

DATE: August 20, 2008

FROM: Michael D. Cannata, Jr. - Senior Consultant
The Liberty Consulting Group

SUBJECT: DE 08-102: Petition by Public Service Company of New Hampshire, Inc. for a License to Construct and Maintain Electric Lines and a Communication Cable Over and Across Public Waters of the Ashuelot River in Keene and Swanzey, New Hampshire

TO: Thomas C. Frantz – Director, Electric Division
New Hampshire Public Utilities Commission

On August 7, 2008 Public Service Company of New Hampshire (PSNH) filed a petition with the Commission under RSA 371:17 for a license to construct and maintain electric lines and a fiber optic communications over and across the Ashuelot River in Keene and Swanzey, New Hampshire. On August 14, 2008, PSNH filed supplemental information required to complete Liberty's review of the petition.

PSNH states that the three new crossings are required to provide additional power transfer capability due to load growth for the A-152 115kV line between the Emerald Street Substation in Keene, New Hampshire and the West Swanzey Substation in Swanzey, New Hampshire. The fiber optic ground wire (OPGW) communications cable replaces an existing All Dielectric Self Supported (ADSS) communications cable and is required to enhance the reliability and capacity of their communications system used in electric system operations. The rebuild of the A-152 115kV line and the three new crossings will allow PSNH to meet the reasonable requirements of service to the public in the western region of New Hampshire. PSNH plans on rebuilding the A-152 line with larger conductor and a new communications cable necessitating the license for the three crossing approvals sought in its petition. Details of each crossing are provided as Appendices A through F.

In support of its petition, PSNH has supplied plan and profile and locational geographic maps for all crossings, previous license information, and construction details of the various structures used. PSNH states that it either owns the land or has the necessary easements at each crossing location. One electric and communications crossing has been previously licensed by the Commission. The other two crossings were not previously licensed, has structures set in jurisdictional wetlands (Appendices A and B) that require New Hampshire Department of Environmental Services (NHDES) permitting, and are in proximity to the Dillant-Hopkins Airport in Keene. PSNH supplied the required NHDES permit and the Federal Aviation Administration "Determination of No Hazard to Air Navigation" with its filing.

Commission Staff requested that the Liberty Consulting Group (Liberty) review PSNH's petition. Based on that review, Liberty concluded that:

- PSNH has provided sufficient information and data to justify the new crossings and assure the Commission that the new facilities will be properly constructed, operated, and maintained, and
- If the proposed facilities are constructed, operated, and maintained as proposed in its filing, PSNH will provide safe and reliable service to the public based on sound engineering standards as specified in the 2007 edition of the National Electrical Code.

Liberty has concluded its review and attaches its report to this memo. In brief, Liberty recommends that Staff recommend approval of PSNH's petition to the Commission with conditions as described in the attached report.

Please contact me if you have any questions or would like to discuss this matter. I can be reached at (603) 463-5540.

Liberty Review of the Public Service Company of New Hampshire Petition for License to Construct and Maintain Electric Lines and a Fiber Optic Communications Cable Over and Across the Public Waters of the Ashuelot River in the City of Keene and the Town of Swanzey, New Hampshire

August XX, 2008

Review Summary

On August 7, 2008, Public Service Company of New Hampshire (PSNH) filed a petition with the New Hampshire Public Utilities Commission (Commission) pursuant to RSA 371:17 for a license to construct and maintain electric and fiber optic communications (OPGW) lines at three locations for the purpose of rebuilding a 115 kilovolt (kV) line depicted as A-152 (Formally the N-186 115kV line) to increase its power transfer capability. PSNH states that the new crossings are required because of load growth. A-152 runs between the Emerald Street Substation in Keene, New Hampshire and the Swanzey Substation in Swanzey, New Hampshire. The load growth results in PSNH's inability to meet its system design guidelines without increasing the capacity of this facility. The A-152 line is presently constructed with 477 kcmil 18/1 ACSR conductor. This rebuild project will replace that small conductor with 1590 kcmil 45/7 ACSR. The rebuild of the A-152 115kV line and the three new crossings will allow PSNH to meet the reasonable requirements of service to the public in this area of New Hampshire. The new 84 fiber OPGW cable will replace the existing All Dielectric Self Supported (ADSS) communications cable and will allow PSNH to enhance the reliability and capacity of their communications systems used in PSNH's electric system operations. Two of these crossings were previously not licensed. The third was previously licensed under the line designation of N-186. PSNH supplemented its filing on August 14, 2008.

In support of its petition, PSNH submitted related figures, appendices, and exhibits as follows: construction detail drawing depicting the construction specifications of the proposed single pole and two pole tangent structures (Figures 1 and 2 respectively) and appendices describing the design conditions of the three proposed crossings (Appendices, A, B, and C). Each appendix contains geographic maps depicting the locations of the three proposed crossings (Exhibits 1, 3, and 5 respectively), plan and profile drawings depicting the locations and projected elevations of the three proposed crossings (Exhibits 2, 4, and 6 respectively). PSNH also filed an approved New Hampshire Department of Environmental services (NHDES) Wetlands and Non-Site Specific Permit, Number 2008-00219 approved on April 3, 2008. Related exhibit identification for the current petition, and previous crossing licence information is shown in Attachment A to this report.

The facilities described in Appendices A and B in the petition are in proximity to the Dillant-Hopkins Airport in Swanzey, New Hampshire. PSNH states that the proposed construction is in adherence to Federal regulations regarding elevations and flight paths.

PSNH filed the Federal Aviation Administration “Determination of No Hazard to Air Navigation” stating that the proposed facilities are in compliance with their regulations.

PSNH states that it owns easements or owns land in fee for its lines and facilities on both sides of the public water bodies at all of the proposed crossing locations and that each of the crossings will be constructed within the limits of those easements or ownership. The new crossings will be constructed at locations described in Attachment B to this report.

The construction of the crossings in Appendices A and B will consist of single pole laminated wood tangent structures (Type WT1) as shown in Figure 1. As designed by PSNH and depicted in Figure 1, the single pole tangent structures will be davit arm construction. The phase conductors will be vertically configured and offset resulting with the highest and lowest conductors on one side of the pole and the middle conductor on the other. The highest conductor will be 15 feet 0-inches from the top of the pole and 6-feet 0-inches offset from the pole. The lowest conductor will be 15-feet 0-inches below the highest conductor and 7-feet 0-inches offset from the pole. On the other side of the pole, the middle conductor will be 22-feet 0-inches from the top of the pole and 6-feet 0-inches offset from the pole. The OPGW communications cable will be mounted on the pole 6-inches from the top of the pole.

The construction of the crossing in Appendix C will consist of a two pole wood tangent structure (Type RAX) as shown in Figure 2. As designed by PSNH and depicted in Figure 2, the two pole tangent structure will be H frame construction. The phase conductors will be horizontally configured with a spacing of 14 feet 0-inches. The OPGW communications cable and the 7 No. 8 Alumoweld static wire will be mounted on each pole, 9-inches from the top of the pole, and will be centered between and 12 feet 7-inches above the phase conductors.

The structure number, structure type and height, crossing span length, and geographic placement relative to the crossing are shown in Attachment C to this report.

PSNH investigated a multitude of weather and loading conditions for its design. The conditions investigated were the National Electrical Safety Code (NESC), ANSI C2-2007 Heavy Load Conditions (0 degrees F, 4 pounds per square foot wind loading, and ½ inch radial ice), minus 20 degrees F ambient temperature, and 285 degrees F conductor temperature. PSNH used these design conditions to determine the minimum clearance of the conductors to the water surfaces of the crossings and to land surfaces. To determine the minimum distances between the phase conductors and the OPGW communication cable, PSNH assumed the phase conductors were at 30 degrees F with no ice while the fiber optic conductor above was at 30 degrees F and with an extreme ice loading of one inch radial ice.

The three phase conductors will be 1590 MCM 45/7 ACSR conductors, constructed in either a vertical or horizontal configuration as described above. The OPGW communication cable and the static wire will be bracket mounted on the poles. The phase conductors will be tensioned to 10,000 pounds and the OPGW communication cable and

the 7 No. 8 Alumoweld static wire will be tensioned to 4,500 pounds. All conductors, the OPGW communication cable, and the static wire will be sagged to NESC, ANSI C2-2007 Heavy Load Conditions.

PSNH used the 100-year flood levels contained in the Federal Emergency Management Agency (FEMA) flood insurance rate maps at all locations in its design. PSNH stated that it used the 100-year flood for water elevations as the normal flood level as 10-year flood levels required by the NESC were not available and that the 100-year flood level will be well above the 10-year flood elevation.

PSNH further states that the maximum sag for the phase conductors always occurs when they are at their maximum operating temperature of 285 degrees F. Water surface areas for Appendices A and B, whose size determines NESC minimum clearance requirements were calculated according to NESC Table 232-1.7a, Note 19, using the surface area of a one mile section of the water body. The water surface area for Appendix C was calculated according to NESC Table 232-1.7a, Note 20, using the surface between obstructing bridges located approximately 300 feet upstream and downstream. The resultant water surface areas ranged from 0.6 acres to 15.3 acres. Table 232-1.7a requires a minimum water surface clearance of 22.1 feet for water surface areas of less than 20 acres when adjusted by NESC Rule 232.C.1.a. for circuits operating at 115kV.

For OPGW communication cables that meet Rule 230C1, the minimum clearance required by Table 232-1 to the water surface is 17.5 feet for water surface areas of less than 20 acres. The maximum sag of the OPGW communication cable will never exceed these clearance requirements as they are located well above and offset from the phase conductors and will never sag to levels near the phase conductors. The 100-year flood elevations, calculated water surface areas, water surface clearance requirements, and minimum water surface clearance for the phase conductors are shown in Attachment D to this report.

For phase conductors adjusted to an 115kV operating voltage by NESC Rule 232.C.1.a, the minimum clearance required by Table 232-1.2 to the land surface where truck traffic is present is 20.1 feet. For OPGW communication cables that meet Rule 230C1, the minimum clearance required by Table 232-1.2 to the land surface is 15.5 feet. The maximum sag of the OPGW communication cable will never exceed these clearance requirements as they are located well above and offset from the phase conductors and will never sag to levels near the phase conductors. The land surface clearance requirements, and minimum land surface clearance for the phase conductors are shown in Attachment E to this report.

PSNH determined that the minimum distance between the OPGW fiber optic cable and the phase conductors occurs when the phase conductors are at a temperature of 30 degrees F and have no ice while the OPGW fiber optic cable or the Alumoweld static wire is at 30 degrees F with an extreme ice loading of 1 inch radial ice. NESC Table 235-6, Section 2a requires that the minimum allowed distance between the phase conductors and the OPGW fiber optic cable or static wire is 54.3 inches or 4.8 feet for circuits

operating at 115kV when adjusted by NESC Rule 235C.2.a.1. The minimum expected vertical and horizontal clearances between the phase conductors and the OPGW communication cable or the Alumoweld static wire are depicted in Attachment F to this report.

According to PSNH, There are no abutters to either side of the crossings because PSNH either owns the property on each side of the structure location on both sides of the river or has permanent easements on both sides of the public water bodies at all of the crossing locations.

PSNH states that three of the four structures required for the two crossings in Appendices A and d B will be set within jurisdictional wetlands or other areas that will require NHDES permitting. PSNH has obtained required NHDES wetlands permits for these locations.

PSNH states that the use and enjoyment by the public of these waters will not be diminished in any material respect as a result of the proposed electric and communication line crossings. PSNH further attests that the construction of the crossing will be constructed, maintained, and operated in accordance with the requirements of the National Electrical Safety Code, American National Standards Institute (ANSI) C2-2007.

Conclusions and Recommendations

Liberty reviewed the petition and associated technical information filed by PSNH in support of its petition.

Liberty found that PSNH has provided sufficient information and data to justify construction of new electric lines and a communications cable across public waters at these locations.

Liberty found that PSNH assures the Commission that the new overhead facilities will be properly constructed, operated, and maintained in accordance with the requirements of the NESC, ANSI C2-2007.

Liberty concluded that if the proposed facilities are constructed, operated, and maintained as proposed in its filing, PSNH will provide safe and reliable service to the public based on sound engineering standards and that construction will be in accordance with the 2007 edition of the National Electrical Safety Code.

Liberty recommends that Staff recommend approval of PSNH's petition to the Commission.

Liberty further recommends that Staff recommend that the Commission include the following conditions on PSNH in its order.

- Require that PSNH shall conform to all requirements of the New Hampshire Department of Environmental Services related to these approved crossings

- Require that all construction and future reconstruction to these approved crossings shall conform to the requirements of the National Electrical Safety Code and all other applicable safety standards in existence at that time
- Require that all construction and future reconstruction of these approved crossings shall conform to the requirements of the Federal Aviation Administration standards in existence at that time
- Require that PSNH maintains and operates these crossings in conformance with the National Electrical Safety Code.

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Attachment A

Correlation of Existing and Current Petition Information

Town	Water Body	Former NHPUC Order No.	Former NHPUC Docket No.	Current Petition Appendix #	Current Petition Location Exhibit #	Current Petition Plan & Profile Exhibit #
Swanzey	Ashuelot River ¹	N/A	N/A	A	1	2
Swanzey	Ashuelot River	12,219 (Electric)	DE 76-22	B	3	4
		22,973 (Communications)	DE 98-100	B	3	4
Keene	Ashuelot River ¹	N/A	N/A	C	5	6

1 – This crossing was not previously licensed.

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Attachment B

Location Descriptions of Crossings

Current Petition Appendix #	Town	Water Body	Current Petition Location Ex. #	Location Description
A	Swanzy	Ashuelot River	1	Approximately 0.40 miles west of the Dillant – Hopkins Airport and 0.15 miles east of Matthews Road.
B	Swanzy	Ashuelot River	3	Approximately 0.10 miles north of Eaton Road and 1.20 miles west of Mount Caesar School on Eaton Road.
C	Keene	Ashuelot River	5	At New Hampshire Route 10 and approximately 1.00 miles north of New Hampshire Route 9.

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Attachment C

Structure and Span Information

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Exhibit #	Structure # & Location	Structure Type & Height (feet)	Span Length (feet)
A	Swanzey	Ashuelot River	2	#22 – North #23 – South	WT1 - 85 WT1 - 80	528
B	Swanzey	Ashuelot River	4	#54 – North #55 - South	WT1 – 75 WT1 - 75	402
C	Keene	Ashuelot River	6	#2 – North #3 - South	RAX – 70 RAX - 75	399

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Attachment D

Phase Wire Water Clearance Information¹

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Ex. #	Structure # & Location	100 Year FEMA Flood Elevation (feet)	Water Acreage (acres)	Phase Wire Water Clearance Required (feet)	Minimum Water Clearance (feet)
A	Swanzey	Ashuelot River	2	#22 – North #23 – South	464	12.1	22.1	22.5
B	Swanzey	Ashuelot River	4	#54 – North #55 - South	466	15.3	22.1	22.3
C	Keene	Ashuelot River	6	#2 – North #3 - South	471	0.6	22.1	33.7

1 - OPGW cable clearance requirements are not shown. Clearance requirements for the OPGW cable to the water surface are always less than the phase wire under these conditions. The OPGW cable is installed well above the phase wires and will never sag within the minimum separation requirements of the phase conductors.

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Attachment E

Phase Wire Land Clearance Information¹

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Ex. #	Structure # & Location	Phase Wire Land Clearance Required (feet)	Minimum Land Clearance (feet)
A	Swanzy	Ashuelot River	2	#22 – North #23 – South	20.1	28.5
B	Swanzy	Ashuelot River	4	#54 – North #55 - South	20.1	31.2
C	Keene	Ashuelot River	6	#2 – North #3 – South	20.1	37.0

1 - OPGW cable clearance requirements are not shown. Clearance requirements for the OPGW cable to the land surface are always less than the phase wire under these conditions. The OPGW cable is installed well above the phase wires and will never sag within the minimum separation requirements of the phase conductors.

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Attachment F

Minimum Clearance Between Phase Conductors and OPGW Cable or Static Wire

Current Petition Appendix #	Town	Water Body	Current Petition Plan & Profile Ex. #	Structure # & Location	Minimum Clearance Required (feet)	Vertical Clearance (feet)	Horizontal Clearance (feet)
A	Swanzey	Ashuelot River	2	#22 – North #23 – South	4.8	11.0	7.0
B	Swanzey	Ashuelot River	4	#54 – North #55 - South	4.8	12.6	6.0
C ¹	Keene	Ashuelot River	6	#2 – North #3 - South	4.8	8.2	7.0

1 – This crossing has both the OPGW communications cable and the Alumoweld static wire above the phase conductors. The minimum distance to either is shown here.