductor as a design guide.

Conclusion

Q. Is it your testimony that the AC and DC lines of the Project would not create any unreasonable adverse effects?

A. Yes. This is based upon my finding that the calculated values are below levels recommended by government and engineering bodies to avoid unreasonable adverse effects.

Q. Have you reviewed the DEIS released by the Department of Energy for the Project?

A. Yes. The findings of the DEIS are consistent with my testimony.

Q. Does this conclude your testimony?

A. Yes, it does.

Exponent®
Failure Analysis Associates®

Exponent
4580 Weaver Parkway
Suite 100
Warrenville, IL 60555

telephone 630-658-7500
facsimile 630-658-7599
www.exponent.com

Gary B. Johnson, Ph.D.
Senior Managing Scientist

Professional Profile

Dr. Gary Johnson is a Senior Managing Scientist in Exponent's Electrical Engineering and Computer Science practice. Dr. Johnson specializes in electrically related issues particularly as they relate to the electrical environment of power systems. He has extensive experience with the electric and magnetic fields of transmission and distribution systems as well as the audible noise, radio noise, and ozone that may be produced by high voltage power systems. His work has involved the measurement, modeling, and mitigation of the electrical environment of transmission lines, transformer vaults, and underground/submarine cables. His power system experience includes issues dealing with lightning, electrical transients, ground currents, and stray voltage.

Dr. Johnson has testified on the corona and field effects of DC and AC transmission lines and been a lecturer at the EPRI Transmission Line Design Seminars. He has given numerous presentations and led several workshops on power line design and the electrical environment. He was a principal investigator in the EPRI research on magnetic field sources and methods of shielding.

Dr. Johnson has performed engineering studies related to power system fields, audible noise, radio noise, induced currents, and ground currents for clients including state and federal agencies, utilities, and site developers. Other areas of expertise include investigations of electrically-related fires in devices ranging from consumer appliances to industrial equipment, electrical injury, electrical faults, electronic component failure, code compliance, and facility wiring systems. Prior to joining Exponent, Dr. Johnson was the President of Power Research Engineering, where he worked on engineering issues related to the electrical environment and power quality.

Academic Credentials and Professional Honors

Ph.D., Electrical Engineering, University of Illinois, 1979
M.S., Physics, University of Illinois, 1976
B.S., Engineering Physics, University of Illinois (Highest Honors), 1974

Tau Beta Pi; Phi Kappa Phi

Publications and Presentations

Bishop J, Johnson G, Nilsson S, McNichol J. Performance of DC transmission line insulator strings. CIGRE Colloquium on HVDC and Power Electronic Systems Including Overhead Line and Insulated Cable Applications, San Francisco, CA, March 7–9, 2012.

Johnson G. Electrical environment: Conversion of an AC to a DC transmission line. CIGRE Colloquium on HVDC and Power Electronic Systems Including Overhead Line and Insulated Cable Applications, San Francisco, CA, March 7–9, 2012.

Bailey WH, Johnson GB, Bishop J, Hetrick T, Su S. Measurements of charged aerosols near ±500 kV DC transmission lines and in other environments. IEEE Transactions on Power Delivery 2012; 27:371–379.

Martens J, Johnson GB, So P. Design considerations for consumer products utilizing high voltage. Presentation and Conference Proceedings, IEEE Symposium on Product Safety & Compliance Engineering, IEEE Product Safety Engineering Society, Irvine, CA, October 23–24, 2006.

Bailey WH, Johnson GB, Bracken TD. Method for measuring charge on aerosol particles near AC transmission lines. Joint Meeting of the Biolectromagnetics Society and the European BioElectromagnetics Association, Dublin, Ireland, June 2005.

Johnson GB, Bracken TD, Bailey W. *Charging and Transport of Aerosols near AC Transmission Lines: A Literature Review*, EPRI, Palo Alto, CA, and National Grid Transco Plc., London, England: 2003. EPRI Report 1008148, Palo Alto, CA, December 2003.

Johnson GB, Guttman JL, Kavet R. Transient magnetic fields and currents in residences. Proceedings, IEEE International Symposium on Electromagnetic Compatibility, Montreal, Canada, August 2001; Vol 1: 227–232.

Guttman JL, Niple J, Kavet R, Johnson GB. Measurement instrumentation for transient magnetic fields and currents. Proceedings, IEEE International Symposium on Electromagnetic Compatibility, Montreal, Canada, August 2001; Vol 1: 419–424.

Kavet R, Ulrich RM, Kaune WT, Johnson GB, Powers T. Determinants of power-frequency magnetic fields in residences located away from overhead power lines. Bioelectromagnetics 1999; 20(5):306–318.

Johnson GB. Instrumentation and measurement technology. Proceedings, EMF Engineering Review Symposium, EMF-RAPID Program, Charleston, SC, April 1998.

Johnson GB. Field-management technologies. Proceedings, EMF Engineering Review Symposium, EMF-RAPID Program, Charleston, SC, April 1998.

Johnson GB, Kavet R, Sastre A. Residential magnetic field transients. Effect of residential services on fields arising from distribution line capacitor bank switching. Bioelectromagnetics Symposium, P-130A, Salt Lake City, UT, June 1995.

Johnson GB, Clairmont BA. Low field transmission lines: Design concepts. Proceedings, 1995 CIGRE Study Committee 36 Colloquium, Foz do Aquacu, Brazil, May 1995.

Clairmont BA, Johnson GB, Zelingher S. Study on the human perception of hybrid fields. Proceedings, 1995 CIGRE Study Committee 36 Colloquium, Foz do Aquacu, Brazil, May 1995.

Johnson GB. HVDC transmission line corona performance and conductor contamination by insects. Proceedings, 1995 CIGRE Study Committee 36 Colloquium, Foz do Aquacu, Brazil, May 1995.

Johnson GB. Residential magnetic field sources. Proceedings, 1995 EPRI EMF Seminar, Santa Clara, CA, March 1995.

Johnson GB. Residential ground current reduction. Proceedings, 1995 EPRI EMF Seminar, Santa Clara, CA, March 1995.

Johnson GB. Residential field sources: EPRI EMF survey. Proceedings, Pennsylvania Electric Association Transmission and Distribution Meeting, Metamoras, PA, May 12, 1994.

Johnson GB, Lordan RJ. EPRI magnetic field technical information center. Proceedings, American Power Conference, Chicago, IL, April 26, 1994.

Johnson GB, Childs DJ, Sullivan TP. WAVECAM: A pocket size magnetic field waveform capture device. Proceedings, American Power Conference, Chicago, IL, April 26, 1994.

Johnson GB. Magnetic field sources in residences: Measurement, detection, and options. EMF Management Techniques Training Session, 1994 IEEE/PES Transmission and Distribution Conference and Exposition, Chicago, IL, April 14, 1994.

Johnson GB, Lordan R, Clairmont B, King K, Rashkes V. Magnetic field management for transmission lines. Proceedings, 1994 Missouri Valley Electric Association Engineering Conference, Kansas City, MO, March 23, 1994.

Johnson GB. Residential field sources at power frequencies. Proceedings, 1993 IEEE International Symposium on Electromagnetic Compatibility, pp. 132–137, Dallas, TX, August 1993.

Johnson GB, Dunlap JH, Zaffanella LE. Survey of residential magnetic field sources: Interim report. Proceedings, 1993 American Power Conference, pp. 1669–1673, Chicago, IL, April 1993.

Johnson GB. Measurements of magnetic field sources in schools. Proceedings, American Power Conference, Chicago, IL, April 1992.

Johnson GB, Clairmont B, Dunlap J. Transmission line magnetic fields: Measurements and calculations. Proceedings, American Power Conference, Chicago, IL, April 1992.

Johnson GB. Magnetic field sources in nonresidential settings. Proceedings, EPRI Science and Communication Seminar, San Jose, CA, October 1991.

Johnson GB. Magnetic field management: Residential low-voltage grounding. Proceedings, EPRI Science and Communication Seminar, San Jose, CA, October 1991.

Rauch GB, Johnson GB, Johnson P, Stamm A, Tomita S, Swanson J. A comparison of international grounding practices and associated magnetic fields. Proceedings, IEEE T&D Conference, Dallas, TX, September 1991, and IEEE Transaction on Power Delivery 1992; 7:934–939.

Johnson GB, Zaffanella LE, Rauch GB. Research facility for the study of power system magnetic fields. Proceedings, IEEE T&D Conference, Dallas, TX, September 1991.

Johnson GB. Residential magnetic field sources. Panel Session Paper at the IEEE Power Engineering Society Summer Meeting, Minneapolis, MN, July 1990, and IEEE Power Engineering Society Transmission and Distribution Conference, Dallas, TX, September 1991.

Johnson GB, Baishiki RS, Bracken TD, Rauch GB, Silva JM, Sussman SS, Zaffanella LE. Studies of power system magnetic fields: Characterization of sources in residential environments, measurements of exposure, influence on computer screens. Proceedings, CIGRE General Conference, Paris, August 1990.

Johnson GB. Degree of corona saturation for HVDC transmission lines. IEEE Trans Power Delivery 1990; PWRD-5:695–707.

Clairmont BA, Johnson GB, Zaffanella LE, Zelingher S. The effect of HVAC – HVDC line separation in a hybrid corridor. IEEE Trans Power Delivery 1990; PWRD-4(2):1338–1350.

Clairmont BA, Johnson GB. Measurements of AC and DC field and corona effects in a hybrid corridor. Proceedings, American Power Conference, Chicago, IL, April 24–26, 1989.

Johnson GB, Carter PJ. Measurement of space charge density using a Faraday cage. Proceedings, 6th International Symposium on High Voltage Engineering, Paper 42.32, New Orleans, LA, August 1989.

Carter PJ, Johnson GB. Space charge measurements downwind from a monopolar 500 KV HVDC test line. IEEE Trans Power Delivery 1988; PWRD-3(4):2056–2063.

Johnson GB. Electric field and ion density in proximity of HVDC transmission lines: Measurements and calculations. CIGRE Study Committee Montreal Colloquium, Montreal, Canada, June 1987.

Johnson GB, Bracken TD. Small air ion environments. In: Air Ions: Physical and Biological Aspects, CRC Press, 1987.

Johnson GB. Electric fields and ion currents of a +/- 400 kV HVDC test line. IEEE Trans Power Apparatus and Systems, PAS-102, 1983.

Johnson GB, Zaffanella LE. Techniques for measurements of the electrical environment created by HVDC transmission lines. Proceedings, 4th International Symposium on High Voltage Engineering, Paper 13.05, Athens, Greece, September 1983.

Comber MG, Johnson GB. HVDC field and ion effects at Project UHV: Results of electric field and ion current measurements. IEEE Trans Power Apparatus and Systems, PAS-101, 1982.

Johnson GB. The electrical environment and HVDC transmission lines. Proceedings, American Institute of Medical Climatology Conference on Environmental Ions and Related Biological Effects, Philadelphia, PA, October 1982.

Johnson GB, Verdeyen JT, Kaye RJ. Extraction of an intense neutralized ion beam from a plasma. Proceedings, 2nd International Conference on Electron Beam Research and Technology, Ithaca, NY, October 1977.

Johnson GB, Johnson WL, Kaye RJ, Verdeyen JT. Ion beam pellet fusion. Proceedings, 4th Inter-University Conference on Energy, Urbana, IL, April 1977.

Johnson WL, Johnson GB, Verdeyen JT. Ion bunching in electronic space charge regions. J Appl Phys 1976; 47:4442.

Workshops/Seminars

Johnson GB. Proposed IEEE standard – 1556: Public impacts. Panel Session: Electric and Magnetic Field Exposure Standards for the Public and Workers: 0 – 3 kHz, IEEE Power Engineering Society Summer Meeting, Vancouver, Canada, 2001.

Johnson GB. Power system magnetic fields. GPU Workshop, EPRI Power Delivery Center-Lenox, MA 1997.

Johnson GB. Measurement of residential magnetic fields. Yankee Conference, Massachusetts Environmental Health Association, Westborough, MA, 1995.

Johnson GB. Residential sources and exposure. EMF Health Research: State of the Science, Harvard School of Public Health, Boston, MA, 1995.

Johnson GB. Power system magnetic field management seminar. HVTRC, Lenox, MA, 1994.

Johnson GB. EMF in substations. IEEE Workshop, Los Angeles, CA, May 1994.

Johnson GB. Proceedings, Substation Magnetic Field Workshop. EPRI Workshop, Palo Alto, CA, EPRI Report on RP 2942-41, TR 101852, April 1993.

Johnson GB. Distribution magnetic field management workshop. HVTRC, Lenox, MA, 1992; Washington DC, 1993.

Johnson GB. End use magnetic field R&D workshop. EPRI Workshop, Raleigh, NC, 1992.

Johnson GB, Frazier M, Dunlap J. EPRI Electrical Potpourri Seminar, Palo Alto, CA, 1990; Haslet, TX, 1991.

Johnson GB. Magnetic field considerations: Low voltage grounding. EPRI Workshop, Colorado Springs, CO, 1991.

Johnson GB. Power system magnetic field measurement workshop. HVTRC, Lenox, MA, 1988 to 1995.

Johnson GB, Zaffanella L, Comber M, Nigbor R, Clairmont B, Anzivino L, Slocik J. EPRI High Voltage Transmission Line Design Seminar, HVTRC, Lenox, MA, 1982 to 1992.

Professional Affiliations

- Institute of Electrical and Electronic Engineers
- American Association for the Advancement of Science
- American Physical Society
- BioElectroMagnetics Society

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF DOUGLAS H. BELL

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name, current position, and business address.

A. My name is Douglas H. Bell and I am a Senior Principal Consultant and President at Cavanaugh Tocci Associates, Inc. My business address is 327 F Boston Post Road, Sudbury, MA.

Q. Please describe your educational background and your work experience.

A. I received a Bachelor of Science degree in Electrical Engineering from the Massachusetts Institute of Technology in 1982, and since that time I have worked in the field of engineering acoustics. My educational experience relevant to this testimony includes course work in acoustics, vibration, physics, and mathematics. In 1989, I joined Cavanaugh Tocci Associates, Inc. as a principal consultant. Cavanaugh Tocci Associates Inc. is a member of the National Council of Acoustical Consultants. As a principal (and later a senior principal) of this firm I have been responsible for all aspects of project management and technical services for a wide variety of projects that are related to sound and vibration control. I have twenty five years of experience in evaluating environmental sound. My environmental sound impact assessment experience includes conducting baseline sound surveys, review of environmental noise regulations, defining appropriate acoustic design goals for projects, developing computer based models to estimate project related sound impact, development of sound mitigation strategies, and conducting post-construction sound compliance testing. I have co-authored a textbook on the topic of Industrial Noise Control and have published several papers in trade related journals. I am a member of the Institute of Noise Control Engineering ("INCE"), and the Acoustical Society of America ("ASA"). Attached to this testimony is a copy of my resume, Attachment A.

Q. What is the purpose of your testimony?

A. For the Northern Pass Transmission Project ("Northern Pass" or the "Project"), as proposed by Northern Pass Transmission LLC ("NPT"), I explain how I (1) conducted baseline sound surveys along the Project route (Report 1 of Appendix 39 of the SEC application) and provided the sound surveys to Dr. Gary Johnson to assess the sound impact produced by the Project's transmission lines; (2) developed acoustic design goals for the Franklin Converter Terminal, the Deerfield Substation expansion, and the Scobie Pond Substation expansion (Reports 2-4 of Appendix 39 of the SEC application); and (3) reviewed construction noise impacts. Report 5 of Appendix 39 of the SEC application.

Baseline Surveys

Q. Please describe the purpose of conducting baseline sound surveys?

A. Sound is a feature of all environments. When a new sound source is introduced into an area, it may be deemed a nuisance or an annoyance when it is inconsistent with the environment, by being either too loud or by being distinct in character. To accurately assess the acoustic impact of a proposed facility, an understanding of the existing acoustic environment in the vicinity of the source is required. To this end, the results of baseline sound surveys provide a basis for making an informed assessment of acoustic impacts.

Q. Please describe the methodology used to conduct baseline sound surveys for the Project.

A. In order to document the time-varying characteristics of ambient environmental sounds in the study areas, I implemented sound monitoring programs which relied on unattended continuous measurements (3 to 7 days periods), and attended intermittent measurements (15 to 20 minutes intervals). The continuous measurements were performed in order to identify typical patterns in existing ambient environmental sound levels, and to obtain a sufficient statistical sample to quantify time-varying background sound levels in the community. Data gathered with the continuous monitors included hourly A-weighted metrics (L_{eq}, L_{max}, L_{min}, L_1, L_{10}, L_{50}, L_{90}, L_{99}), for the entire monitoring periods. The intermittent measurements were conducted in order to obtain detailed observations of the acoustic environment during daytime and late night/early morning hours. Data gathered during the intermittent measurements included A-weighted and 1/3 octave band frequency analysis for each interval (L_{eq}, L_{max}, L_{min}, L_1, L_{10}, L_{50}, L_{90}, L_{99}), and 1-second time histories to identify transient events. The results of the survey allow both quantitative and qualitative analyses of the acoustical environment surrounding the Project. A glossary of acoustic terminology used in this testimony can be found in Annex A of Reports 1-5 in Appendix 39 of the SEC Application.

Q. Where were the baseline sound measurements performed?

A. The baseline sound surveys can be divided into two categories (Stationary Facility Surveys, and Project Route Survey):

1. ***Stationary Facility Surveys***

For these surveys, reviews of the existing land use in the vicinity of the facilities were conducted to identify the closest and most representative receptor locations. On the basis of these reviews, the following locations were selected:

a. *Franklin Converter Terminal:*

i. Continuous monitoring at one location adjacent to the nearest residence east of the Project

ii. Intermittent measurements at three locations (north, east, and south) of the Project

b. *Deerfield Substation:*

i. Continuous monitoring at one location adjacent to the nearest residence west of the Project

ii. Intermittent measurements at three locations (north, west, and south) of the Project

c. *Scobie Pond Substation:*

i. Continuous monitoring at two locations adjacent to the nearest residential properties north and south of the Project

ii. Intermittent measurements at the same two locations as the continuous monitoring (north, and south)

2. Project Route Survey

Seventeen (17) measurement locations were selected to assess ambient sound along the proposed Project route. These locations were selected in order to provide a representative sample of the various acoustic environments that exist along the Project route. Intermittent measurements were conducted at all seventeen (17) locations, and continuous measurements were conducted at two (2) of the selected locations. It should be noted that since this survey was conducted an additional underground length of transmission line has been proposed in the vicinity of Locations 8, 8A, 9, 9 CM and 10. Although transmission line sound will not impact these locations, the data derived is relevant in characterizing similar environments along the route.

Q. When were the baseline surveys performed?

A. The measurements were conducted during a cold weather season with leaves off the trees, and a warm weather season with foliage and insect sounds present. Specific time windows follow:

1. ***Stationary Facility Surveys***
   a. *Continuous Measurements*
      i. Winter: January 30, 2014 – February 6, 2014
      ii. Summer: June 16, 2014 – June 23, 2014
   b. *Intermittent Measurements*
      i. Winter – Daytime: January 30, 2014 (9 a.m. – 2 p.m.)
      ii. Winter – Nighttime: January 31, 2014 (midnight – 4: a.m.)
      iii. Summer – Daytime: June 16, 2014 (noon – 4 p.m.)
      iv. Summer – Nighttime: June 17, 2014 (midnight – 4 a.m.)
2. ***Project Route Survey***
   a. *Continuous Measurements*
      i. Winter: March 24, 2014 – March 27, 2014
      ii. Summer: July 21, 2014 – July 24, 2014
   b. *Intermittent Measurements*
      i. Winter – Daytime: March 24-27, 2014 (10 a.m. – 4 p.m.)
      ii. Winter – Nighttime: March 27-April 3, 2014 (10 p.m. – 4 a.m.)
      iii. Sumer – Daytime: July 21-23, 2014 (9 a.m. – 3 p.m.)
      iv. Summer – Nighttime: July 21-25, 2014 (10 p.m. – 4 a.m.)

Q. Please describe the results of the stationary facility surveys.

A. A primary objective of these surveys was to quantify the background sound levels that typically occur in the vicinity of the facilities. The background sound level is the nearly steady-state level that occurs in the environment devoid of transient sounds. In most environments, background sound levels reach a minimum during the late night or early morning hours when local traffic is negligible. It is comparisons to these lowest background sound levels that serve as our basis for assessing project sound impact. To obtain a conservative estimate of these lowest background sound levels that occur in each Project area, we begin by using the $L_{90(1\text{-hour})}$ metric. This metric represents the sound level that is exceeded for 54 minutes of each measured hour. In other words, the ambient sound only falls below the $L_{90\ (1\text{-hour})}$ for six minutes in the hour. We then select the lowest $L_{90(1\text{-hour})}$ that occurred in each continuous 24-hour period of the survey. There are seven lowest $L_{90(1\text{-hour})}$'s in a week long (168-hour) survey. We then average these seven values to obtain a metric that we refer to as the "nominally lowest" background sound level. Background sound levels rarely fall below this level, and only for brief periods; usually during the early morning hours (between 2 a.m. and 4 a.m.). The "nominally lowest" background sound levels measured during the summer and winter surveys follow:

1. *Franklin Converter Terminal*
   a. Winter: 21 dBA
   b. Summer: 27 dBA

2. Deerfield Substation
   a. Winter: 24 dBA
   b. Summer: 27 dBA

3. Scobie Pond Substation
   a. Winter:
      i. North monitor: 30 dBA
      ii. South monitor: 31 dBA
   b. Summer:
      i. North monitor: 34 dBA
      ii. South monitor: 36 dBA

Method to Assess Incremental Sound Impact

Q. Please describe your method to assess incremental sound impact.

A. Sound impacts of a Project are often assessed with respect to pre-existing background sound levels. Limits for incremental changes in background sound that result from sound produced by a project can be used as criteria for controlling sound impact. However, appropriate limits for acceptable incremental changes above the pre-existing background can vary greatly depending on the metric used to define the background sound level, and an understanding of the character of both the existing background sounds and the facility sound. To evaluate the potential impact of Project related sounds at the stationary facilities, I have utilized an impact assessment method that is based on incremental increases above the "nominally lowest" background sound level measured in the above discussed baseline sound surveys. Thus the starting point for my assessment is based on a very low sound level that only occurs for brief periods of time typically during the early morning hours. I then defined impact classifications with respect to the incremental amount that the facilities might exceed the "nominally lowest" background sound level, using the following classification scheme to rate the impacts.

Up to 5 dBA– *little or no impact*

5-10 dBA – *minimal impact*

Greater than 10 dBA – *significant impact*

This approach recognizes that the average person can rarely distinguish a 3 dBA change in sound level and that a change in sound level in excess of 10 dBA is readily apparent to the average person. It should also be noted that for the most part, during daytime and evening hours, pre-existing background sound levels significantly exceed the "nominally lowest" level. As such when using this metric as a basis for assessing incremental changes, the above classifications become extremely conservative with respect to the anticipated response from acoustically sensitive receptors.

Acoustic Design Goals

Q. Please describe the purpose of acoustic design goals.

A. Acoustic design goals are used in the engineering and design of facilities in order to achieve certain sound emission criteria. The acoustic design goals are included in the specifications provided to vendors as part of requests for proposals by NPT.

Q. What are the acoustic design goals that you recommend for the Franklin Converter Terminal, the Deerfield Substation expansion, and the Scobie Pond Substation expansion?

A. In order to obtain a characterization of "minimal impact" or less, I recommend the following acoustic design goals:

1. Franklin Converter Terminal

The maximum sound level for continuous sound produced by the operation of all equipment located at the facility shall not exceed 30 dBA at any existing occupied residential receptor property when measured within the boundaries of the receptor property.

2. Deerfield Substation Expansion

The maximum sound level for continuous sound produced by the operation of all equipment located at the facility shall not exceed 29 dBA at any existing occupied residential receptor property when measured within the boundaries of the receptor property.

3. Scobie Pond Substation Expansion

The maximum sound level for continuous sound produced by the operation of all equipment located at the facility shall not exceed 35 dBA at any existing occupied residential receptor property when measured within the boundaries of the receptor property.

These acoustic design goals will be incorporated into the material procurement contracts. Prior to the purchase of equipment, the contractor will be required to demonstrate using appropriate acoustic modeling methods that the design will meet the acoustic requirements. At the conclusion of construction, the contractor will demonstrate through field measurements that the Project complies with the acoustic specifications.

Construction Noise Impacts

Q. Have you considered construction noise in your evaluation?

A. Construction of the Project will take place over a time frame of approximately two and a half years. For the most part, construction activities will take place during daytime hours. The construction schedule will include many overlapping phases that will occur throughout the extent of the Project route. Construction tasks for this Project can be grouped into the following categories:

- Overhead Transmission Line Construction
- Underground Transmission Line Construction
- Fixed Site Construction

Due to the temporary nature of most construction components of this Project, construction noise is not expected to create an appreciable impact at sensitive receptors. During the detailed design process and during construction, areas where activities may occur for extended periods of time will be identified. The need for noise mitigation measures at these locations will depend on proximity to sensitive receptors and the anticipated duration of sound impact. Construction noise is difficult to control because of the mobile nature of its sources and the flexibility of schedule inherent in most construction. However, as a starting point, the following noise abatement measures will apply throughout the project:

- The federal regulations that define limits for truck noise, for the sale of new trucks will be complied with.

- The construction equipment manufacturers' stock sound muffling devices will be used, and will be kept in good repair throughout the construction process.
- The majority of the potentially noisy construction work will be performed during daytime hours, and as permitted by applicable requirements,
- The Project will maintain communication with the communities during the construction process in order to inform of potential impact during construction, and to respond to community concerns.

Conclusion

Q. Are there any noise regulations that apply to the Project facilities?

A. To the best of my knowledge, there are no Federal, or State regulations that specifically govern the sound produced by the Project facilities. I am aware, however, that the SEC has determined appropriate sound levels in a number of cases. In the Antrim wind case, the SEC relied on the 2009 WHO Guidelines in establishing a sound level condition of 45 dBA or 5 dBA above ambient during daytime at the outside facades of residences, and a nighttime level not to exceed 40 dBA or 5 dBA above ambient, whichever is greater.

Q. How do the Project acoustic design goals associated with the Franklin Converter Terminal, the Deerfield Substation expansion, and the Scobie Pond Substation expansion compare to the SEC precedent?

A. The acoustic design goals I have recommended for the stationary facilities, which apply at all existing occupied residential properties, are very stringent, and well within the limits of the SEC precedent.

Q. What is your opinion regarding construction noise?

A. It is my opinion that if the protocols are observed, sound produced by the construction of the Project will not have an appreciable impact at sensitive receptors.

Q. Have you seen the DEIS released by the Department of Energy for this project?

A. Yes. The findings are consistent with my Testimony

Q. Does this conclude your testimony?

A. Yes.

ATTACHMENT A

Douglas H. Bell

President/Senior Principal

Education:

Massachusetts Institute of Technology, BS 1982

Professional Affiliations:

Member, Acoustical Society of America
Member, Institute of Noise Control Engineering

Publications:

Co-Author, *Industrial Noise Control-Fundamentals and Applications,* Second Edition, Marcel Dekker, Inc., New York, 1993.

Experience:

1989 – Present	Cavanaugh Tocci Associates Inc., Sudbury, MA Currently President / Senior Principal Consultant
1982 – 1989	Bruel and Kjaer Instruments, Inc. Marlborough, MA Application Engineer, Project Manager

As President of Cavanaugh Tocci Associates Inc., Mr. Bell is responsible for both its technical and business activities. He also consults to architects, engineers, and industrial clients in the analysis and control of noise and vibration in buildings and the environment. Typical projects include noise impact assessment and control for industrial facilities and transportation systems, mechanical system noise and vibration control in buildings, and the control of structureborne and groundborne noise and vibration.

Mr. Bell also specializes in the field of vibration with respect to sensitive applications in laboratory, manufacturing, and medical facilities. Typical projects include pre-installation site evaluations, development of appropriate design goals for new laboratory facilities, evaluation and control of occupant induced vibration, and development of vibration isolation recommendations for mechanical systems and sensitive equipment.

Representative projects on which Mr. Bell has consulted include:

- **Bethlehem Energy Center, Bethlehem, NY**
  Environmental noise impact analysis including baseline noise monitoring, facility sound modeling, recommendations for facility sound control, application preparation, and testimony at public hearings for a 750-megawatt combined-cycle combustion turbine power plant.
- **LeMessurier Consultants, Cambridge, MA**
  Design, development and testing of tuned mass dampers to control occupant

induced vibration on long floor spans at the Davis Museum and Cultural Center in Wellesley, MA

- **Dana Farber Cancer Institute, Boston, MA**

  Site vibration evaluation, facility design criteria, and building foundation vibration isolation design for a 14-story building used to conduct vibration sensitive research in an urban environment.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF ROBERT W. VARNEY

**IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW
HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW
HAMPSHIRE**

October 16, 2015

<u>Qualifications of Robert W. Varney</u>

Q. Please state your name and business address.

A. My name is Robert W. Varney and my business address is 25 Nashua Road, Bedford, NH 03110.

Q. Who is your current employer and what position do you hold?

A. I am President of Normandeau Associates, Inc.

Q. Please describe your background, experience and qualifications.

A. Since 2009, I have served as Executive Vice President and then President at Normandeau Associates, an environmental science consulting firm based in Bedford, NH. Founded in 1970, Normandeau is an employee-owned company serving a broad range of clients in the public and private sectors including: federal, state, and local governments; transportation agencies; energy generation and transmission companies and many others. Normandeau employs about 300 staff, with and 18 offices in 12 states. Our professionals includes marine, aquatic, wetland terrestrial ecologists, environmental and land use planners, fisheries biologists and limnologists, soil scientists, geologists, public involvement professionals, statisticians and GIS and data processing specialists.

Prior to joining Normandeau, I served 8 years as Regional Administrator of the United States Environmental Protection Agency (EPA), New England, where I was responsible for implementation and enforcement of numerous federal environmental laws and programs and the review, evaluation and resolution of numerous high-profile complex EIS and permitting issues involving major highways, airports, energy facilities and developments within the six New England states. I also undertook many initiatives such as climate change, energy efficiency and renewables, integration of energy and environmental programs and restoration of rivers, lakes and coastal areas.

From 1989 to 2001 I served as Commissioner of the New Hampshire Department of Environmental Services. By virtue of that position, I also served as a member and as Chairman of the New Hampshire Site Evaluation Committee (“SEC”) for that same 12 year period. Projects before the SEC during this period included the Portland Natural Gas Transmission (PNGTS) pipeline in Coös County, the Maritimes and Northeast gas pipeline in Rockingham County, the Newington Energy and Granite Ridge (Londonderry) power plants, the Tennessee Gas pipeline from Dracut to Londonderry, a NH Electric Cooperative electric transmission line in Carroll County, a PSNH electric transmission line in Carroll County, the Champlain Pipeline project in Cheshire County, and the Northeast Expansion Tennessee Gas pipeline project in southern New Hampshire.

I was appointed by the Governor as Director of the New Hampshire Office of State Planning (NHOSP) in 1989 before being appointed as NHDES Commissioner, in that same year. NHOSP is responsible for local, regional and statewide planning, growth management and interagency coordination. It has since been merged with the former Governor's Energy Office, and is now the Office of Energy and Planning (OEP).

I have extensive experience with local and regional planning in New Hampshire, having served as Executive Director of the Nashua Regional Planning Commission for 2 years (1987-1989), as Executive Director of the Upper Valley Lake Sunapee Regional Planning Commission for 4 years (1983-1987), and as a local and regional planner at Lakes Region Planning Commission for 4 years (1979 – 1983). During this time I was involved in the preparation of numerous regional plans, and dozens of local land use ordinances and master plans.

I hold a bachelor's degree in economics from the University of New Hampshire and a master's degree in urban planning from Michigan State University. A copy of my resume is attached as Attachment A.

Q. Are you involved with any organizations outside your duties as President of Normandeau?

A. Yes. I am on the Board of Trustees of The Nature Conservancy (TNC), the Board of the New Hampshire Lakes Association, and as a governor-appointed commissioner of the New England Interstate Water Pollution Control Commission. I also serve as a member of the Joint Public Advisory Council (JPAC), which I chaired in 2014. The JPAC is an independent tri-national committee which provides advice and promotes public involvement and transparency in the administration of the North American Free Trade Agreement (NAFTA) environmental side agreement through the Commission for Environmental Cooperation (CEC) and the governments of Mexico, Canada and the United States.

I am a member of professional planning organizations such as the American Planners Association (APA), the New Hampshire Planners Association and Plan New Hampshire.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is two-fold. First, I provide the SEC with my assessment of and opinion on potential impacts of construction and operation of the Project on local land use. Second, I offer my opinion that the Project will not unduly interfere with the orderly development of the region.

Local Land Use

Q. Did you prepare a report on potential land use impacts and local and regional planning documents?

A. Yes. I prepared a report titled *Northern Pass Transmission Project, Review of Land Use and Local, Regional and State Planning, October 2015.* It is included as Appendix 41 of the SEC application. I developed the report with the support of Normandeau staff who assisted with research, mapping and editing.

Q. What was the methodology you used for developing your report?

A. I began my review with an examination of local land uses in each community along the project right-of-way (ROW) and conducted a review of local, regional, state and federal long-range planning documents. I also considered comments received through the applicant's public open houses and discussions with local and regional planners.

In order to assess the impacts of construction and operations on local land uses, I reviewed existing land use patterns, and other land use information. This information was obtained principally from the applicant, local communities, regional planning commissions, state agencies, University of New Hampshire GRANIT, as well as Google Earth and a windshield survey conducted at numerous locations along the ROW.

I considered a wide range of information relating to land use planning and orderly development. Land uses along the corridor include forestry, agriculture, residential, commercial/ industrial, transportation, institutional/government, recreation areas, conservation, historical, and natural features such as rivers, wetlands, and wildlife habitat. This information was compiled into detailed existing land use descriptions for each community in the Project corridor, which are summarized in my report. I compared these summaries with the SEC application for the Project. I also reviewed and considered the DEIS and comments received during the DOE scoping process, the DEIS comment period, and the applicant's pre-application Public Information

Sessions. For each community, I considered the potential impacts of construction and operation of the Project on the existing land use in or adjacent to the right of way.

Separately, I reviewed each town's master plan and the recently completed regional plans from each of the four regional planning commissions in the project area and other regional planning documents such as local river corridor management plans, and state and federal plans that involve different aspects of land use, environment, energy, and transportation infrastructure.

Q. Please summarize your conclusions on land use implications.

A. I have concluded that the Project will not have an adverse impact on local land use. The details of my assessment are contained in my report *Northern Pass Transmission Project Review of Land Use and Local, Regional and State Planning*.

In summary:

1. Over 83% of the project is located in existing electric transmission line and transportation corridors. The electric transmission system in New Hampshire was constructed beginning in the early 1900's. The existing ROWs along the Project route contain several transmission and distribution lines constructed at different times, which are regularly upgraded and maintained as electric utility corridors. The use of this transmission corridor will not change, and NPT's use of the corridor will not change the land uses in the area. Siting a new transmission line in already developed corridors is a sound planning and environmental principle because it reinforces local patterns of development and minimizes environmental impacts.

2. The prevailing land uses along the corridor include forest, agriculture, residential, commercial, industrial, transportation, utilities, historic, natural resources, as well as conservation and recreation areas. These uses have coexisted with existing electric utility and transportation corridors as a part of the fabric of local and regional development. The Project will not prevent these uses from continuing in the future.

3. The new ROW that will be constructed between Pittsburg and Dummer traverses sparsely populated land, which is primarily forested and managed for uses such as timber, recreation and other energy facilities. Of the 40 miles in this new segment, 32.25 miles will be located either underground or within the working forest managed by Wagner Forest Management, a commercial forestry operation. This area also has an existing energy facility that received a certificate from the SEC in 2009, the Granite Reliable Wind Project, located in

Dixville, Millsfield and Dummer. This facility includes 33 wind turbines about 410 feet in height, a new substation and switching stations, and a new 5.8 mile overhead electric transmission line that connects to a substation in Dummer. It also included the upgrade of 19 miles of existing roads and the construction of 12 miles of new roads. Other land uses along the corridor include logging roads, ATV and snowmobile trails, and camps. The Pontook Hydroelectric facility on the Androscoggin River in Dummer is another significant local and regional energy project that has been developed in the area.

The remaining eight (8) miles of the corridor is sparsely populated and mostly forested land which will be leased by NPT.

4. Sixty miles of the Project route will be placed underground. This includes approximately 8 miles of the Project in Pittsburg, Clarksville and Stewartstown, and the entire section of the route from Bethlehem to Bridgewater, in and around the White Mountain National Forest, Franconia Notch area, the Rocks Estate area, and along the Appalachian Trail. This will result in no permanent impact on land use.

Q. Is there new information in the DEIS that has affected your review of land use impacts?

A. No. My conclusions are consistent with the DEIS analysis of impacts to land use. The DEIS states that there is no land use impact where the Project is located in a pre-existing roadway or utility corridor. The new ROW is located within a sparsely populated area, primarily forested and managed for uses such as timber, recreation and energy facilities. The Project can co-exist with these activities and will not prevent the continuation of these uses.

Orderly Development of the Region

Q. Have you also considered the overall question of whether the Northern Pass Project will unduly interfere with the orderly development of the region?

A. Yes, I have.

Q. Please explain.

A. In addition to my own analysis of the local land use aspects of the orderly development criterion in RSA 162-H, I have also reviewed and considered the expert testimony and related information included in the Project's SEC application on other factors relevant to the SEC's review of regional orderly development. This includes:

(1) The pre-filed direct testimony of James Chalmers and information presented in the Chalmers & Associates study, *High Voltage Transmission Lines and Real Estate Markets in New Hampshire: A Research Report, July 2015*, Appendix 46, which demonstrates that despite public perception to the contrary, there is no evidence that high-voltage transmission lines result in consistent measurable effects on property values, and, where there are effects, the effects are small and decrease rapidly with distance; and overall, there is no basis to expect that the Project would have a discernable effect on property values or marketing times in local or regional real estate markets;

(2) The pre-filed direct testimony of Lisa Shapiro of Gallagher, Callahan & Gartrell, P.C., and information presented in, *Northern Pass Transmission Project – Estimated New Hampshire Property Tax Payments Report*, Appendix 44, which indicates that the Project will substantially increase the property taxes received by local communities, counties, and the State;

(3) The pre-filed direct testimony of Julia Frayer and information presented in the report *Cost-Benefit and Local Economic Impact Analysis of the Proposed Northern Pass Transmission Project*, Appendix 43, prepared by Julia Frayer of London Economics, Inc. which concludes that the Project will have positive impacts on employment and the economy locally, regionally, and state-wide; and

(4) The pre-filed direct testimony of Mitch Nichols, and information presented in the report *Northern Pass Transmission and New Hampshire's Tourism Industry September 2015*, Appendix 45, prepared by Mitch Nichols, in which he concludes that the Project will not affect regional travel demand or have a measurable effect on New Hampshire's tourism industry.

I also reviewed the recently completed regional plans from each of the regional planning commissions in the project area and other regional planning documents such as local river corridor management plans, and statewide plans that involve different aspects of land use, environment, and energy and transportation infrastructure.

I am aware that many towns in past years have passed a warrant article concerning Northern Pass or taken other action urging the town in some fashion to not cooperate with the Project's development in that town. I do not view them as definitive actions inconsistent with the town's master plan or regional development plans. Notwithstanding various prior town meeting warrant articles or other town actions that took positions on cooperating with the development of the Project, the Project will not interfere with the implementation of local, regional and state-wide plans.

Q. What is your opinion of whether the Project will unduly interfere with the orderly development of the region?

A. The Project will not unduly interfere with the orderly development of the region. By using existing electric transmission and transportation corridors, and locating substantial portions of the Project underground, the Project will have minimal impact on prevailing land uses and is consistent with local patterns of development. The electric transmission system in New Hampshire was constructed beginning in the early 1900's. The existing ROWs along the Project route contain several transmission and distribution lines constructed at different times, and have been regularly upgraded and maintained as electric utility corridors through to the present day. Similarly, roadway corridors have traditionally been used as a route for overhead or underground electric lines throughout the State. The use of these corridors will not change, and Northern Pass's use of the corridor will not change land patterns in the surrounding area. Siting a new transmission line in existing corridors is a sound planning and environmental principle because it reinforces local patterns of development and minimizes environmental impacts. There will be no changes to prevailing land uses as a result of the operation of the Project.

The 52 mile section of the route from Bethlehem to Bridgewater, including the route in and around the White Mountain National Forest, Franconia Notch area, Rocks Estate area, and along the Appalachian Trail, and approximately 8 miles of the Project in Pittsburg, Clarksville, and Stewartstown will be placed underground. There will be no change to the existing land uses in these underground sections of the route.

The new ROW that will be constructed between Pittsburg and Dummer traverses sparsely populated land, which is primarily forested and managed for uses such as timber, recreation and other energy facilities. Of the 40 miles in this new segment, approximately 8 miles will be constructed underground along existing roadways. Twenty-four of the 40 miles are located in the Bayroot property managed by Wagner Forest Management, where forest management, operation of the Granite Reliable Wind Project, and recreation will continue uninterrupted after construction of Northern Pass.

Also, operation of the line will not place any new demands on local or regional services or facilities.

The Project is consistent with local, regional and statewide long-range plans. These plans present vision statements and goals for the orderly development of the region. They include recommendations and action strategies to implement the goals. The goals, objectives and recommendations in the regional plans are summarized and assessed in my full report. In most instances, these plans do not directly relate to the construction or operation of the Project; however, the Project is consistent with the general goals and objectives of those plans and will not interfere with their implementation. Of the 192 miles the Project traverses, 184 miles are either within existing transmission corridors, underground along public roadways or remotely located in an existing working forest that will be used in the same fashion after the Project is constructed. The remaining 8 miles of new corridor will be located on land leased by the applicant.

As demonstrated in Julia Frayer's report and testimony, the Project will have positive impacts on employment and the economy locally, regionally, and state-wide. Also, as the Chalmers' report and testimony indicate, there will be no discernible effect of the Project on property values or marketing times in local or regional real estate markets. In addition, as explained in the Nichols' report and testimony, there is no evidence that the Project will affect travel demand in the region or will have any measurable effect on tourism. Finally, as presented in the Shapiro report and testimony, the Project will increase revenue generated from property taxes in local communities, within the Project counties, and throughout New Hampshire.

Q. Does this conclude your testimony?

A. Yes, it does.

NORMANDEAU ASSOCIATES
Environmental Consultants

ATTACHMENT A

ROBERT W. VARNEY
President

Considered one of the nation's most experienced and respected environmental leaders, Robert Varney is a former Environmental Protection Agency (EPA) New England Regional Administrator, who joined Normandeau Associates in 2009. He was the longest-serving regional administrator and the top environmental official in New England and is recognized for instituting many innovative approaches and policy initiatives that have served as national models. Prior to EPA, Mr. Varney was one of the longest-serving state environmental commissioners, appointed by three Governors of both political parties.

He is nationally recognized for his efforts on global climate change; energy efficiency and renewables; integration of energy and environmental programs, homeland security and preparedness; clean air, clean water and safe drinking water; superfund and brownfields cleanup and redevelopment; environmental justice and healthy communities; restoration of rivers, lakes and coastal areas; strong and consistent enforcement and compliance assistance; strengthening partnerships and improved agency management and performance.

PROFESSIONAL EXPERIENCE

Normandeau Associates, Inc. (2009-Present). Mr. Varney serves as President of Normandeau Associates, Inc., managing one of the largest and most respected science-based environmental consulting firms in the United States serving both the private and public sectors. Founded in 1970, the company is well known for delivering sound, innovative scientific solutions to a global clientele. Normandeau's staff includes marine, aquatic, wetland, and terrestrial ecologists; environmental planners; fisheries biologists and limnologists; soil scientists, geologists, and hydrologists; engineers; regulatory specialists; public involvement professionals; statisticians and data processing specialists. Headquartered in Bedford, New Hampshire with 18 offices in 12 states, Normandeau is 100% owned by its employees. For more information please visit

EDUCATION

M.S., Urban Planning, Michigan State University

B.A., Economics, University of New Hampshire

PROFESSIONAL EXPERIENCE

2009-Present	Normandeau Associates
2001-2009	Regional Administrator, EPA, Region 1: New England, Boston, MA
1989-2001	Commissioner, New Hampshire Department of Environmental Services, Concord, NH
1989	Director, New Hampshire Office of State Planning, Concord, NH
1987-1989	Executive Director, Nashua Regional Planning Commission, Nashua, NH
1983-1987	Executive Director, Upper Valley-Lake Sunapee Council, Lebanon, NH

PROFESSIONAL AFFILIATIONS

- Past Chairman, JPAC (U.S., Canada, Mexico, appointed by President Obama)
- Board of Trustees, The Nature Conservancy
- Board of Directors, Lakes Association of NH
- Commissioner/Past Chair, NE Interstate Water Pollution Control Commission
- Past President, Environmental Council of the States (ECOS)
- Past Chairman, Federal Ozone Transport Commission (OTC)
- Past Chairman, Governmental Advisory Committee (advisory committee to EPA Administrator Carol Browner on environmental effects of NAFTA)
- Past Chairman, State/EPA Superfund Policy Forum, representing National

www.normandeau.com.

EPA, Region 1; New England (2001-2009). Mr. Varney served as Regional Administrator of EPA Region 1 in New England, where he managed a staff of 700 employees and a budget of $532 million. He was responsible for implementation of numerous federal environmental laws and programs such as the Clean Water Act, Clean Air Act, Safe Drinking Water Act, Superfund, brownfields redevelopment, hazardous waste management, emergency response and preparedness, environmental justice, children's health, wetlands permitting and protection, stormwater controls, enforcement and compliance assistance, environmental sampling and laboratory analysis and grants to state and local governments. He also undertook many initiatives regarding energy efficiency and renewables, climate change, environmental justice, creation of a Healthy Communities Grant Program for disadvantaged communities, collaborative efforts to clean up the Mystic River and the Charles River, elimination of chronic beach closures, designation of all coastal waters as "no-discharge" areas, and development of innovative stormwater controls in significantly impaired watersheds. He helped achieve several high-profile settlements to clean up and restore the Charles River, South Boston beaches, Mt. Hope Bay, Portsmouth Harbor, and portions of the Connecticut, Merrimack, and Assabet rivers.

New Hampshire Department of Environmental Services (1989-2001). As one of the nation's longest-serving state environmental commissioners, Mr. Varney was appointed by three governors of both political parties. He managed a state agency with over 450 employees and an annual budget of $100 million. The Department of Environmental Services is responsible for solid and hazardous waste management, air quality, dam inspections as well as operation, maintenance and reconstruction of State-owned dams, wetlands permitting and protection, water supply systems, wastewater treatment plants, septic system design and installation, laboratory analysis, rivers and lakes management, groundwater protection, geological studies, permitting and enforcement, emergency oil spill and chemical response and other associated environmental programs. During difficult economic times, Mr. Varney significantly increased revenue generated by the agency to make it more self-supporting, greatly improved internal management, successfully undertook several legislative initiatives including new State grant programs for municipal wastewater and drinking water infrastructure, landfill closures and protection of local water supply lands. He also greatly improved communication with the legislature, municipalities and professional groups. He was elected by his peers as President of ECOS, the national association of state environmental commissioners and served as chairman of numerous federal, regional and state commissions, boards and committees. He was widely credited with instituting many innovative approaches and policy initiatives that served as national models.

New Hampshire Site Evaluation Committee (1989-2001). Mr. Varney has vast experience with the state energy facility siting process. For 12 years he served as Chairman of the New Hampshire Site Evaluation Committee, and has coordinated with siting board members throughout New England for the past 25-plus years. As Chairman of the NH SEC, Mr. Varney was responsible for all aspects of the state's energy facility siting process; providing pre-application advice to applicants, chairing all public hearings and committee works sessions, coordinating multiple federal, state and local agencies, managing SEC staff and preparing documents and environmental permits for all energy facilities in the state within legislatively-prescribed timelines. Projects approved and successfully permitted during his tenure included several electric generation facilities, electric transmission lines and natural gas pipelines.

New Hampshire Office of State Planning (1/89-7/89). As State Planning Director, Mr. Varney managed 40 employees and an $8.6 million annual budget and served in the Governor's Cabinet. Agency was responsible for local, regional and statewide planning, growth management and interagency coordination. Also responsible for Coastal Zone Management Program, Great Bay National Estuaries Research Reserve program, Community Development Block Grant Program (housing, water, sewer, community facility, and economic development grants), coordination with regional planning commissions and local boards and officials, monitoring of federal funds in New Hampshire, administration of state's intergovernmental Review Process, statewide database management, preparation of population estimates and projections. Also initiated and designed Governor's Recycling Grants Program.

Nashua Regional Planning Commission (1987-1989). Mr. Varney directed New Hampshire's largest regional planning agency in one of the fastest growing areas of the country. NRPC is responsible for the regional Transportation Improvement Program, regional database management, water resource mapping and protection, development of local and regional plans, coordination of household hazardous waste collections and the solid waste district. Initiatives included preparation of the state's first Regional Recycling Plan and development of the Merrimack River Management Plan, the first such plan completed pursuant to the state's new river management and protection program. Other projects included the Nashua-Boston Passenger Rail Feasibility Study, an impact fee handbook and evaluation of Nashua's bus system, local water resource management and protection plans, and local conservation plans. Chaired Route 101-A Bypass Study Steering Committee composed of federal, state and local officials. Also initiated and chaired the Water Supply Task Force, a public/private partnership formed to prepare a long-range water supply plan for the rapidly growing southern tier of New Hampshire. A high percentage of these plans and proposals have been implemented.

Upper Valley-Lake Sunapee Council (1983-1987). Mr. Varney directed a unique bi-state regional planning agency serving 31 communities in New Hampshire and Vermont. Recruited to revitalize a troubled agency contemplating abolishment. Within 18 months, membership doubled from 15 to 30 communities, and staffing grew from two to fourteen. Responsible for directing all council activities including local and regional planning, preparation and administration of grants for housing rehabilitation, economic development, community facilities, and wastewater and drinking water systems, environmental protection, historic preservation, transportation, downtown revitalization, industrial development, recreation planning and water resource management. Chaired Hanover-Lebanon Area Highway Study Committee.

Lakes Region Planning Commission (1979-1983). Mr. Varney worked as a regional planner, economic development specialist and community development director at a regional planning commission serving 32 communities in the Lakes Region of New Hampshire. Duties included preparation of local master plans, downtown revitalization strategies, zoning ordinances and subdivision and site plan review regulations, regional economic development strategy, regional tourism plan and environmental impact assessments, coordination of the Concord-Lincoln Rail Study; and management of Franklin's CDBG loan program in the central business district.

AWARDS AND AFFILIATIONS

Mr. Varney's professional affiliations and honors are extensive. Mr. Varney has chaired the Environmental Council of the States (ECOS), State/EPA Superfund Policy Forum, Federal Ozone Transport Commission (OTC), Governmental Advisory Committee to the US Representative to the Commission for Environmental Cooperation (CEC), Gulf of Maine Council on the Marine Environment, New England Interstate Water Pollution Control Commission and New England Governors' Conference Environment Committee. He also was a member of EPA's Environmental Justice Advisory Council. Mr. Varney currently serves on the NH Board of Trustees for The Nature Conservancy (TNC) and was appointed by President Obama to (and chaired) the CEC Joint Public Advisory Committee (US, Mexico, Canada). Mr. Varney is the recipient of numerous environmental awards such as the EPA Lifetime Achievement Award, NE Water Works Association's John H. Chafee Award, Charles River Watershed Association's Anne Blackburn Award, Environmental Business Council of NE's Paul Keough Award and the ECOS Founder's Award.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF JULIA FRAYER

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Pre-Filed Testimony Withheld Due to Confidential Information

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF LISA K. SHAPIRO

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name, title and business address.

A. My name is Lisa K. Shapiro and my business address is 214 North Main Street, Concord, New Hampshire 03301. I am Chief Economist at Gallagher, Callahan & Gartrell, P.C.

Q. Please summarize your relevant background and employment experience.

A. I hold a Ph.D. in Economics from Johns Hopkins University and have approximately 15 years of experience in analyzing New Hampshire property taxes as part of my job. My doctoral dissertation was on property taxes and voting behavior with a case study of New Hampshire. I was the lead author on the seminal study on the then-proposed new statewide property tax enacted in New Hampshire. I also prepared the analysis of the estimated property taxes paid by the proposed Portland Natural Gas Transmission System. I have prepared property tax analyses for a variety of private and institutional organizations. I have consulted for utilities, merchant generators, and manufacturers to assist with property tax analysis, including testifying and representation before the New Hampshire Legislature on legislative proposals regarding property taxes. I have provided preliminary property tax estimates for the Northern Pass Transmission project. I have also served on the boards of the Federal Reserve Bank of Boston's New England Public Policy Center Advisory Board, Josiah Bartlett Center for Public Policy, and was a member of Governor Shaheen's New Hampshire Commission on Education Funding. For further information, please see my CV, attached hereto as Attachment A.

Q. What is the purpose of your testimony?

A. I have been retained by Northern Pass Transmission LLC ("NPT") to provide information on the estimated property tax payments to New Hampshire local communities, and the direct impacts of those payments on local communities generated by the construction and operation of the Northern Pass Transmission Project ("Northern Pass" or the "Project").

Estimated Northern Pass Local Property Tax Payments

Q. Please provide an overview of the sources of data and the approach and methodologies to developing these estimates?

A. Northern Pass total project costs allocated town-by-town were provided by the Project team. These allocated costs provided the basis for taxable value in the first full year of operation. Community and county data on tax rates, expenditures, and tax bases were found in New Hampshire Department of Revenue Administration reports, and select annual town, county, and state reports. Estimates of the Northern Pass New Hampshire property tax payments, and its local fiscal community impacts, were developed by running simulations using historical data, and a range of growth rate assumptions.

Detailed explanations of the data, assumptions, and the tables of results, can be found in the "Northern Pass Transmission Project – Estimated New Hampshire Property Tax Payments Report," (the "Report") which is attached as Appendix 44.

Q. Please summarize the estimates of the Northern Pass New Hampshire property tax payments to local communities after the project is constructed?

A. In its first full year of operation, the Project will pay New Hampshire property taxes estimated in the range of approximately $35 million to $40 million. This overall estimate can be broken down into the following categories:

- Approximately $21 million to $26 million municipal and local education property taxes;
- Approximately $4 million county taxes; and
- Approximately $10 million state utility education property taxes redistributed to local communities for education.

Q. Please summarize the impact of the addition of Northern Pass to the local tax base?

A. The Northern Pass new taxable investment is estimated to be in the aggregate approximately 11 percent of the total local taxable base across the 31 host communities in the first full year of operation.

While data is not readily available to identify whether this would make NPT the largest taxpayer or among the largest taxpayers in those communities, the share analysis indicates that the Project would likely be the largest or among the largest taxpayers in most of the host communities.

The estimated median percent Northern Pass share of the local property tax base is 12.3 percent, with half the communities less than that and half more. The average Northern Pass share is approximately 18 percent, with the Northern Pass share of property value exceeding 15 percent of the tax base in 14 communities. See Figure 6, the Report, Appendix 44.

Q. Please summarize the impact of Northern Pass property additions on county taxes?

A. Five counties are impacted by the Project. Northern Pass is estimated to be approximately 10 percent share of the total taxable base in Coos County, 3.7 percent in Grafton, 3.1 percent in Merrimack, and 0.3 percent in Belknap and in Rockingham in the first full year of operation. See Figure 7, the Report, Appendix 44.

Q. Please summarize the impact of Northern Pass on State property taxes?

A. Northern Pass is expected to pay an estimated new $9.8 million in utility state education property taxes in the first full year of operation. The most recent data (FY 2015, unaudited) reports approximately $41 million collected for the state utility education tax. Using this as the base year, Northern Pass will provide approximately a 25 percent increase in that revenue. The actual payment and percent depends upon the final cost of the project, its Fair Market Value, and other collections at that time. See Figure 8, the Report, Appendix 44. This revenue source is redistributed to local communities to support local education.

Q. Please explain how Northern Pass tax payments reduce the tax burden for other taxpayers in a community?

A. Each municipality, school district, and county sets its own budget. Other revenue sources are applied to those budgets. Of the remaining budget that needs to be covered by property taxes, for any individual property owner, the price of public services is their share of the taxable property tax base. For example, if an owner's taxable property is equivalent to 1 percent of the total taxable value in a community, than that owner's share of tax expenditures in that community is 1 percent (not taking into account collections, exemptions, and credits). With the addition of a large new taxable property value in a community, for the same amount of expenditures, each existing owner's share of the taxes is reduced. Alternatively, a community could increase expenditures to reflect the new Northern Pass tax payments but hold the tax rate down. For a detailed review of the assumptions and adjustments please see the Report, Appendix 44.

Q. What factors may cause the actual Northern Pass tax payments to differ from your estimates?

A. Actual Northern Pass New Hampshire property tax payments depend on a number of factors. These factors can be organized into two groups. The first set of factors depends upon Northern Pass -- the actual Project costs and allocation of costs across communities, and its taxable value over time. The second set of factors depends on the community -- the level of government expenditures, other sources of revenue, and the taxable base. See the Report, Appendix 44 for detailed explanation and results for the base case estimates and a range of simulations.

Q. What are the estimated Northern Pass property tax payments over time?

A. It is very difficult to estimate the Northern Pass property tax payments over time because many different factors, and the interaction of them, will determine the future property taxes made by the Project.

For qualifying renewable energy projects in New Hampshire, communities in some cases have negotiated a Payment in Lieu of Taxes (PILOT) agreement to provide the community with a more predictable revenue stream over the life of the project. The current PILOT law, however, does not apply to projects like Northern Pass.

The taxable value of the Project over time depends on the fair market value of the investment over time, which is not known. Northern Pass property tax payments over time, however, are important to consider when analyzing local community benefits. In order to provide a lower bound estimate of Project new property tax payments over time, I took a simplifying assumption that the fair market value is equal to the total invested value (less rebuilds, relocations and land) in the first full year of operation. Following the first year, I assumed a straight-line depreciation rate of 2.5 percent per year for the first 20 years of operation.

Under this simplifying assumption, tax payments and the local tax relief a project provides may be largest in the early years and gradually decline over the life of the project.

Using the estimated Northern Pass net book value as fair market value for tax purposes, the Project would pay an estimated $564 million to $692 million in total New Hampshire property taxes over the first 20 years of operation. For detailed assumptions and simulations please see the Report, Appendix 44.

Q. Will Northern Pass pay property taxes during the construction phase of the project?

A. Yes. Each year during construction the amount of investment is one approach to estimating the taxable value for the following year. During the construction phase, total new Northern Pass New Hampshire property tax payments (municipal, county, local education, state education) are estimated to be approximately $56 million, depending on actual costs, timing and tax rates. Property taxes paid during the final year of construction versus the first full year of operation is sensitive to the specific construction timeline.

Q. Have you considered any other property tax implications that may result from the Project?

A. It should be pointed out that unlike development that brings new students to local communities; there are no new expected direct education expenses as a result of the Project.

Q. Does that conclude your testimony?

A. Yes, it does.

ATTACHMENT A

CURRICULUM VITAE

LISA SHAPIRO, Ph.D.
Gallagher, Callahan & Gartrell
214 North Main St.
Concord, NH 03301
shapiro@gcglaw.com
phone (800) 528-1181
fax (603) 226-3477

EDUCATION

Ph.D. in Economics, June, 1995. Johns Hopkins University, Baltimore, Maryland.
T. Rowe Price Memorial Fellowship, 1990-1991.

M.S. in Agricultural and Resource Economics, August, 1990. University of Maryland, College Park, Maryland. Research Fellowship funded by the Economic Research Service, U.S. Department of Agriculture.

Bachelor of Arts Degree in Sociology, cum laude, August, 1985. Cornell University, Ithaca, New York, (transferred from the University of New Hampshire, Durham, New Hampshire, 1983).

PROFESSIONAL EXPERIENCE

Chief Economist, Gallagher, Callahan & Gartrell, P.C., Concord, New Hampshire, October 1994 – present. Analyze economic and industry trends of interest to the firm's clients, regulators and others with whom the firm interacts. Work on complex economic and financial projects in public and private settings. Issues include energy and communications markets, healthcare policies, taxation, infrastructure development, environmental economics, labor markets and the financial services industry. Work with businesses and nonprofit organizations on strategic economic issues, legislative and regulatory matters.

Economist, Tellus Institute, Boston, Massachusetts, January 1993 – September 1994. Researched and wrote reports, worked with clients, supervised researchers, wrote proposals. Topics included electricity pricing, and electric utility planning.

Research Director, Arnesen for Governor Campaign, New Hampshire, April – November, 1992.

Consultant, LandCare Associates, Dover, New Hampshire, September 1991 – March 1992. Created computerized billing and accounting systems. Prepared financial statements.

Researcher, University of Maryland, College Park, Maryland, Dr. Kenneth McConnell, August 1987 – August 1988. Managed ongoing database of fishing quality in the Chesapeake Bay and prepared statistical analysis.

Research Fellow, Energy Conservation Coalition, Washington D.C., March – September 1987.

BOARDS, COMMISSIONS & MEMBERSHIPS

Governor Hassan's Cost Containment Commission for Retiree Health Plans. (September - December 2013).

Chairman of the Board of Trustees of the New Hampshire Retirement System (February 2008 – July 2013).

Commission to Make Recommendations to Ensure the Long-term Viability of the New Hampshire Retirement System, Chair of Benefits Subcommittee, (August – December 2007).

Federal Reserve Bank of Boston's New England Public Policy Center Advisory Board (March 2007 to September 2011).

Josiah Bartlett Center for Public Policy, Board member. (1999 – 2005).

Governor Shaheen's New Hampshire Commission on Education Funding. (2000).

Governor Shaheen's Business Commission on Child Care and Early Education. Staff. Prepared and presented economic analysis report. (1999)

Leader of the Economic Perspectives Technical Work Group of the New Hampshire Comparative Risk Project. (1998)

President, Board of Directors, Concord Cooperative Market, Concord, New Hampshire, October 1992 – October 1994 (Board Member, October 1991 – 1996. Member of the Finance Committee, October 1996 to 2000).

Campaign for Ratepayer's Rights (CRR), September 1993 – September 1994. Board Member.

New Hampshire Community Reinvestment Association, Member. September 1993 – September 1994.

Agricultural and Resource Economics Graduate Students Association, President. University of Maryland, College Park, Maryland, June 1988 – May 1989.

Member of the American Economic Association, the National Association for Business Economics, and the National Tax Association.

Above & Beyond Award from the Business & Industry Association of New Hampshire, May 2002

TESTIMONY & EXPERT WITNESS APPEARANCES

Testified on numerous energy bills to the New Hampshire State Legislature over the past 15 years including RPS, RGGI, electric industry restructuring, equipment & utility taxes, and renewable energy and planning policies.

Testified on other business and tax issues, healthcare, housing policy, taxation, and land use planning policy on behalf of industry groups, business clients, and not-for-profits.

Prepared testimony and testified as an Expert Witness on the economic impacts of the Power Purchase Agreement between Public Service of New Hampshire and Laidlaw Berlin Biopower, LLC. New Hampshire Public Utilities Commission DE-10-195.

Expert witness in private arbitration renewable energy case.

<u>REPORTS</u>

Proposed Northern Pass Transmission Project, Economic Impact Update, Estimated New Hampshire Jobs During 3 Year Construction Phase, prepared for Northern Pass Transmission LLC with Heidi Kroll, April 2011.

Preliminary Economic and Fiscal Impacts of the Proposed Northern Pass Transmission Project, prepared for Northern Pass Transmission LLC with Heidi Kroll, October 2010.

Preliminary Economic and Fiscal Impacts of the Proposed Northern Pass Transmission Project, Franklin Converter Station and Line Work, prepared for Northern Pass Transmission LLC with Heidi Kroll, October 2010.

The Economic Impacts of Constructing a Scrubber at Merrimack Station, prepared for Public Service Company of New Hampshire with Heidi Kroll, March 13, 2009.

The Economic Impacts of Greater Investments in New Hampshire's Transportation Infrastructure Funded by an Increase in the Gas Tax, prepared for the Aggregate Manufacturers of New Hampshire with Heidi Kroll, February 17, 2009.

Estimated Economic Impacts of Childhood Lead Poisoning in New Hampshire, prepared for Child Health Services with Heidi Kroll, October 3, 2008.

Land Use Regulations in New Hampshire, prepared for the New Hampshire Public Policy Alliance for Housing, the Home Builders & Remodelers Assoc. of New Hampshire, and the New Hampshire Housing Finance Authority with Heidi Kroll, January 2007.

Housing New Hampshire's Workforce, prepared for the New Hampshire Workforce Housing Council with Heidi Kroll, March, 2005.

Public Opinion Poll Results in the Study of Select Economic Values of New Hampshire Lakes, Rivers, Streams and Ponds-Phase III Report, prepared for the New Hampshire Lakes Association with Heidi Kroll, December 2004.

Estimates of Select Economic Values of New Hampshire Lakes, Rivers, Streams and Ponds–Phase II Report, prepared for the New Hampshire Lakes Association with Heidi Kroll, June, 2003.

The New Hampshire Forum On Higher Education–Recommended Strategy Going Forward, prepared for The New Hampshire Forum On Higher Education with Heidi Kroll, October 30, 2002.

Transmission Transition: Toward an Efficient Electricity Grid, Energy User News, October, 2002.

Budget Deficits and Business Taxes in New Hampshire, prepared for the New Hampshire Bankers Association, with Charles Connor and Heidi Kroll, May 9, 2002.

A Study of the Economic Values of the Surface Waters of New Hampshire–Phase I Report - Preliminary Assessment of the Existing Literature, Data, and Methodological Approaches to Estimating the Economic Value of Surface Water, prepared for the New Hampshire Lakes Association with Heidi Kroll, August 1, 2001.

2001 NH Local Impact Assessment Project - Economic Statistics on LIAP Forestry and Water Issues, prepared for the Society for the Protection of New Hampshire Forests with Heidi Kroll, May, 2001.

Energy Issues and the Economy, A presentation to the N.H. Electric Utility Oversight Committee, February 20, 2001, and to the N.H. Senate Ways and Means Committee, February 14, 2001.

Making Economic Sense of Electricity Price Spikes, Energy User News, December, 2001.

Workforce Opportunity Council (WOC) Information and Data Gathering Initiative, prepared for the Demand Committee of the Workforce Opportunity Council, October, 2000.

The Economic Impacts of the New Hampshire Housing Finance Authority Tax Exempt Bond Programs, with Richard England, prepared for The New Hampshire Housing Finance Authority, August, 2000.

New Choices Mean New Rules for the Electricity Market, June, 2000.

Access to Capital in a Changing Economy, INTERFACE TECH NEWS, May 2000, p. 33.

Short-term Economic and Fiscal Impact Analysis of Senate Bill 401 – The Establishment of the Land and Community Heritage Investment Program – Testimony before the House Finance Committee on Senate Bill 401, prepared for the Society for the Protection of New Hampshire Forests, May, 2000.

Vermont's Digital Economy and Government Regulation of Access – Comments on House Bill 817, prepared for AT&T, April, 2000.

Local Fiscal Impact Study for the Proposed Mall at Long Wharf, City of New Haven, Connecticut, prepared for the Connecticut Economic Resource Center, Inc., January, 2000.

New Hampshire's Digital Economy and Government Regulation of Access – Testimony before the NH House Science, Technology and Energy Committee on House Bill 1372, January 25, 2000.

The Economic and Fiscal Impacts of a Uniform Statewide Property Tax, with Charles Connor, Richard England and Daphne Kenyon, National Tax Association Proceedings - 1999, 92nd Annual Conference on Taxation, Atlanta, Georgia, October 24-26, 1999.

The Economic Impacts of the New Hampshire Housing Finance Authority Mortgage Revenue Bond Programs – Preliminary Assessment Report, with Richard England, prepared for The New Hampshire Housing Finance Authority, August, 1999.

Closing the Education Funding Structural Deficit Through an Increase in the Statewide Property Tax, October, 1999 with Charles Connor.

The Economic and Fiscal Impacts of a Uniform Statewide Property Tax, January, 1999. Co-author and Project Coordinator. Co-authors: Dr. Richard England, Whittemore School of Business and Economics, University of New Hampshire; Dr. Daphne Kenyon, Simmons College; and Mr. Charles Connor, former Director of the Office of the Legislative Budget and the Governor's Budget Director. Also published in State Tax Notes, (June 14, 1999) Vol. 16, No. 24.

The New Hampshire Economy and Child Care Markets, May, 1998. Report submitted to Governor Shaheen's Business Commission on Child Care and Early Education.

The Economic Impacts of Community Development Finance Authority Programs, January, 1998. Co-authors: Dr. Richard England, Whittemore School of Business and Economics, University of New Hampshire, and Mr. Benjamin Ellis, Research Assistant. Report submitted to the NH Community Development Finance Authority and to the New Hampshire Legislature.

Creating a Comparative Advantage in New Hampshire Capital Markets, The New Hampshire Business Development Corporation's Financial Forum, Fourth Edition, August, 1997. Guest Commentary.

Agriculture and Nitrate Concentrations in Maryland Community Water Systems, The Journal of Environmental Quality, Volume 26, Number 1, January-February, 1997. Co-author Dr. Erik Lichtenberg.

Economic Perspectives on Environmental Risks in New Hampshire, November, 1996. Report submitted to the Public Advisory Group of the New Hampshire Comparative Risk Project.

Portland Natural Gas Transmission System: Select Fiscal and Economic Impacts, Update Study, October, 1996. Original Study, November, 1995. Co-author Dr. Richard England, Whittemore School of Business and Economics, University of New Hampshire.

Banking on Small Business in New Hampshire, May, 1995. Report on economic trends in small businesses in the Granite State. Prepared for the New Hampshire Delegation to The White House Conference on Small Business.

Tax Policy and Voting Behavior in Statewide Elections, June, 1995. Unpublished Ph.D. Dissertation, John Hopkins University, Baltimore, Maryland.

Comments Submitted to the Delaware Public Utilities Commission on Ratemaking Standards, August, 1993. By joint authors at the Tellus Institute, Boston, Massachusetts, on behalf of the Staff of the Delaware Public Utilities Commission.

The State of Integrated Resource Planning in North America, May, 1993. By joint authors at the Tellus Institute, Boston, Massachusetts, on behalf of Hydro-Quebec and a Consortium of Intervenors.

A Brighter Future: State Actions in Least-Cost Electrical Planning, 1987. Joint authors, Paul Markowitz and Nancy Hirsh. Published by the Energy Conservation Coalition, Washington, D.C.

TEACHING EXPERIENCE

Adjunct Faculty, Introduction to Microeconomics, University of New Hampshire, Manchester, Fall Semester, 1998.

Adjunct Faculty, Graduate Introduction to Public Policy, University of New Hampshire, Whittemore School of Business and Economics, Fall Semester, 1997.

Instructor, Introductory Statistics, Technical College at Berlin, New Hampshire, August – December, 1992.

Teaching Assistant, Graduate Macroeconomics, Johns Hopkins University, January – May 1991.

Instructor, Introductory Microeconomics, Johns Hopkins University, September – December 1990.

PRESENTATIONS

Presentation before the **New Hampshire House Ways & Means Committee's "Revenue Structure Informational Session**," October 21, 2009

"Adjusting to a Challenging Economy," **Greater Somersworth Chamber of Commerce - Tri-Chambers Breakfast Forum**, Somersworth, New Hampshire, September 10, 2008.
"The Cost of Opting in to RGGI" **Greater Manchester Chamber of Commerce Breakfast Forum**, Manchester, New Hampshire, May 21, 2008.

"A Survey of Land-use Regulations in New Hampshire," **Mortgage Bankers Association**, Bedford, New Hampshire, January 18, 2007.

"Energy Cost Outlook: Impact on New Hampshire," **New Hampshire House and Senate Joint Finance and Ways & Means Committees' Global, National and Regional Economic Briefing**, Concord, New Hampshire, December 14, 2005.

"Housing New Hampshire's Workforce," **Eastern Lakes Regional Housing Coalition**, Wolfeboro, New Hampshire, October 18, 2005.

"Housing New Hampshire's Workforce," **Strafford Regional Planning Commission**, Rochester, New Hampshire, May 26, 2005.

"Housing New Hampshire's Workforce," **Upper Valley Housing Coalition**, West Lebanon, New Hampshire, April 29, 2005.

"Housing New Hampshire's Workforce," **Public Policy Alliance for Housing: State of Housing in New Hampshire Conference**, Manchester, New Hampshire, May 17, 2005.

"Notes on Electric Restructuring in New Hampshire and Beyond," **New Hampshire House Science, Technology and Energy Committee**, Concord, New Hampshire, February 8, 2005

"New Hampshire Seacoast Region Wastewater Management Study," **Gulf of Maine Council on the Marine Environment**, Portsmouth, New Hampshire, December 9, 2004.

"Testimony on behalf of Merrill's Marine Terminal Services, Inc. in their support of Maine Legislative bill LD 1647", **Maine Appropriations and Financial Affairs Committee**, Augusta, Maine, February 18, 2004.

"State and Local Tax Incentives for Business," Respondent, **National Tax Association 96th Annual Conference on Taxation**, The Drake Hotel, Chicago, Ill., November 13-15, 2003.

"School Costs and Affordable Housing," Moderator, **New England Housing Network Overcoming the Obstacles - Creating and Preserving Affordable Housing**, Nashua, NH, September 9, 2003.

"Connecting Businesses with Education, Government, and Money," **Sullivan County Business Information Expo** Tax Panelist with David Alukonis, Chair, N.H. House Ways & Means Committee, Stanley Arnold, Commissioner, NH Department of Revenue Administration, David Juvet, VP, Business and Industry Association. NH Community Technical College, Claremont, NH, May 22, 2002.

"Budget Deficits and Business Taxes in New Hampshire," **New Hampshire Bankers Association Spring CEO Meeting**, The Inn at Mill Falls, Meredith, NH, May 9, 2002.

"A Citizens Summit - Beyond September 11th: NH Citizens Charting Our Economic Future," Panelist (House Speaker Gene Chandler, Facilitator), **Citizens Resource Foundation**, Manchester, NH, October 17, 2001.

"New Hampshire Tax Options," **New Hampshire Bankers Association Spring CEO Meeting**, Woodstock, VT, May, 2001.

"Energy, Taxes & the NH Economy," **New Hampshire Association of Health Underwriters, The New Hampshire Chapter of The Society of Chartered Property and Casualty Underwriters, Inc.**, April 25, 2001.

"Tax and Expenditure Options for Closing the State Budget Deficit," Moderator, **Options for Closing the State Budget Deficit–What Now?, Josiah Bartlett Center for Public Policy**, April 30, 2001.

"Electric Restructuring in New Hampshire: Outlook and Options," **Dollars & Sense of Electric Competition, Business & Industry Association of New Hampshire**, April 9, 2001.

"An Open Forum Between Providers and Users to Discuss New Hampshire Specifics," Moderator, **Telecommunications in the Year 2000 and Beyond, New Hampshire Public Utilities Commission**, March 17, 2000.

A Presentation of the Study – *"The Economic and Fiscal Impacts of a Uniform Statewide Property Tax,"* **Current Issues in U.S. Property Taxation, National Tax Association 92nd Annual Conference on Taxation**, Atlanta, Georgia, October 24-26, 1999.

"The Economic Impact and Looking to the Future," Moderator, **Reading, Writing and Revenues Post Claremont, Josiah Bartlett Center for Public Policy**, Concord, New Hampshire, October 14, 1999.

"North Country Telecommunications: The Next Steps" **Berlin Economic Development Council**, Bretton Woods, New Hampshire, September 29, 1999.

"What is the Future for Electric Rates in New Hampshire?" **Josiah Bartlett Center for Public Policy**, Concord, New Hampshire, September 15, 1999.

Keynote Speaker, Annual Conference and Trade Show, **New Hampshire Telecommunications Association**, Manchester, New Hampshire, June, 1999.

"Electric Industry Deregulation – Looking Ahead and Meeting the Challenge," **National Manufacturing Week Conference '99**, Chicago, Illinois, March 17, 1999.

"PUC & FCC Annual Regulatory Seminar" **New Hampshire Telecommunications Association**, Bedford, New Hampshire, December 17, 1998.

"*The Economics of On-Site Generation Under Regulatory Uncertainty*," **Producing Your Own Electricity On-Site Conference and Exhibition, Governor's Energy Office and Others**, West Lebanon, New Hampshire, November 17, 1998.

"Investment Opportunities," **Northern New England Community Reinvestment Conference, Granite State Community Reinvestment Association, Federal Reserve Bank of Boston**, October 6, 1998.

"The Myths and Reality Behind Energy Resale," **Telecom Business Conference**, Jacob Javitz Center, New York, New York, September, 1998.

"Child Care Markets: Challenges and Opportunities," **New England Rural Development Conference, Federal Reserve Bank of Boston**, Sheraton Harborside Hotel, Portsmouth, New Hampshire, June 15, 1998.

"New Hampshire Economy and Child Care Markets," **Governor Shaheen's Business Commission on Child Care and Early Education**, Concord, New Hampshire, May 26, 1998.

"Restructuring Electricity Markets: Telecommunications Opportunities," **Telecom Reseller Opportunities Conference**, Jacob Javitz Center, New York, New York, September, 1997.

"Demystifying Electric Industry Restructuring," **New Hampshire North Country Council**, Lincoln, New Hampshire, July, 1997.

"Centralized Versus Decentralized State Fiscal Systems," **New Hampshire's Fiscal Foundation: Granite or Quicksand, Josiah Bartlett Center for Public Policy**, Concord, New Hampshire, April 11, 1997.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF JAMES CHALMERS, Ph.D.

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name, title, and business address.

A. My name is James Chalmers. I am the Principal of Chalmers & Associates, LLC whose business address is 616 Park Lane, Billings, MT 59102.

Q. Briefly summarize your educational background and work experience.

A. I received the BS degree in economics from the University of Wyoming in 1963 and the Ph.D. in economics from the University of Michigan in 1969. In addition, I am a Certified General Real Estate Appraiser licensed in several states.

From 1969 to 1978, I was an economics professor at Amherst College, Thammasat University in Bangkok, Thailand and Arizona State University.

Beginning in 1974 on a part-time basis, and from 1978 to present on a full-time basis, I was a real estate consultant with Mountain West Research, Inc., Coopers & Lybrand, LLC, PricewaterhouseCoopers, LLC and Chalmers & Associates, LLC.

I have specialized in assessing the effects of externalities (contamination, pipelines, highways, transmission lines, and others) on the value of real estate. I have also managed several large multi-discipline assessments of energy related projects including the damage assessment for the U.S. Nuclear Regulatory Commission of the accident at Three Mile Island and the assessment of the proposed High Level Nuclear Waste Repository at Yucca Mountain for the State of Nevada.

Please see my resume as Attachment A.

Q. Have you previously testified before the Site Evaluation Committee ("SEC")?

A. Yes. I have provided testimony in connection with the Merrimack Valley Reliability Project application pending before the SEC.

Q. What is the purpose of your testimony?

A. To provide my professional opinion with respect to the possible effects of the Northern Pass Transmission Project ("Northern Pass" or the "Project"), as proposed by Northern Pass Transmission LLC ("NPT"), on both property values and marketing times in local and regional real estate markets.

Q. What is your role in Northern Pass?

A. I was initially retained by NPT to assess the state of knowledge with respect to property value effects of high voltage transmission lines ("HVTL") and to supplement existing research with New Hampshire-specific initiatives as appropriate. In addition, I was subsequently retained by Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH") and New England Power Company d/b/a National Grid ("NEP") in connection with the Merrimack Valley Reliability Project and by PSNH in connection with the Seacoast Reliability Project. I have summarized the published research and the new, New Hampshire-specific research initiatives in a report titled *High Voltage Transmission Lines and New Hampshire Real Estate Markets: A Research Report* (the "Research Report") and then applied the findings summarized in the Research Report to the Northern Pass Transmission Project. My report is found at Appendix 46.

The Research Report

Q. Please describe the objectives of the Research Report.

A. The objectives of the Research Report are threefold: (1) to summarize existing knowledge on the effects of HVTL on real estate markets, (2) to supplement that knowledge with New Hampshire-specific research initiatives, and (3) draw conclusions with respect to the New Hampshire-specific initiatives and evaluate the consistency of the New Hampshire findings with the broader national literature.

Q. Please describe the elements of the Research Report?

A. I first analyzed the core of the professional literature, including a total of 12 residential, two commercial/industrial, five vacant land and six attitudinal studies. I then reported on three New Hampshire-specific research initiatives. They include the Case Studies—an analysis of 58 individual residential sales of properties crossed by, or bordered by, a HVTL[1]; the Subdivision Studies—analyzing the timing and pricing of lot sales in 13 subdivisions where

[1] According to the New Hampshire Public Utilities Commission, power lines at or above 69 kV are considered transmission lines and lines less than 69 kV are considered distribution lines. This Report is focused on the potential effect of transmission lines on real estate markets but four of the 58 Case Studies and two of the 13 Subdivision Studies involve properties that abut, or are crossed by, a ROW containing 34.5 kV lines. When speaking generally about the research, we will continue to use the acronym HVTL but when discussing the particular cases with the 34.5 kV lines, they will be referred to as distribution lines.

some lots in a subdivision are crossed by, or are bordered by, a HVTL and others are not; and the Real Estate Market Activity Research—looking at sale price to list price ratios and days on market for residential sales in different locational zones relative to a HVTL corridor.

Literature Review

Q. Please summarize the literature review that you conducted.

A. The published literature is extensive. It is based on comparing the sales of properties potentially affected by a HVTL to the sale of properties unaffected by HVTL. These studies are carried out using different methods (statistical studies, subdivision studies, case studies). The findings of these studies can be summarized as follows. For residential properties, about half of the studies found some measure of negative proximity effects, and the other half found none. Where effects were found, they tended to be small, usually in the 1-6% range. Additionally, where they were found, they tended to decrease rapidly with distance from the HVTL. Effects seldom extended beyond 500 feet from the HVTL. Two of the studies found that where there were effects, they dissipated over time as well. Once proximity was accounted for, visibility generally had no additional, independent effect in the statistical studies. Finally, encumbrance frequently had no effect on market value. Where there was an effect, it was small relative to the size of the encumbrance.

For commercial/industrial properties, there were no effects unless development of the site was constrained in a way that reduced the income producing potential of the property.

For vacant land, there were generally no effects. Exceptions include properties where development of the land was constrained by the ROW or where the HVTL were the principal differentiating feature of otherwise very similar parcels.

There is also published literature on attitudinal studies based on survey research methodology. Homeowners report concerns with HVTL on health effects, aesthetics and property value issues. Of those buyers of homes affected by HVTL, two of the studies found that over 70% of the respondents reported that their purchase decision and the price paid were not affected by the lines.

Q. Does the existing knowledge base with respect to the effects of HVTL on real estate markets have relevance to New Hampshire?

A. Yes. The results are sufficiently consistent across geographies and development patterns that one would expect applicability. In addition, two of the studies have particular relevance because the study area investigated is close to New Hampshire.

Dr. Frank Voorvaart and I carried out statistical studies of over 1,600 property sales in four neighborhoods in Connecticut and Massachusetts and found no market value effects associated with either proximity to, or visibility of, HVTL. The areas studied have similarities to many parts of southern New Hampshire.

Similarly, Dr. William Kinnard analyzed both home sales and raw land sales in Penobscot County, Maine. This was a statistical study that concluded no market value effects of HVTL proximity.

Q. What additional research did you undertake to address possible HVTL effects on New Hampshire real estate markets?

A. As identified briefly above, there were three initiatives—Case Studies, Subdivision Studies and Market Activity Analysis.

Case Studies

Q. What was the methodology used in the Case Studies research?

A. The Case Studies research is based on analysis of 58 individual sales of properties either crossed by, or abutting, a HVTL ROW. HVTL corridors were selected that represented much of the State of New Hampshire. These included two major north/south HVTL corridors (referred to below as Corridor #1 and Corridor #2) and several short corridors in and around Portsmouth (referred to as Study Area #3). All recent sales in each corridor were identified from either assessor tax cards or multiple listing services. The universe of sales was then filtered to eliminate sales that did not meet the definition of a “fair market sale”, defined as an arm’s length transaction between knowledgeable and typically motivated parties. The sales most frequently eliminated included foreclosures, “short” sales, liquidation sales and sales between related parties.

Each of the remaining sales was then the subject of a case study that had four basic components—the facts of the sale, the physical relationship of the property to the HVTL, interviews with transaction participants, and appraisal evidence based on an estimate of value at the time of sale ("Retrospective Appraisal") absent the influence of HVTL, i.e. using comparable sales not influenced by HVTL.

Based on these four categories of evidence, conclusions were drawn with respect to the effect, if any, of the HVTL on the sale price and the marketing period in the transaction.

Q. What were the findings of the Case Studies research?

A. The findings of the Case Studies for the three study areas were as follows. Sale price effects in the 24 Corridor #1 Case Studies were infrequent, small and only occurred where there was very close proximity, i.e. less than 100 feet from the house to the edge of the ROW combined with clear HVTL visibility. Proximity of that degree in the absence of clear visibility appeared not to be an issue nor was substantial visual intrusion in the absence of very close proximity. Marketing time effects were even less frequent. In only two cases did marketing time appear to be affected by the HVTL. There were several comments with reference to reduction in buyer interest due to the HVTL, but rarely did there appear to be any material effect on the marketing period. Further, there were references to several buyers who saw the corridor as an asset to the property.

Sale price effects in the 28 Corridor #2 Case Studies were also infrequent and only occurred where there was a combination of very close proximity and clear HVTL visibility. Like Corridor #1, proximity without clear visibility and clear visibility without proximity did not result in sale price effects. Marketing time effects were found in seven cases and suggested as possible in three others. In eighteen cases it was found that the HVTL did not affect marketing time.

Of the six case studies in Study Area #3, there were sale price effects in two cases and sale price effects were suggested as possible in one other. Effects on marketing time were found in one case and suggested as possible in one other. The results are similar to those for Corridors #1 and #2. The two properties for which sale price effects were found were located adjacent to the ROW in one case and 11 feet distant in the other, with both properties having clear visibility of the HVTL.

Q. Overall, what conclusions can be drawn from the New Hampshire Case Studies?

A. The Case Studies represent a broad spectrum of properties crossed by, or adjacent to, a HVTL in New Hampshire. There is variety in terms of property location, size and value and in the way in which the property is physically affected by the HVTL. While the results of any single case study are necessarily anecdotal, useful generalizations can be drawn when considering the results from all 58 case studies. These include the following. Sale price effects are infrequent—10 cases out of 58 found a sale price effect with another 11 cases suggesting a possible sale price effect. Thirty-seven cases or 64% found no sale price effect. Where sale price effects were found, they appear to have been small. Sale price effects decrease very rapidly with distance. Only one of the 10 cases had a house located more than 100 feet from the edge of the ROW (it was106 feet from the edge of the ROW) and seven were within 30 feet. With only one exception, close proximity had to be combined with clear visibility of the HVTL for there to be a sale price effect. Of those properties that combined close proximity and clear visibility, eight of the 14 had a sale price effect and six did not. The cases with sale price effects not only had homes close to the ROW but they were often forced to be close to the ROW because the developable portion of the lot was constrained by the location of the ROW on the property. Marketing time effects were also infrequent. In 41 of the 58 cases, there was no marketing time effect of the HVTL.

Subdivision Studies

Q. How do the Subdivision Studies differ from the Case Studies?

A. The Case Studies focus on individual sales of improved residential properties, i.e. properties on which homes have been built. The Subdivision Studies analyze the sale of unimproved lots before homes have been built. They analyze the original sale of the lots by the subdivision developer. Subdivisions are selected where some of the lots are crossed by, or abut, a HVTL while others are not.

Q. What was the methodology used in the Subdivision Study research?

A. An attempt was made to identify a subdivision in each of the towns crossed by Corridor #2 that had reasonably homogeneous lots, some crossed or abutting a HVTL, some not. No more than one subdivision was selected in any one town and a total of ten were identified. Corridor #1 did not lend itself to Subdivision Studies because of the more rural character of the area it crosses. In addition, an attempt was made to identify candidate subdivisions in the towns in Study Area #3. A total of three was identified.

A representative group of crossed or abutting ("Subject") lots and lots not crossed or abutting ("Control") were identified for each subdivision. Chain of title was established for each lot back to the original sale of the unimproved lot by the developer. The date and sale price for the original lot sale was recorded. This provided the basis for analyzing differences, if any, in the pricing and marketing time of the Subject lots relative to the Control lots.

Q. What were the findings of the Subdivision Study research?

A. For the 10 subdivisions crossed by Corridor #2, 133 lot sales were identified. Fifty-one of these sales involved encumbered or abutting lots. Seven of the 51 were abutting and 44 were encumbered. Five of the 10 subdivisions had some sales after the year 2000 while the others were fairly evenly divided between the 1970's, 80's and 90's. The extent of the encumbrance varied but there were several instances of lots encumbered in the 30% to 70% range.

Of the 51 lots either encumbered or abutting the ROW of Corridor #2, only four showed any evidence of price effects. In three of the four cases where there was an effect, development of the lots was severely compromised by the ROW. Further, in every case, the percentage discount was less than the percentage of the lot encumbered. In seven of the subdivisions, the encumbered or abutting lots sold at the same rate, or in some cases faster, than the Control lots.

In Study Area #3, there were 34 lot sales in the three subdivisions identified for study; 22 of these lots were encumbered by a ROW.[2] The time periods involved included the early 1990's, the late 1990's and the early 2000's. In two of the subdivisions, there were price effects for the

[2] Two of the subdivisions in Study Area #3 were encumbered by a 100 foot wide ROW containing a 34.5 kV distribution line. The other subdivision in Study Area #3 and all 10 of the subdivisions in Corridor #2 were crossed or bordered by HVTL.

encumbered lots although the price effects were small compared to the reduction in the development area of the affected properties. Overall, the lots in Study Area #3 were smaller (one to two acres), were of greater value and did not have acreage in addition to the home site (what we called excess acreage) which was characteristic of many of the subdivisions studied in Corridor #2.

There were timing effects observed at two of the three subdivisions studied. In those two subdivisions, the heavily encumbered lots sold less quickly than the unencumbered lots.

Q. Overall, what conclusions can be drawn from the New Hampshire Subdivision Studies?

A. Lot sales were studied at 13 subdivisions where some lots were crossed or bordered by a HVTL ROW and others were not. The response of the market to the two categories of lots was analyzed both in terms of sale price and marketing time. Investigation of the lot sale history along Study Corridor #2 indicates a general lack of marketability issues associated with lots encumbered by, or abutting, a HVTL ROW. Timing issues were apparent in three of the ten subdivisions and two of those were minor. Price effects were even less frequent.

The absence of price and timing effects in the Corridor #2 subdivisions appears to be due to the fact that the used and value generating portion of the lot is generally a small enclave at the front of the lot where the residence is developed. The rear of the lot plays little role in the value calculation and the presence, therefore, of a HVTL ROW in the rear portion of the lot apparently has little impact on the marketability of the lot. In each of the four cases where there was a price effect, the lot was bisected and the development area of the remaining portion of the lot between the ROW and the lot frontage was constrained.

The findings for the three subdivisions in Study Area #3 appear to reflect the reality in the Portsmouth area of smaller lots, higher land prices and a general lack of lower valued, ”excess” land. In the two subdivisions where price effects were observed, the encumbered lots sold for 10% to 30% less than the unencumbered lots despite the fact that their development area was 60% to 70% smaller. The ratio of land value to property value is variable, but if land value averaged one-third of the overall property value, this would translate into property value effects in the 3% to 10% range. Consistent with the Corridor #2 findings, it appears that there have to be serious constraints on the development options for a site before HVTL ROW encumbrance becomes a price issue. Or, put another way, the encumbrance has to impinge on the portions of the lot important to the siting of the home for there to be an impact on value.

With respect to marketing time, there was no effect identified in eight of the 13 subdivisions studied. In the five subdivisions where there was an effect, the effects in two were small and the other three subdivisions had lots that were heavily encumbered by the HVTL ROW or by a combination of the HVTL ROW and wetlands.

Q. If the value of a lot is adversely affected by a HVTL, does the land owner at the time the easement was purchased, or do subsequent buyers of the lot, suffer economic damage?

A. No. The existence of market value effects does not imply economic damages to the property owner. The owner at the time of easement purchase would have been compensated for market value effects. Further, if there were market value effects, subsequent owners would have purchased the property at a discount, so they would have suffered no economic damage.

<u>Market Activity Research</u>

Q. What is the Market Activity Research?

A. The Market Activity Research is a third New Hampshire-specific initiative that examines Multiple Listing Service data to see if there is evidence of market resistance to "for sale" properties based on their location relative to a HVTL corridor.

Q. What was the methodology used in the Market Activity Research?

A. Multiple Listing Service ("MLS") data was collected for all residential property sales within one mile of Corridor #2 ROW beginning on January 1, 2013 and continuing through 2014. Data were initially collected for all sales occurring in towns for which some portion of the town falls within the one mile criterion of the research. The location of the property sold was determined and straight line distance to the ROW was measured from satellite imagery. The sales were categorized by distance into three groups—encumbered or abutting, one foot to 500 feet and 500 feet to one mile.

Two measures of market activity shed light on pricing and timing issues. The MLS data describe both the listing price of the property and the sale price. The ratio of the sale price to the listing price ("SP/LP") is taken as an indication of the strength of the market with significant shortfalls of sale prices relative to listing prices indicative of buyer resistance. Second, the MLS data describe the days the property was on the market ("DOM") under the current listing and again, relatively high DOM would be an indication of buyer resistance. Quarterly averages were calculated for both measures for sales occurring in each of the three locational zones.

Q. What were the findings of the Market Activity Research?

A. The sales of the encumbered or abutting properties tend to have the same or higher SP/LP ratio than either of the other two location groups. The proximate properties (one to 500 feet) have a more mixed relationship to the more distant properties, lower in some quarters, similar in several and higher in others. The number of observations in each quarter is small so not too much should be read into these results, but there is no indication of a systematic market disadvantage of the encumbered properties or the proximate properties relative to the more distant group.

In six of the eight quarters, the average DOM was the same or lower for the abutting/ encumbered properties compared to the other two groups. The proximate properties have lower DOM than the more distant properties about half the time and higher DOM about half the time. Again, caution must be used in drawing conclusions based on relatively small numbers of observations, but there appears to be no systematic tendency for the DOM of the abutting, encumbered or proximate properties to be greater than for properties at a greater distance from the HVTL.

Conclusions

Q. Having completed the Research Report, do you have an opinion on the possible effect of HVTL on real estate markets in New Hampshire?

A. Yes. Everything I have learned from the research we have carried out over the past 18 months as documented in the Research Report is consistent with the basic conclusions of the professional literature, namely: there is no evidence that HVTL result in consistent measurable effects on property values, and, where there are effects, the effects are small and decrease rapidly with distance.

Q. To what do you attribute the general absence of property value effects?

A. The behavior of real estate market participants is a function of a large number of considerations that influence different people in different ways. Therefore, the only reliable method of assessing effects is to observe the result of the interactions of all the participants as they are revealed in actual transactions. Nevertheless, based on the perspective gained from the Case Studies and Subdivision Studies research, we are able to identify considerations that may be responsible for the absence of property value effects.

HVTL corridors are often screened by vegetation or topography. Despite significant encumbrance, HVTL corridors often only affect the rear of lots that contribute little utility or value to the property. The character and condition of the improvements to the property (house, yard, etc.) tend to dominate the attributes of the lot in determining the market value of the property. With many of the larger rural acreages, other lot characteristics (access, views, vegetation, water, etc.) dominate the HVTL effects. HVTL effects are most likely in the situation where there are similar properties except for the HVTL. This condition seldom holds in New Hampshire due to variability of terrain and the generally heterogeneous housing stock. Finally, the HVTL corridors have positive, as it relates to open space, as well as negative attributes.

My conclusion is that even though the presence of a HVTL corridor is generally perceived to be a negative attribute of a property, the weight attached to this particular attribute compared to all the other considerations that go into market decisions is apparently too small to have any consistent measurable effect on the market value of real estate.

Q. Are you familiar with the proposed Northern Pass Project?

A. Yes, I am.

Q. Does your opinion on HVTL effects on the market value of New Hampshire real estate and the evidence on which it is based also apply to the Project?

A. Yes.

Q. Please explain.

A. Nothing in the Research Report indicates any reason to expect property value effects of the Project to be more common than reported in the published literature or in our New Hampshire research. On the contrary, the research indicates that when effects occur, proximity of the house to the ROW combined with clear visibility of the HVTL are the critical variables. For Northern Pass, in the northern-most 40 miles of the Project route, development is sparse. There are no homes within 100 feet of the ROW where the line is overhead.[3] Then there are over 60 miles of the route that will be underground where there are no visibility concerns. From that point south, the new HVTL is in an existing ROW so proximity of homes with respect to the existing ROW will not change.

Based on our research, those properties that could potentially be affected are homes very close to the ROW that do not have clear visibility of the existing line but will have clear visibility of the existing line or the new Northern Pass line after it is built. The number of such properties is very small. Of the estimated 89 properties with homes located within 100 feet of the ROW boundary, about 80% already have clear visibility of the line(s) in the ROW and will have clear visibility after the project is constructed or have partial visibility of the existing line(s) and will have partial visibility after the project is constructed. An additional 10 % or so have no visibility now but are sufficiently screened that they will not have visibility of the lines after the Project is built. Of the remaining properties, our research suggests some will experience small market value effects and some will not.

Q. Please explain the apparent inconsistency between your opinions and the intuitive feeling that some observers have that HVTL must have an effect on real estate values.

A. Many have an intuitive feeling that HVTL must have an effect on real estate values. If you focus purely on HVTL, most people would expect the direction of the effect on market value to be negative. But it doesn't follow that there is a discernible effect on market value. The effect on market value, if any, depends on the weight given the HVTL effect relative to all the other positive and negative variables that shape a property purchase decision. All other

[3] The only exception is a single home within 100 feet owned by Eversource.

things equal, the property without the HVTL would generally be preferred, but all other things are never equal. We have intuition with respect to the direction of the effect but not the weight it is given by buyers and sellers of homes. Ultimately that has to be inferred from market data.

Q. How do you account for public concern with respect to property value effects?

A. I think it helps to keep in mind that people come to this issue from several different perspectives. There is the "Market Value" perspective which investigates whether the price arrived at in a fair market sale is affected by a HVTL. This is an objective concept based on market data. This is the perspective addressed in the Research Report and is the basis for the opinions I have offered here.

A second perspective is the "Owner" perspective. This is the subjective perspective of the owner of an affected property who has an opinion of the personal implications of the HVTL. This might include a scenario where the removal of a tree could have great personal significance or where a portion of a HVTL structure becoming visible causes tremendous harm in the subjective opinion of an individual property owner. In both of these scenarios, however, it's entirely possible that a prospective buyer, or, more generally, the market, would be oblivious to the change.

A third perspective is that of a non-owner who enjoys an affected resource (hiking or driving for example) and feels that their use/enjoyment of that resource is impaired by the HVTL. This perspective can be referred to as the "Public" perspective.

Both the Owner and the Public perspectives are genuine and must be respected, but those coming from these perspectives often confuse the issue by claiming market value effects. In fact, they may claim market value effects that are of magnitudes similar to the effects they suffer from a subjective or public perspective, e.g. "the value of my property will be destroyed." This may be true from their personal, subjective perspective, but the market value issue is an empirical question that must be answered with market data.

Q. Please provide your ultimate opinion on the issue of the Project's potential effect on real estate markets.

A. In my opinion, there is no basis in the published literature or in the New Hampshire-specific research initiatives as described in the Research Report to expect that the Project would have a discernible effect on property values or marketing times in local or regional real estate markets.

Draft Environmental Impact Statement

Q. Is there new information in the DEIS that has affected your opinion with respect to property value effects of the Project?

A. No.

Q. Is your opinion consistent with the property value analysis in the DEIS?

A. No. The analysis in the DEIS both misrepresents the published literature and addresses the wrong issue.

Q. In what way is the literature misrepresented?

A. The central, and universally shared, conclusion of the literature is that property value effects cannot be presumed. They have been found in some studies and not in others. This is explicitly concluded, or at least acknowledged, in each of the three published studies relied upon in the DEIS that review the literature. Nowhere in the literature is it stated or implied that the results of one or more studies are sufficiently consistent or broadly applicable that they can be applied to previously unstudied areas. To average the results from two Canadian, one New Zealand and one Illinois study and then apply it uniformly to the 189 miles of the Project is to misunderstand and misrepresent the literature.

Q. In what way does the DEIS analysis address the wrong issue?

A. The DEIS addresses the impact of an existing line on the value of surrounding properties. The central issue for Northern Pass is not the impact of the Project in isolation on surrounding properties, but, rather, the incremental impact of the Project in an existing ROW that already contains one or more 115 kV lines. The DOE recognizes this flaw in concluding that the DEIS "likely overstates the adverse impact for segments of the Project that would parallel existing transmission lines." More appropriately acknowledged, the DEIS certainly overstates the adverse impact since all of the overhead Portion of the project is in an existing ROW containing one or more 115 kV lines except for 32 miles of the northern-most 40 miles where property values are not an issue due to the absence of development. Further, there is no way within the DOE's approach to correct for the overestimate of the claimed impact.

Q. Does that conclude your testimony?

A. Yes.

ATTACHMENT A

JAMES A. CHALMERS

POSITION

Principal, Chalmers & Associates, LLC

EDUCATION

Ph.D. - Economics, University of Michigan - 1969
B.A. - Economics, University of Wyoming - 1963

EXPERIENCE

I. ECONOMICS

Broad range of experience in quantitative economic analysis and problem solving applied to regional and urban growth issues, public planning, economic modeling, fiscal analysis, industry economics and socioeconomic impact assessment. Selected engagements are described below:

Regional/Urban Economics

- City of Phoenix. Economic and residential development strategies for newly annexed peripheral areas.
- Maricopa Association of Governments. Official population, employment and land use projections for Metropolitan Phoenix at the traffic analysis zone (1300 zones) level of analysis.
- Arizona Department of Economic Security. Demographic and employment projections for each county in Arizona, adopted as the State's official planning projections.
- U.S. Bureau of Reclamation. Effect on California's Central Valley economy of limiting water rights to farms no larger than 160 acres.

Economic Development/Site Selection

- Governor's Blue Ribbon Task Force. Assisted the State of Arizona in preparing a proposal to site the U.S. West Advanced Technology core research facility in Arizona.
- Clark County, NV. Market studies of heavy industry demand, land absorption projections, and implementation program for APEX Heavy Industry Park outside Las Vegas.
- Greater Phoenix Economic Council. Competitive city operating cost comparisons for six different industrial sectors.

Impact Assessment

- Colorado Cumulative Impact Task Force. Project director for consortium of energy companies and local governments to establish database, standards for impact analysis, and common analytic tools for assessing socioeconomic and fiscal impacts of oil shale projects in six-county, western Colorado region.

- U.S. Bureau of Land Management. Economic and fiscal impacts of coal development in 40 county region of eastern Montana and western North Dakota.

- U.S. Nuclear Regulatory Commission. Case studies of the impacts of 12 nuclear power plants on their host communities across the United States.

Litigation Services

- Shughart, Thomson & Kilroy, Kansas City, MO. Prepared testimony with respect to redevelopment of Union Station in Kansas City, Missouri.

- Clifford Chance, London. Provided expert testimony with respect to market conditions in the interdealer broker industry in the late 1980's.

II. REAL ESTATE

Experienced in applying economic and financial analysis together with relevant market data to real estate development, investment counseling, asset management, and real property valuation. Projects include large, urban, mixed-use projects, single use projects of all types, and large master-planned community studies. Selected engagements include the following:

Development Consulting

- Belmont Corporation. Designed and managed research to investigate feasibility of master-planned community in western Maricopa County.

- Evans-Withycombe. Carried out market and feasibility analyses for proposed high-density residential developments.

- National Golf Foundation. Advised with respect to market forces affecting participation and frequency of play.

- Summa Corporation. Advised with respect to timing and market positioning of commercial and industrial development in Las Vegas, Nevada.

- Symington Company. Evaluated commercial office market conditions for purposes of evaluating both proposed and existing projects.

Investment Counseling

- Bay State Milling. Provided ongoing counseling with respect to the redevelopment options for the Hayden Flour Mill property in downtown Tempe, Arizona.

- Arizona State University - West Campus. Evaluated market conditions relative to privatization of 70 acres of the ASU West Campus.

- Banning-Lewis Ranch. Evaluated and provided development counseling for 25,000 acre property in Colorado Springs.

- Scottsdale School District. Advised the Scottsdale School Board regarding alternative scenarios for disposition of the 38-acre Scottsdale High School site located in downtown Scottsdale.

Workout/Disposition Counseling

- Cole Equities. Evaluated loan restructuring options for large office complex.
- Kidder Peabody. Prepared due diligence for securitization of $250 million apartment portfolio.
- Denro, Ltd. Developed and analyzed repositioning strategies for 1,300 acre, golf-oriented master planned community.
- Resolution Trust Corporation. Developed asset management alternatives for 2,500 acre mixed-use commercial and master planned residential community in Mesa, Arizona.

Litigation Services

- Baker & Botts, Houston. Provided an analysis of overall trends in values of office, industrial, multi-family, hotel and raw land properties in several Arizona markets.
- Lewis & Roca, Phoenix. Analyzed distribution of benefits from a proposed special improvement district.
- Bodman, Longley & Dahling, Detroit. Produced evidence on alternative development concepts for a golf course community in Michigan.
- Mariscal, Weeks, McIntyre and Friedlander, Phoenix. Provided testimony with respect to appropriate due diligence procedures in a commercial real estate fraud case.
- Morrison & Foerster, San Francisco. Developed evidence with respect to evolution of multi-family market conditions in the southwestern United States since 1980.

III. ENVIRONMENTAL DAMAGES QUANTIFICATION/ REAL PROPERTY VALUATION

Have applied real estate and economics background to litigation oriented engagements focused on environmental damages in the context of valuation of contaminated property, valuation of property affected by hazard or risk, natural resource damages and value of real property in the context of eminent domain. Selected engagements include:

Valuation of Contaminated Property

- Faulkner, Banfield, Doogan & Holmes, Anchorage, AK. Defense of major oil company with respect to property value diminution claims associated with storage of heavy industrial equipment.
- Aspey, Watkins & Diesel, Flagstaff, AZ. Quantified damages to property owners stemming from the malfunction of a lake in a master-planned community in northern Arizona.
- Holme Roberts & Owen, Denver, CO. Assessment for a major oil company of damages to real property from groundwater contamination.

- Streich Lang, Phoenix, AZ. Quantification of damages to building supply business stemming from property contamination by a previous owner.
- Coffield Ungaretti & Harris, Chicago, IL. Damage assessment for midwestern manufacturing client with respect to groundwater contamination claim by an adjacent property owner.
- Morgan, Lewis & Bockius, Los Angeles, CA. Quantified damages to an industrial property from ground water contamination from an adjacent property.
- Dickstein, Shapiro & Morin, Washington, D.C. Quantified damages to industrial land developer from lost sale due to soil and groundwater contamination from adjacent industrial facility.
- Shughart, Thomson & Kilroy, Kansas City, MO. Estimate diminution of value to large, industrial property due to smelter tailings and lead paint related contamination.
- Paul, Weiss, Rifkind, Wharton & Garrison, New York. Review documents pertaining to diminution of value to resort property affected by petroleum spill.
- Arnold & Porter, Los Angeles, CA. Evaluated diminution of value claims for an industrial property in the Long Beach area.
- McCarter & English, Newark, NJ. Quantified damages to industrial property due to soil contamination.
- Graham & James, Los Angeles, CA. Quantified damages to a property in Los Angeles resulting from a leaking UST.
- Powell, Goldstein, Frazer & Murphy, Atlanta, GA. Evaluated diminution of value claims for industrial property in South Carolina.
- Smith, Gill, Fisher & Butts, Kansas City, MO., and Whitman, Breed, Abbott & Morgan, Newark, NJ. Evaluated diminution of value claims for residential property in the Midwest.
- Jackson, DeMarco & Peckenpaugh, Irvine, CA. Evaluated diminution of value claims for industrial property in Southern California.
- Shaw, Pittman, Potts & Trowbridge, Washington, DC. Evaluated diminution of value claims for industrial property in Colorado.
- Day, Berry & Howard, Hartford, CT. Evaluated diminution of value claims for industrial property in Connecticut.
- Howrey & Simon, Washington, DC. Quantified damages to a property in Virginia due to soil and groundwater contamination.
- Paul, Hastings, Janofsky & Walker, Washington, DC. Quantified damages to a property in Orange County, California.
- Jones, Day, Reavis & Pogue, Los Angeles, CA. Analyzed property value diminution due to soil contamination at a manufacturing and warehousing facility in central Los Angeles.

- McClintock, Weston, Benshoof, Rochefort, Rubalcava & MacCuish, Los Angeles, CA. Analyzed residential market conditions relative to a damages claim at a large mixed-use property in Riverside County, CA.
- McClintock, Weston, Benshoof, Rochefort, Rubalcava & MacCuish, Los Angeles, CA. Analyzed property value diminution claims for an office/industrial property in Sunnyvale, CA affected by petroleum and VOC contamination.
- Union Pacific Railroad Company. Investigated diminution in value claims associated with commercial property in Riverside County, CA affected by lead contamination.

Valuation of Hazard Impacted Property

- U.S. Nuclear Regulatory Commission. Assessed the full range of economic damages associated with the accident at Three Mile Island.
- Latham & Watkins and Fadem & Douglas, Los Angeles, CA. Produced evidence for Howard Hughes Properties with respect to damages stemming from proximity to a major, high-pressure, interstate gas transmission line.
- Nevada Nuclear Waste Project Office. Project director for the State of Nevada for a five year, $8 million study of the effects of a proposed high level nuclear waste repository on the State of Nevada.

Natural Resource Damage Assessment

- State of Wisconsin – Provided technical oversight for Fox River NRDA.

Eminent Domain

- U.S. Attorney's Office, Phoenix. Analyzed highest and best use for lands surrounding Lake Pleasant, north of Phoenix.
- Burch & Cracciolo, Phoenix. Provided testimony on behalf of landowner whose property was taken for a city hall expansion.
- City of Chandler. Provided testimony with respect to highest and best use and market value of a small office building in the redevelopment area of Chandler, Arizona.
- Fadem & Douglas, Los Angeles. Provided evidence with respect to master-planned community from which land was taken for a recreation area and reservoir.
- US Attorney’s Office, Phoenix, AZ. Impact of transmission lines on residential property.
- Nevada Attorney General. Prepared evidence relating to the highest and best use of a large commercial parcel that was partially taken for purposes of highway improvement.
- Fadem & Douglas, Los Angeles. Valued abandoned railroad ROW in Manhattan Beach, California in the context of inverse condemnation action.
- Lewis, Babcock & Hawkins, Columbia, S.C. Prepared testimony with respect to master planned community on Hilton Head Island impacted by freeway alignment.

- U.S. Attorney's Office, Salt Lake City. Prepared market, financial feasibility and highest and best use evidence in several cases stemming from the creation of the Jordanelle reservoir.
- Arizona Attorney General. Provided testimony with respect to development timing and highest and best use on lands impacted by freeway development.
- Michigan Department of Transportation. Prepared evidence to support litigations in the M-59 corridor, northeast of Detroit.
- Northeast Utilities. Impact of 345 kV transmission lines on residential property values.

PROFESSIONAL AND BUSINESS HISTORY

Chalmers & Associates, LLC, Principal, 7/02 to present.

PricewaterhouseCoopers LLP, Principal, Financial Advisory Services. 7/98 to 6/02.

Coopers & Lybrand L.L.P. Principal, Financial Advisory Services. 1990 to 6/98.

Mountain West: 1974 to 1989. President and Economic Consultant.

Arizona State University: 1972 to 1979. Faculty of Economics, College of Business.

Rockefeller Foundation: 1970 to 1972. Special field staff at Thamasatt University, Bangkok, Thailand.

Amherst College: 1966 to 1970. Faculty of Economics.

TESTIMONY

I. COURT

Alabama Circuit Court
- Jefferson County

Arizona Superior Court
- Coconino County
- Maricopa County
- Pima County

California Superior Court
- Contra Costa County
- Los Angeles County
- Santa Clara County

Colorado District Court
- Adams County
- Eagle County

England, High Court of Justice, Queen's Bench Division

Florida Circuit Court
- Charlotte County

Georgia Superior Court
- Cobb County

Georgia State Court
    Fulton County
Louisiana District Court
    Parish of Calcasieu
Massachusetts Superior Court
    Essex County
Missouri Circuit Court
    Jackson County
New Jersey Superior Court
    Passaic County
United States District Court
    Anchorage, Alaska
    Baltimore, Maryland
    Charleston, South Carolina
    Las Vegas, Nevada
    Los Angeles, California
    Rome, Georgia
    Salt Lake City, Utah
    Southern Division, District of Maryland
    Southern District of New York
Virginia Circuit Court
    Loudoun County

II. OTHER

California Energy Commission
Connecticut Siting Council
Contra Costa County, California
    Board of Supervisors
Fairfax County, Virginia
    Board of Equalization
Nevada Commission on Nuclear Projects

CERTIFICATIONS

Arizona: General Real Estate Appraiser #30487
New Jersey: Certified General Appraiser #42RG00193400
New Hampshire: Certified General Appraiser #NHCG-878

PUBLICATIONS

Books Published

<u>One Hundred Centuries of Solitude - Redirecting America's High-Level Nuclear Waste Policy</u> (with James Flynn, Doug Easterling, Roger Kasperson, Howard Kunreuther, C.K. Mertz, Alvin Mushkatel, K. David Pijawka and Paul Slovic) Westview Press (1995).

<u>Economic Principles: Macroeconomic Theory and Policy</u> (with Fred R. Leonard) MacMillan (1971).

Selected Articles Published

"Transmission Line Impacts on Rural Property Value", <u>Right of Way</u>, May/June 2012; 32-36.

"High Voltage Transmission Lines and Rural, Western Real Estate Values", The Appraisal Journal, Winter 2012: 30-45.

"High Voltage Transmission Lines: Proximity, Visibility and Encumbrance Effects", The Appraisal Journal, Vol. 77, No. 3, Summer 2009; 227-245.

"Recent Developments in Natural Resource Damage Claims: Smoke or Fire?" (with Suzanne M. Stuckwisch), Environmental Compliance & Litigation Strategy, Vol. 15, No. 10, March 2000.

"Creating Value--and Profits--from Contaminated Real Estate" (with William V. Trefethen), Workouts & Asset Management, Vol. 5, No. 1, October 1996.

"Risk Factors in the Appraisal of Contaminated Property" (with Thomas O. Jackson), The Appraisal Journal, Vol. 64, No. 1, January 1996; 44-58.

"The Emerging Market in Contaminated Real Property," California Environmental Compliance Monitor, Vol. 5, No. 24, 320-322, October 16, 1995.

"Quantifying Contamination's Effects on Residential Property Values" (with Sue Ann Adams), Environmental Compliance & Litigation Strategy, September 1995; 4-6.

"Valuation Issues - Assessing Value of Environmentally Impaired Properties" (with Jeffre Beatty and Robert Ecker), as a chapter in Environmental Aspects of Real Estate Transactions, published by the ABA Section of Natural Resources, Energy and Environmental Law, 1995.

"Supporting Appropriate Adjustments in Large Scale Condemnation Actions" (with Daniel Sorrells), The Appraisal Journal, October 1994.

"Property Value Diminution: Residential and Commercial Cases Demand Different Approaches" (with Jeffre B. Beatty), Environmental Compliance & Litigation Strategy, February 1994; 4-7.

"Issues in the Valuation of Contaminated Property" (with Scott A. Roehr), The Appraisal Journal, Vol.61, No.1, January 1993; 28-41.

"Perceived Risk, Stigma, and Potential Economic Impacts of a High-Level Nuclear Waste Repository in Nevada" (with Paul Slovic et al), Risk Analysis, Vol. II, No. 4, 1991; 683-696.

"A Methodology for Valuing Contaminated Property" (with Steve Pritulsky, Scott Roehr, and Dan Sorrells), Land Rights News, November 1991.

"Contributions of Real Estate Economics to Right-of-Way Acquisition and Valuation" (with S. Pritulsky and D. Sorrells), Right-of-Way, June 1991; 8-13.

"Impacts of Nuclear Generating Plants on Local Areas" (with D. Pijawka), Economic Geography, Vol. 59, No. 1, January 1983; 66-80.

"Evaluation of Underutilized Resources in Water Resource Development" (with J.R. Threadgill), Water Resources Research, 1981.

"Integrating Planning and Assessment through Public Involvement" (with James L. Creighton and Kristi Branch), Environmental Impact Assessment Review, Vol. 1, No. 4; 349-353, April 1981.

"An Empirical Model of Spatial Interaction in Sparsely Populated Regions" (with E.J. Anderson, T. Beckhelm, and W. Hannigan), International Regional Science Review, Vol. 3, No. 1, Fall 1978.

"Some Thoughts on the Rural to Urban Migration Turnaround" (with M.J. Greenwood), International Regional Science Review, Vol. 2, No. 2, Spring 1978.

"The Role of Spatial Relationships in Assessing Social and Economic Impacts of Large-Scale Construction Projects," National Resources Journal, Vol. 17; 209-222, April 1977.

"Shift and Share and the Theory of Industrial Location" (with T. Beckhelm), Regional Studies, Vol. 10; 15-23, 1976.

2/12/2015

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF MITCH NICHOLS

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

Qualifications and Purpose of Testimony

Q. Please state your name, business address, and current position.

A. My name is Mitch Nichols. My business address is 16 Tee Place in Bellingham, Washington. I am Founder and President of Nichols Tourism Group.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide my assessment of the tourism industry in New Hampshire in relation to the Northern Pass Transmission Project ("Northern Pass" or the "Project"), as proposed by Northern Pass Transmission LLC ("NPT"). I conclude with my opinion that the Project will not affect regional travel demand or have a measurable effect on New Hampshire's tourism industry.

Q. Please describe your background and qualifications.

A. I have more than 20 years' experience working with tourism destinations analyzing their performance and assisting them in developing strategic direction to maximize their performance. These assignments have occurred throughout the U.S., with destinations ranging from Alaska to Florida. They typically have entailed "top level" advisory services with destination management organizations, their CEOs and Boards. After extensive analysis of a tourist destination, long-range strategies are developed to direct the organization and its diverse range of business members to maximize the potential impact of the industry in future years.

Approximately fifteen years ago, I worked with the State of New Hampshire in the development of a long-range tourism strategic plan and an assessment of its identity in the tourism marketplace.

A more complete description of my background and experience is contained in my resume. Attachment A.

Q. How are you familiar with Northern Pass?

A. I was retained in 2013 to develop a study methodology and first met with the Project representatives in July 2013. I have reviewed background information regarding the Project, including the proposed route. That information includes written descriptions of the Project and access to the on-line, Google Earth-based tool developed by the Project for viewing the Project route and details. I have also driven the route and surrounding area in person. These visits were supplemented with first hand discussions with tourism industry participants. Last, I have reviewed the July 2015 Draft Environmental Impact Statement ("DEIS") issued by the U.S. Department of Energy for this project.

Q. Please describe the methods you used to evaluate the possible effects of the Project on tourism in New Hampshire.

A. I prepared a report titled *Northern Pass Transmission and New Hampshire's Tourism Industry* dated September 2015. See Appendix 45. My analysis was focused on five areas. The analysis begins with a general discussion of Nichols Tourism Group's 20 years of experience assisting destinations to strategically plan ways to maximize tourism's contribution to their economy. That section also notes the absence of quantitative research on the possible impacts of power lines to tourism demand.

The second area examines data from Plymouth State University's Institute for New Hampshire Studies and other sources on New Hampshire's tourism industry. This provided context as to who the State's tourism visitors are, where they come from, where they go while in the State, what activities and experiences they undertake and what level of expenditures they provide to the State.

A third study element considers thoughts and perspectives of participants in New Hampshire's tourism industry regarding Northern Pass and its potential relationship to the tourism industry. A mix of representatives was included, providing diversity from both a business and geographic basis.

The fourth study element looks at Bureau of Labor Statistics data to gauge whether there is evidence of actual business expansion or contraction in the tourism industry from existing large electric transmission lines built in New Hampshire and Maine.

The final study element is a prospective visitor survey. It assesses how the State of New Hampshire is seen by prospective visitors from key feeder markets to New Hampshire, what drives their travel decisions, and how different destination attributes can influence their choices of travel destinations.

Q. Please summarize your findings on the key attributes the State of New Hampshire's tourism industry.

A. The tourism industry is obviously important in New Hampshire and supports approximately 10 percent of jobs in the State. Industry performance has fluctuated over the years, and a variety of key influencing factors have been consistently noted by the Institute for New Hampshire Studies at Plymouth State University. Large infrastructure projects, like transmission lines, have never been noted in these explanations. Most of the State's visitors come in the summer and fall months. While visitors travel and spend throughout the State, the Merrimack Valley attracts the largest amount of visitor spending and the Great North Woods region attracts the least. Approximately 75 percent of visitors come from the New England region, given the easy access and wide range of experiences that New Hampshire offers.

Q. What other research studies on effects of transmission lines on tourism have you found?

A. There are no published studies that address the quantitative impacts of transmission lines to a destination's visitor industry. While there are studies that developed processes to qualitatively rank power line routing alternatives as they related to tourism and recreation, none developed quantitative estimates of impacts of these new power lines to the tourism industry. Additionally, there are attitudinal studies, primarily done in relation to the development of wind farms that assess general attitudes towards large infrastructure projects.

Q. What did you learn from the listening sessions you conducted?

A. Input from a mix of industry representatives was considered through a series of interviews in December of 2013. Participants noted a mix of factors influencing visitor demand that were similar to those noted by Plymouth State University, my experience and other research studies. Again transmission lines were not identified as a factor influencing past travel decisions. While some expressed concern about future potential impacts of Northern Pass, no one provided any specific foundation or empirical support for the concern. Some participants also noted potential benefits of the Project as a source of consistent, affordable energy, employment generating new business and potential use of the corridor for a mix of recreational purposes.

Q. Please explain the results of your review of Bureau of Labor statistics data in the vicinity of two large transmission lines in New Hampshire and Maine.

A. A study of the existing Phase II transmission line project in New Hampshire[1] and the Maine Power Reliability Program ("MPRP")[2] indicates that tourism establishments and employees increased both during construction of those lines and after construction was completed. In the case of the Phase II line in New Hampshire, the data suggests that tourism business expansion in counties with transmission line development grew at rates 1.7 times that of counties where no transmission development occurred. In the case of the Maine project, the number of business establishments grew at rates approximately three times that of areas with no transmission line development. From this data, there is no indication that the construction and operation of new transmission lines had any negative effect on the tourism industry.

Q. Please discuss the key findings of your prospective visitor survey.

A. A survey of prospective visitors from key feeder markets to New Hampshire reinforces the position that key visitor decision factors include the range of products and experiences offered by a destination, its value for the money, the range of recreational amenities and access to a diverse mix of dining and shopping options. Other factors, such as ease of access and cellphone or broadband availability, also play important roles. While factors such as transmission lines, wind turbines and traffic delays were noted as barriers, the destination benefits were noted at levels three to six times more often by respondents. It is the collective mix of destination attributes that influences visitors' choice of destination, and the presence of power lines is very low on the overall scale of importance of these variables.

Q. What are your overall conclusions?

A. The presence of transmission lines does not impact regional travel demand. I do not recall in my 20 years of work on tourism planning that any concern was raised about the presence of transmission lines and their possible effect on visitor demand. From my analysis of this in New Hampshire, none of the five areas of my analysis suggests a different outcome, either for transmission lines in general or for the Northern Pass Project specifically.

---

[1] The Phase II line is a 450 kV HVDC electric transmission line that travels between Littleton, NH and Hudson, NH.
[2] MPRP includes the construction and re-build of 440 miles of 345 kV and 115 kV electric transmission lines in the State of Maine.

Visitors come to New Hampshire because of the diversity of visitor experiences the State can provide, its ease of access and its general affordability. Consistent with the pre-filed testimony presented by Terrence DeWan and Jessica Kimball, the presence, or absence, of transmission lines does not drive their decision to choose New Hampshire. Even for those New Hampshire visitors who have a negative attitude towards transmission lines, other destination factors are of far greater importance in their travel decisions. While it is conceivable that the presence of power lines may be a factor in travel decisions for a very small number of New Hampshire visitors, on the overall scale of importance of the mix of destination attributes that influence visitors' choice of destination, the positive attributes of a destination far outweigh any speculative adverse effects from transmission lines.

In my opinion Northern Pass will not affect regional travel demand and it will not have a measurable effect on New Hampshire's tourism industry.

Q. Does the analysis in the DEIS of the potential effects of Northern Pass on the State's tourism industry lead you to modify your conclusions?

A. No. My statement on the absence of other studies that provide quantitative estimates that would result to the tourism industry was also made by the DOE at p. 4-13 of the DEIS. In addition, at pages 4-13 and 4-15 the DOE noted consumer confidence, unemployment rates, gasoline prices, and weather as macro-economic factors influencing tourism demand and that other factors such as competition, value and overall attractiveness of the State also influence performance. These elements of the DEIS are fully consistent with my findings—that impacts to tourism are more influenced by these factors than by site-specific considerations.

Q. Does that conclude your testimony?

A. Yes.

ATTACHMENT A

Mitch Nichols

President – Nichols Tourism Group, Inc.

Career Summary and Background

Mitch Nichols is President of Nichols Tourism Group, Inc. (NTG) and leads the strategic planning and product development activities of the firm. Mr. Nichols' expertise is focused on the study of a destination's underlying economic factors, the impacts of changing market conditions and the resulting implications to product and destination performance. He has directed and overseen a wide range of strategic destination planning efforts, ranging from the states of Alaska to Sonora, Mexico. In all instances the challenge is similar, how do destinations or projects strategically prioritize their opportunities in ways that maximize their competitive position. The firm prides itself on developing strategies that are embraced on an industry-wide basis and are truly implementable.

Experience

Mitch's experience ranges from broad strategy planning efforts in beach destinations like Sarasota, Florida to unique mountain destinations such as the Mt. Hood region in Oregon and Ashville, North Carolina. Many assignments have taken a statewide orientation including the states of Alaska, Arizona, Illinois, Delaware, Kansas, New Hampshire, Rhode Island and Washington. This strategy work has also been focused on unique heritage destinations like the State of Montana's most well known historic gold mining towns of Virginia City and Nevada City, as well as the powerful living history experiences in the Historic Triangle regions of Virginia, including Jamestown, Yorktown and Williamsburg.

These strategies address key destination factors of target market segments, associated marketing and public relations initiatives, along with competitive and product development related factors. He has also directed unique marketing and public relations initiatives, like a bi-national Geotourism MapGuide that co-branded the states of Arizona and Sonora with National Geographic in highlighting the unique differentiated elements around the Sonoran Desert.

Recognizing the critical role proactive product development plays in successful destination attraction, Mitch is often involved in analyzing and recommending project specific components in large-scale, mixed-use developments, both in the United States in Mexico. He has served as the primary consultant to the U.S. Forest Service and Park Service, analyzing the demand potential and prospective impacts of a $600 million mixed-use, resort development planned as the gateway to Grand Canyon National Park. His experience has also included helping downtown areas, like Austin's Historic Sixth Street District, in targeting and expanding this well-known downtown destination.

EDUCATION

- *Master of Science, Business Administration, Arizona State University,*
- *Bachelor of Science (Cum Laude), Business Administration, Arizona State University*

PROFESSIONAL AFFILIATIONS

- *Arizona Lodging and Tourism Association, Board of Directors Member*
- *U.S. Travel Association, Associate Member*
- *Travel and Tourism Research Association - Western Region Board Member*
- *Previous Financial Advisor to the Industrial Development Authority of the County of Maricopa*

Prior to the more than 20 year long tenure of NTG, Mitch's consulting efforts were associated with the development and hospitality advisory activities of Laventhol & Horwath, Coopers & Lybrand and the regional economic and development firm Mountain West Research. Mitch received both his Bachelor of Science (Cum Laude) and Masters in Business Administration degrees from Arizona State University. He is the past Southwest Chair of the nationally recognized Counselors of Real Estate (CRE) and previously served as the Financial Advisor to the Industrial Development Authority of the County of Maricopa where he helped close millions of dollars of bond transactions related to public purpose development initiatives.

Mitch works closely with the University of Florida and their National Laboratory of Tourism and eCommerce in applying cutting edge international research to real-world challenges. He is also an instructor with Destination Marketing Association International, the country's lead trade organization, and their Certified Destination Management Executive program.

THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF BRADLEY P. BENTLEY

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

October 16, 2015

<u>Qualifications and Purpose of Testimony</u>

Q. Please state your name, title, and business address.

A. My name is Bradley P. Bentley. My title is Director – Transmission System Planning. I work for Eversource Energy Service Company ("Eversource") and my business address is 56 Prospect Street, Hartford, CT 06103.

Q. Briefly summarize your educational background and work experience.

A. I have a Master of Science degree in Electrical Engineering from The Ohio State University in Columbus, Ohio, a Bachelor of Science degree in Electrical Engineering from Clarkson University in Potsdam, NY. I have a Master in Business Administration from the University of Connecticut. I am also a registered Professional Engineer in the state of Ohio.

I have worked in the electrical engineering field for 24 years for various utilities including American Electric Power in Columbus, OH, GridAmerica in Cleveland, OH, and San Diego Gas & Electric in San Diego, CA, before joining Eversource in 2008. I have experience in Nuclear Generation, Transmission Operations, Energy Marketing and Trading, and Transmission System Planning. I have been employed by Eversource as the Director Transmission System Planning for the last seven years being responsible, on behalf of Eversource Energy's operating companies, for planning the company's transmission systems in New Hampshire, western Massachusetts, and Connecticut.

For the past seven years, I have represented Eversource as a member, and the Chairman for two years, of the Northeast Power Coordinating Committee ("NPCC") Task Force on Coordination of Planning. I have also represented Eversource on the NPCC Reliability Coordinating Committee during this time.

Q. Have you previously testified before the Site Evaluation Committee?

A. No. However, I submitted pre-filed testimony in SEC Docket 2015 – 05. In addition, as part of the Least Cost Plan filed in New Hampshire by Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH"), I have worked with the New Hampshire Public Utilities Commission staff. I have testified for the company before the Electricity Facility Siting Board in the State of Massachusetts, the Connecticut Siting Council in the State of Connecticut, and the Maine Public Utilities Commission in the State of Maine. I have also worked with the Massachusetts Department of Public Utilities staff on Western Massachusetts Electric Company d/b/a Eversource's Annual Reliability Review filing.

Q. What is the purpose of your testimony?

A. My testimony has two purposes. First, I explain why the Northern Pass transmission project ("Northern Pass" or the "Project"), as proposed by Northern Pass Transmission, LLC ("NPT"), will not adversely impact system stability or reliability. Second, I describe the benefits that Northern Pass will provide to the electric transmission system.

ISO-NE Project Approval

Q. What regional reliability approvals are necessary for the Project to interconnect with the New England power system?

A. The Project must receive approval from the Independent System Operator of New England ("ISO-NE") pursuant to Section I.3.9 of the ISO-NE Tariff in order to interconnect to the New England regional electric grid.

Q. What is the process for ISO-NE approval of Northern Pass?

A. Pursuant to the ISO-NE tariff, which was revised for 2015, NPT must submit a package of materials referred to as Proposed Plan Applications ("PPAs"), including certain transmission facility data and study results. ISO-NE performs transmission studies, which must show, through rigorous and complex technical analyses, that the Project will have no significant adverse effect upon the reliability or operating characteristics of any transmission facilities or systems comprising the regional electric grid. The technical analysis includes system impact study work for steady state, stability, and short circuit conditions. Additional testing of inter-regional transfers is conducted to ensure that the Project does not affect neighboring transmission systems.

Q. Has the Project received ISO-NE PPA approval?

A. NPT submitted PPAs in October 2013 for a 1,200 MW project under the ISO-NE's prior rules. ISO-NE issued a letter approving that proposal on January 9, 2014, subject to certain requirements. See Appendix 40. Subsequently, NPT asked ISO-NE to study a proposal for a technology change that would reduce the Project capacity from 1,200 MW to 1,090 MW, which is described in the testimony of James A. Muntz. NPT therefore submitted an interconnection request for an elective transmission upgrade early in 2015, which initiated another ISO-NE study and approval process. See Appendix 40. NPT expects to submit PPAs for ISO-NE approval by the end of 2015.

Q. Did the original ISO-NE approval identify upgrades to the transmission system?

A. Yes. The results of the testing for the PPAs concluded that transmission upgrades at the existing Deerfield and Scobie Pond Substation, and on three 345 kV lines that connect to the Deerfield and Scobie Pond Substations, would be required. The upgrades include capacitor banks and a static var compensator ("SVC"), as well as breakers and transmission structure upgrades. The details of these upgrades are included in the ISO-NE PPA approval letter for NPT in Appendix 40.

Q. Will similar upgrades be required for the new design?

A. Due to the limited changes to the Project, it is expected that similar upgrades will be required. This will be confirmed by the final study results expected by the end of 2015.

<u>System/Electrical Benefits</u>

Q. What benefits does Northern Pass provide to the regional electric grid?

A. The Federal Energy Regulatory Commission ("FERC") identified a number of specific benefits to the regional power grid when it accepted NPT's Transmission Service Agreement with H.Q. Hydro Renewable Energy, Inc., a subsidiary of Hydro Québec. It noted, for example, that the Project "will include making available up to 1,200 MW of hydro-electric power previously unavailable from Québec. The [Project] will not only diversify New England's power supply mix, but it will also allow more energy imported from Québec to be delivered during peak hours when marginal generation costs and market-clearing prices are highest."[1] FERC also commented that, "we find that with the addition of hydro-electric power to the base case, the existence of the [Project] will help mitigate overloads."[2]

Q. Will the Project address power system concerns raised by ISO-NE?

A. As described in the pre-filed testimony of Julia Frayer, the Project will help to respond to the nearly 8,300 MWs of coal- and oil-fired generation retirements that ISO-NE faces between now and 2020.[3] In addition, it will increase fuel diversity in New England, which has become increasingly dependent on natural gas for power generation. The region's heavy

---

[1] *Northern Pass Transmission LLC*, 134 FERC 61,095 at ¶ 40 (2011).
[2] *Id.* at ¶ 26.
[3] ISO-NE, *ISO New England's Strategic Transmission Analysis, New England Electricity Restructuring Roundtable: Generation Retirement Study & 2020 Resource Options* at 4 (June 14, 2013).

dependence on natural gas raises serious questions about the reliability of power delivery in winter months because the gas is also needed for home heating and industrial uses. Over the long term, the Project will also help to meet future load growth requirements, and it may avoid or defer the need to construct new fossil fuel plants and associated transmission projects that would otherwise be required to produce an equivalent quantity of reliable power.

Q. As an HVDC project, does Northern Pass provide benefits to the power system?

A. The Project provides important system benefits. First, the DC link will provide power system support. Second, it may be able to limit the effects of a cascading blackout and provide emergency support after outages. Third, it has the capability of helping New England meet its reserve requirements. Finally, this new regional interconnection is highly dispatchable and will allow for use by others when Hydro-Québec has not scheduled power deliveries.

Q. Will the Project's AC transmission system upgrades provide benefits to the power system?

A. Yes, the AC system upgrades will help maintain system voltages and reactive reserve, and improve power transfer capabilities and deliverability in New Hampshire as described below. First, transmission system operators must deal with changes in load and generation on a minute-by-minute basis and be prepared to respond to disturbances on the system. In addition, operators must be able to schedule maintenance outages without significant risk to reliability. These expected regional network upgrades that is likely to be required by ISO-NE allows the system operators to be more responsive and flexible in responding to power system needs. This is because the required upgrades are designed to address stressed conditions, which occur infrequently during the year. At other times, the system operators will be able to support the power system with the additional infrastructure. Second, in addition to providing increases in power carrying capability, new transmission infrastructure provides resiliency benefits. When new transmission reactive devices, such as those NPT expects to construct, are added to the system, the devices help support the power system in emergency conditions, especially during storm events. Essentially, a power system that has multiple paths to connect various areas of the system is more reliable. This includes new line interconnections and reactive support for areas as load continues to grow. Fourth, the location of the converter terminal in Franklin facilitates the potential use and incorporation of the 345 kV alternating current transmission facilities of Northern Pass into a PSNH reliability project should ISO-NE determine that those facilities, along with other system improvements, could address a reliability need at some point in the future.

Q. In summary, what is your conclusion with respect to the interconnection of Northern Pass to the New England transmission system?

A Based on my experience and knowledge of the extensive testing and analyses performed by ISO-NE as part of the I.3.9 process, Northern Pass will be able to interconnect with the New England transmission system in a manner that assures system stability and reliability. Moreover, as discussed above, the Project will provide material benefits to the New England transmission system.

Q. Does this conclude your testimony?

A. Yes.

ATTACHMENT A

BRADLEY BENTLEY, P.E.

56 Prospect St.
Hartford, CT
860-728-4603
E-mail: bradley.bentley@eversource.com

Summary

Twenty four year career working in major utility companies throughout the U.S. with experience testifying before various state public utility commissions and regulators. Extensive knowledge of successful investor owned utilities regulatory, financial and operational structures and practices.

Professional Experience

Eversource Energy, Hartford, CT 2008 - Current

A major U.S. electric and gas utility with more than 3.6 million customers in CT, MA, and NH

Director Transmission System Planning, Transmission Department

Responsible for directing the functions of the Transmission System Planning Group

- Direct and oversee the development and approval of major transmission plans and projects throughout the Eversource system
- Experience testifying before and working with various regulatory agencies in CT, MA, ME and NH on transmission projects, integrated resource plans, energy security & reliability reviews
- Manage regional studies required for transmission projects that access and integrate large renewable resources with the Independent System Operator of New England (ISO-NE)
- Coordinate transmission and reliability plans with distribution companies, multiple municipalities in CT and NH, large customers and regional entities
- Chairman of the Task Force for Coordinated Planning and Eversource representative on the Reliability Coordinating Committee for the Northeast Power Coordinating Council (NPCC)
- Responsible for completion of transmission planning studies to comply with Federal mandates

San Diego Gas & Electric (SDG&E), San Diego, CA 2005 - 2008

A major U.S. electric and gas utility with more than 3 million customers in CA

Transmission Planning Manager, Transmission Planning Department

Responsible for managing Internal Grid Assessment Team and External Team

- Direct completion of SDG&E's Annual Grid Assessment for transmission & substation projects
- Manage technical and financial approval process for planning projects
- Collaborate with Transmission Engineering, Substation Engineering, and Protection and Control to finalize design, cost, and scheduling for transmission and substation projects
- Prepare transmission reliability testimony for SDG&E's $1.3 billion 500 kV transmission project

- Manage coordination with Grid Operations in resolving operational and planning issues
- Thorough knowledge of FERC/NERC Mandatory Reliability Standards, Large Generator Interconnection Process and developing Renewable Portfolio Standards

Team Lead, Transmission Planning Department

- Led planning studies coordinating transmission projects with neighboring utilities in the WECC
- Directed import capability studies for SDG&E due to transmission and generation additions
- Led the review of regional planning studies of large generation and transmission projects
- Responsible for participation in California ISO Resource Adequacy proceedings and California Energy Commission's Long Term Procurement Plan proceeding

GridAmerica LLC, Cleveland, OH 2003 - 2005

An Independent Transmission Company founded by National Grid that focused on providing superior electric transmission service in the Midwest ISO (MISO)

Transmission Planning Engineer, Investment Planning Department

Identified investment improvements for First Energy, Northern Indiana Public Service, and Ameren

- Completed transmission reliability and power transfer studies utilizing PSS/E and MUST
- Team lead for development of transmission investment and congestion analysis using PROMOD
- Chairman of the Transmission Model Building Working Group at the MISO
- Participated in MISO Planning Subcommittee, Expansion Planning Group, and user groups
- Assisted Operations in AFC calculations, transmission service requests and outage planning
- Familiar with Generator Interconnection studies, Financial Transmission Rights analysis and Midwest power market

American Electric Power (AEP), Columbus, OH 1991 - 2002

A major U.S. electric utility with more than 5 million customers in 11 states

Natural Gas Trader, AEP Energy Services, (2000 – 2002)

Financial Basis / Physical Gas Trader responsible for financial performance of trading positions

- Created computer models to analyze and predict market prices, and manage trading position risk
- Managed risk for and evaluated pipeline transportation and gas storage contracts

Energy Market Analyst, AEP Energy Services, 1999 – 2000

Generated Eastern U.S. and ERCOT power market analysis for power traders

- Created generation outage applications for traders to analyze market volatility
- Lead analyst of nuclear power plant issues throughout U.S.

Transmission Planning Engineer, System Planning Department, 1996 – 1999

Responsible for transmission planning activities in Ohio, Indiana and Michigan

- Completed area planning studies using PSS/E and short circuit studies using ASPEN
- Proposed projects and implemented recommendations to improve reliability

- Coordinated projects and negotiated contracts between AEP and Electric Cooperatives

Instrumentation and Controls (I&C) Engineer, 1992 – 1996
Nuclear Engineering Department

- Modernized obsolete and malfunctioning I&C systems to improve performance and costs
- Familiar with design processes, testing procedures, and startup of power plant control systems

Electronic Support Intern Engineer, Systems Operations Division 1991

- Programmed computer applications for monitoring AEP's power generating plants' performance

Education & Licenses

University of Connecticut, Storrs, CT
Master of Business Administration (MBA)

The Ohio State University, Columbus, OH
Master of Science, Electrical Engineering (MSEE)

Clarkson University, Potsdam, NY
Bachelor of Science, Electrical Engineering (BSEE)

Professional Engineer, Ohio Professional Engineering license since 1997