

TABLE 1
Crossing Licenses for Proposed 3124 Line

Public Land	NHPUC Order Number	NHPUC Docket Number	Address	Tax Map	Lot No.	Pole Structures	Current Petition Appendix
State of New Hampshire; Department of Public Works & Highways	Not Previously Licensed		106 Rear Hovey Road, Londonderry	13	14	277-278	A
State of New Hampshire; Department of Public Works & Highways	Not Previously Licensed		71 Rockingham Road, Londonderry	13	57	278-279	A
New Hampshire Department of Transportation	Not Previously Licensed		Railroad Rockingham Road, Londonderry	13	143	285-286	B

TABLE 2
Summary of Clearances at Crossings

Location	Structure - West	Height (ft)	Structure - East	Height (ft)	Span (ft)	Clearance at 285 °F (ft)
1	#277 – SEA - HF	115	#278 – SEA - HF	115	548	54
2	#278 – SEA - HF	115	#279 – SEA - HF	105	458	56
3	#285 – SEA - HF	105	#286 – SED - 2	90	719	39.9

APPENDIX A

3124 Line Spans 277-278 and 278-279 – I-93 Crossing Londonderry, NH

1. The design and proposed construction location of the structures regarding this crossing are shown on the attached PSNH Transmission Business Drawing, Exhibit 2.
2. The 3124 Line will cross the public land adjacent to Interstate 93 on 2-pole, direct embed steel tangent horizontally configured h-frame type structures. Briefly described, Structures 277 and 278 have 115 foot poles with 13.5 feet embedded in the ground (101.5 feet Above Ground Line “AGL”). Structure 279 has 105 foot poles with 12.5 feet embedded in the ground (92.5 feet AGL). The static wires for the 3124 Line are two OPGWs located approximately 24’ above the phase conductors and serve as communication cables for the remote end substations as well as lightening protection for the phase conductors. The phase conductors for the 3124 are 1590 kcmil ACSR conductor, code named “Falcon” by conductor manufacturers. The conductor is suspended from a horizontal crossarm between the two poles, bundled two conductors per each of the three phases. Additional details of these structures are shown in Exhibit 2.
3. Information for the mapping of property, physical features, adjacent transmission lines and ROW boundaries were collected from various sources as detailed below:
 - The property lines are based on information from tax maps.
 - The physical features such as the location of the highway were digitized from geo-referenced aerial imagery of the project area, dated 2012.
 - The adjacent transmission line locations are based on survey information from PSNH dated 2011.

- The existing and future limits of DOT ROW are based on geo-referenced information received from NHDOT in January 2015.
4. Through the design and modeling process a multitude of weather and service conditions were examined to verify that proper NESC and PSNH required clearances will be maintained. The NESC clearance verifications, combined with PSNH standard conductor and shield wire clearance and spacing requirements, ensure minimum clearances will be maintained under all service conditions. The applicable clearances mandated by the NESC and internal PSNH standards are identified and summarized below:

Required Vertical Clearances for 345 kV Phase Conductors

Vertical Clearance Type	NESC Minimum Design Clearance (ft)	PSNH Standard Design Clearance (ft)
Ground - Pedestrian-Access Only	20.7	24
Ground - Vehicle/Horse Accessible	24.7	29
Roadway	24.7	48*

* Additional clearance for roadway crossings is driven by clearance to existing or future distribution lines along the roadway.

Required Horizontal Clearances for 345 kV Phase Conductors

Horizontal Clearance Type	NESC Minimum Design Clearance (ft)	PSNH Standard Design Clearance (ft)
Phase-to-Phase (on same circuit)	11.2	26*
Phase-to-Structure (on same circuit)	7.8**	8.1**
Phase-to-Phase (on adj. circuit)	11.2	17
Phase-to-Structure (on adj. circuit)	8.2**	12**

* Based on the H-Frame structure type being used for this line

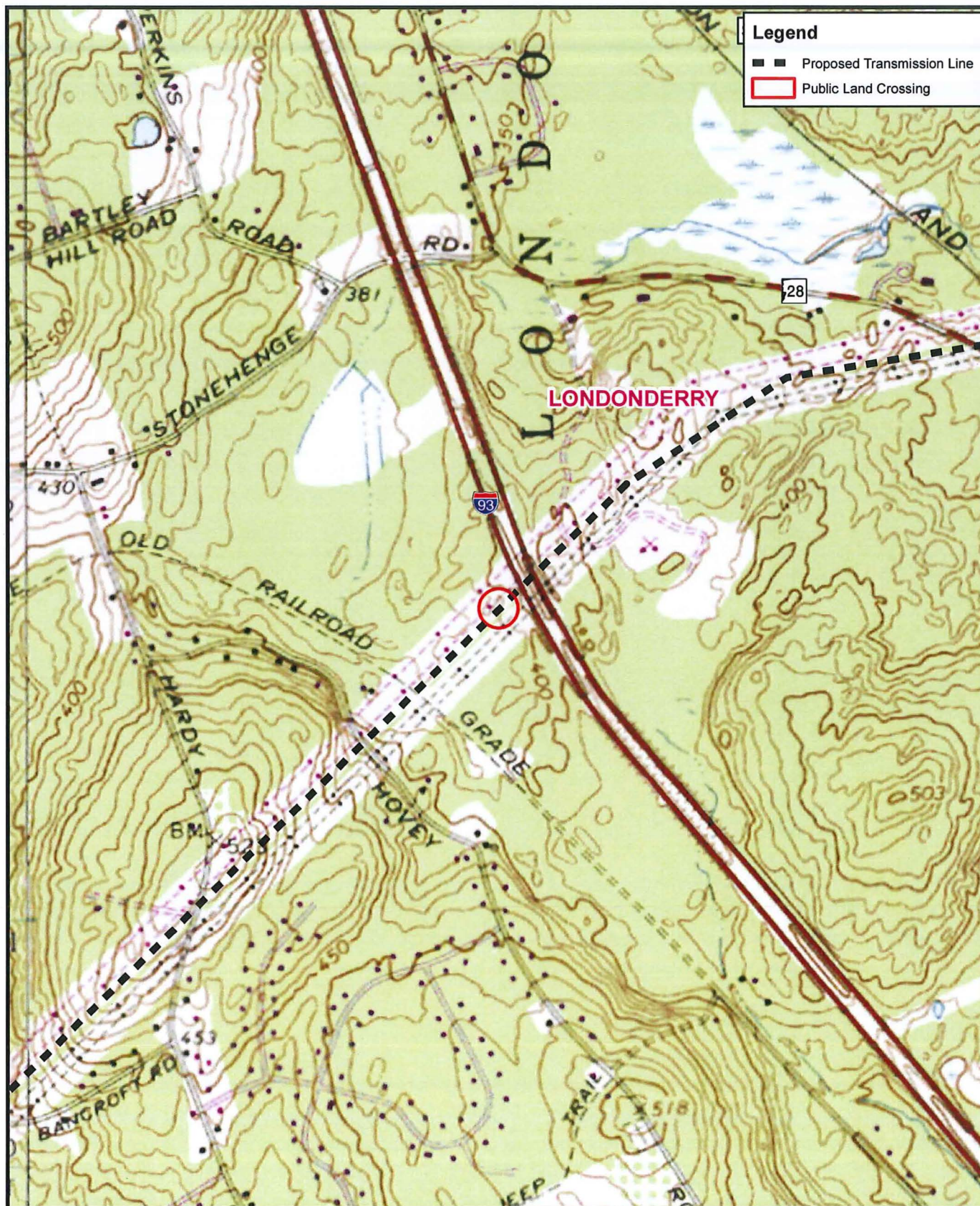
** Clearance may be reduced by 25% if insulated guy rods are used

Required Vertical Clearances for OPGW (0 kV)

OPGW Weather Case	345 kV Conductor Weather Case	NESC Minimum Design Clearance (ft)	PSNH Standard Design Clearance (ft)
Any weather case	Same as OPGW	8.5	13
30 Deg F, 0.5" Ice	30 Deg F, 0" Ice	N/A	8
30 Deg F, 1.0" Ice	30 Deg F, 0" Ice	N/A	5

Note: The OPGW is located above the 345 kV conductors in all locations; therefore the OPGW to conductor clearance will control in all cases rather than OPGW to ground or other objects.

5. The sags and clearances to the requirements above have been met or exceeded as follows:
- 345 kV Phase Conductors Vertical Clearance - The 285°F weather condition for the maximum operating temperature of the phase conductors produces the greatest sag in the phase wires and therefore the minimum clearance to the ground. As noted in paragraphs 10 and 14 of the Petition and Table 2, the phase conductors between Structures 277 and 278 as well as Structures 278 and 279 have been designed to have a minimum above ground clearance of 54 feet and 56 feet respectively under the 285°F weather case. These clearances exceed the vertical clearance requirements for 345 kV phase conductors over roadways and ground accessible by vehicles stated above.
 - 345 kV Phase Conductors Horizontal Clearance – PSNH standard centerline spacing is based upon the geometric configuration of the structures along a line assuming a maximum 1000 foot span length under a 6 pounds per square foot (“psf”) sustained transverse wind. The 3124 Line is spaced apart from adjacent lines as specified by PSNH standard and no span along the PSNH portion of the 3124 Line exceeds a 1000 foot length. Furthermore, a span by span verification was completed assuming a 9psf sustained transverse wind to ensure the horizontal clearances above were exceeded.
 - 0 kV OPGW Vertical Clearance – The design tension of the OPGW cable along the 3124 Line was selected such that the OPGW sags less than the twin-bundled 1590 ACSR “Falcon” conductor. Per PSNH standard, span by span verifications were also completed assuming the specified weather conditions above to ensure the required vertical clearance was maintained. The particular tensioning of the cables and follow-up verifications listed above ensure the required vertical clearances were exceeded.



Scale:
 1:12,000
 1 inch = 1,000 feet

MERRIMACK VALLEY RELIABILITY PROJECT

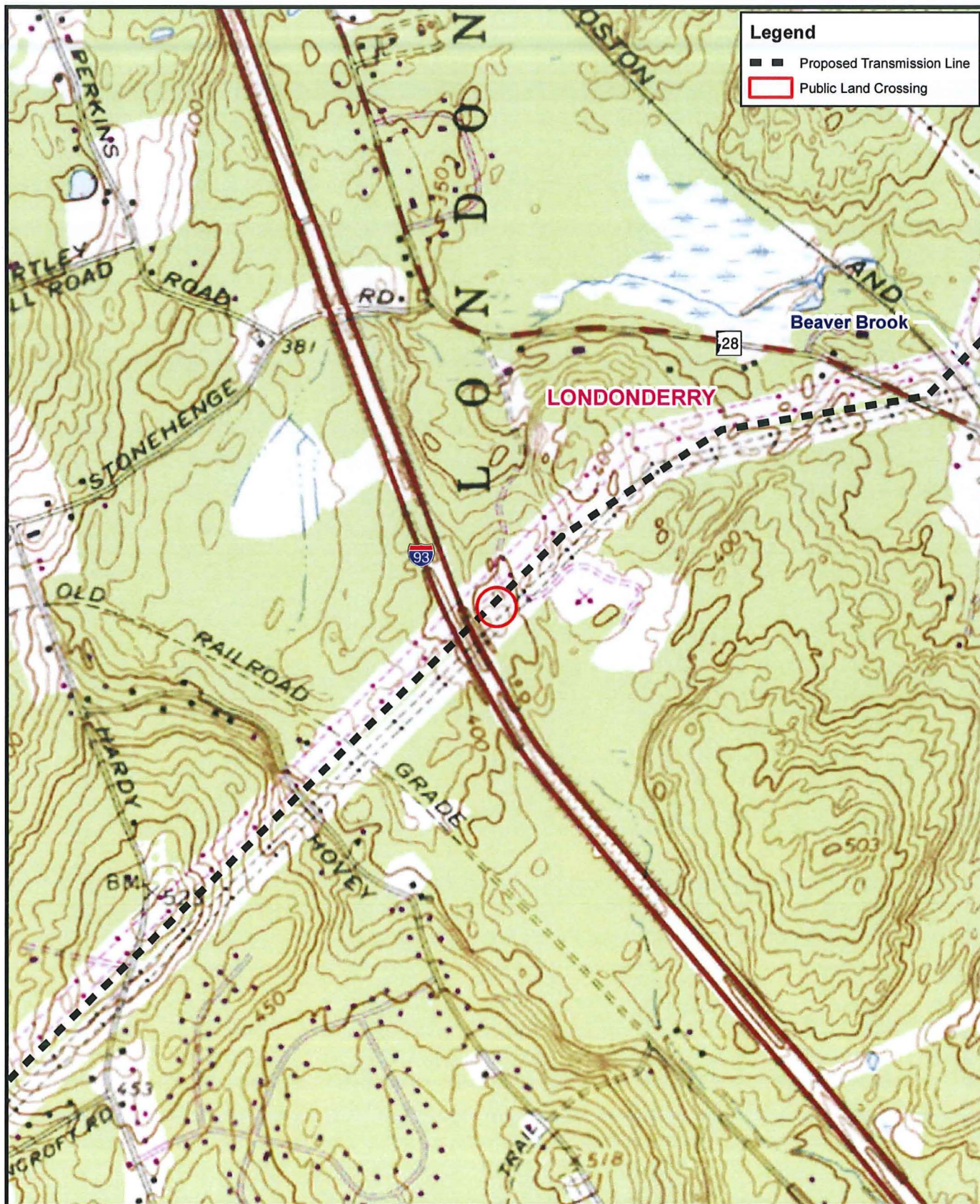
Exhibit 1- Location Plan
 Merrimack Valley Reliability Project 3124 Line (345 KV)
 Public Land Crossings
 Londonderry, New Hampshire

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SCALE N.T.S.	FILE: S3124-P0007 SH.1.DWG	DRAWING NO. S3124-P0007 SH.1
	IMAGE: .	





Scale:
 1:12,000
 1 inch = 1,000 feet

MERRIMACK VALLEY RELIABILITY PROJECT

Exhibit 3- Location Plan
 Merrimack Valley Reliability Project 3124 Line (345 KV)
 Public Land Crossings
 Londonderry, New Hampshire

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APPENDIX B

3124 Line Span 285-286 – Granite State Rail Trail Crossing Londonderry, NH

1. The design and proposed construction location of the structures regarding this crossing are shown on the attached PSNH Transmission Business Drawing, Exhibit 5.
2. The 3124 Line will cross the public land over the Granite State Rail Trail using one 2-pole structure (Str 285) and one 3-pole structure (Str 286). Both structures will be direct embed steel horizontally configured h-frame type structures. Briefly described, Structure 285 has two 105 foot poles with 12.5 feet embedded in the ground (92.5 feet Above Ground Line “AGL”). Structure 286 has three 90 foot poles with 11.0 feet embedded in the ground (79 feet AGL). The static wires for the 3124 Line are two OPGWs located approximately 24’ above the phase conductors and serve as communication cables for the remote end substations as well as lightening protection for the phase conductors. The phase conductors for the 3124 are 1590 kcmil ACSR conductor, code named “Falcon” by conductor manufacturers. The conductors are twin-bundled with two conductors per phase. Additional details of these structures are shown in Exhibit 5.
3. Information for the mapping of property, physical features, adjacent transmission lines and ROW boundaries were collected from various sources as detailed below:
 - The property lines and boundaries of the Granite State Rail Trail are based on information from tax maps.
 - The physical features such as the location of Rockingham Rd (Route 28) were digitized from geo-referenced aerial imagery of the project area, dated 2012.

- The adjacent transmission line locations are based on survey information from PSNH dated 2011.
4. Through the design and modeling process a multitude of weather and service conditions were examined to verify that proper NESC and PSNH required clearances will be maintained. The NESC clearance verifications, combined with PSNH standard conductor and shield wire clearance and spacing requirements, ensure minimum clearances will be maintained under all service conditions. The applicable clearances mandated by the NESC and internal PSNH standards are identified and summarized below:

Required Vertical Clearances for 345 kV Phase Conductors

Vertical Clearance Type	NESC Minimum Design Clearance (ft)	PSNH Standard Design Clearance (ft)
Ground - Pedestrian-Access Only	20.7	24
Ground - Vehicle/Horse Accessible	24.7	29
Railroad	32.7	37

Required Horizontal Clearances for 345 kV Phase Conductors

Horizontal Clearance Type	NESC Minimum Design Clearance (ft)	PSNH Standard Design Clearance (ft)
Phase-to-Phase (on same circuit)	11.2	26*
Phase-to-Structure (on same circuit)	7.8**	8.1**
Phase-to-Phase (on adj. circuit)	11.2	17
Phase-to-Structure (on adj. circuit)	8.2**	12**

* Based on the H-Frame structure type being used for this line

** Clearance may be reduced by 25% if insulated guy rods are used

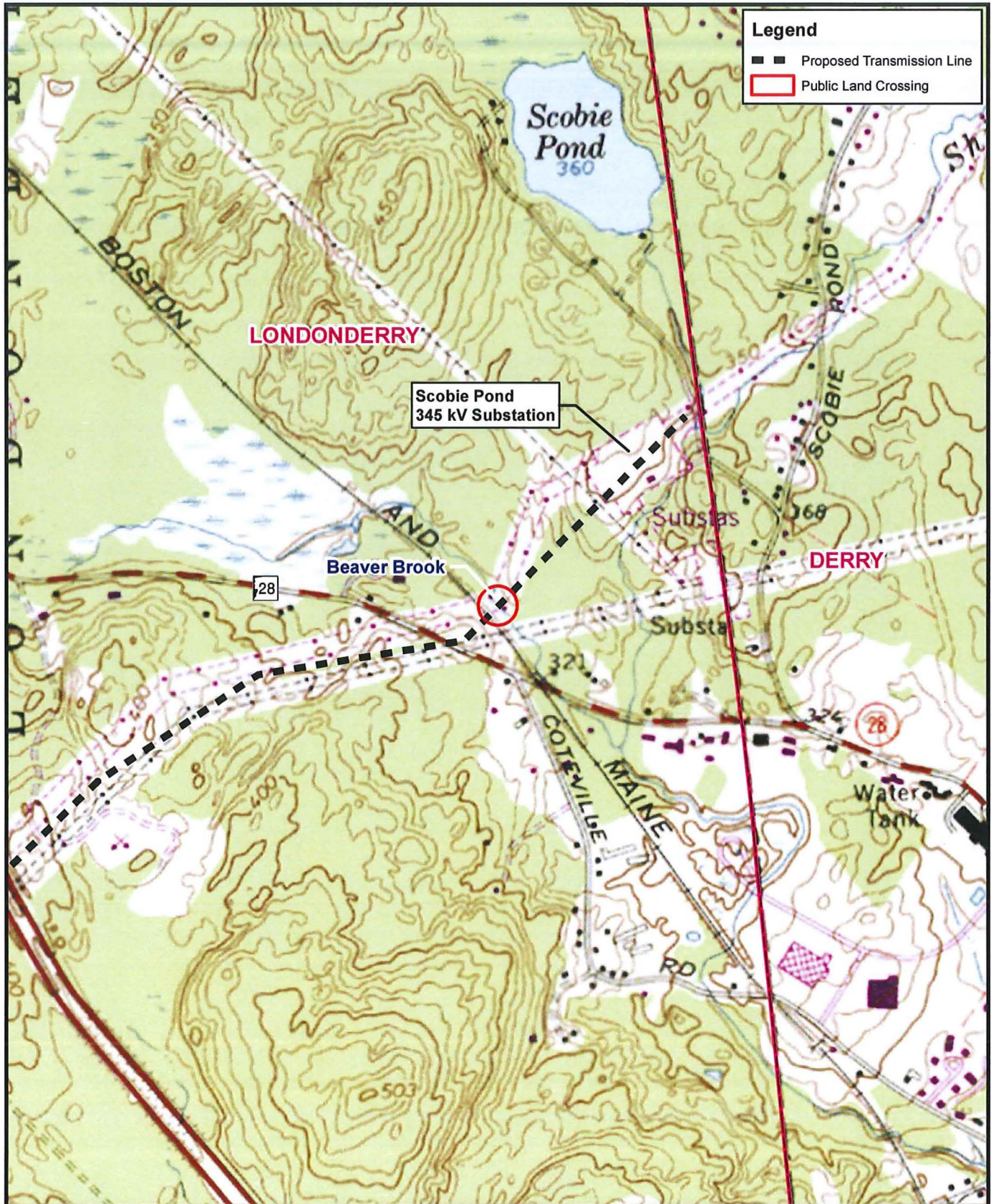
Required Vertical Clearances for OPGW (0 kV)

OPGW Weather Case	345 kV Conductor Weather Case	NESC Minimum Design Clearance (ft)	PSNH Standard Design Clearance (ft)
Any weather case	Same as OPGW	8.5	13
30 Deg F, 0.5" Ice	30 Deg F, 0" Ice	N/A	8
30 Deg F, 1.0" Ice	30 Deg F, 0" Ice	N/A	5

Note: The OPGW is located above the 345 kV conductors in all locations; therefore the OPGW to conductor clearance will control in all cases rather than OPGW to ground or other objects.

5. The sags and clearances to the requirements above have been met or exceeded as follows:

- 345 kV Phase Conductors Vertical Clearance - The 285°F weather condition for the maximum operating temperature of the phase conductors produces the greatest sag in the phase wires and therefore the minimum clearance to the ground. As noted in paragraph 17 of the Petition and Table 2, the phase conductors between Structures 285 and 286 have been designed to have a minimum above ground clearance of 39.9 feet under the weather case for the 285°F condition maximum operating temperature, which exceeds the vertical clearance requirements for 345 kV phase conductors summarized above.
- 345 kV Phase Conductors Horizontal Clearance – PSNH standard centerline spacing is based upon the geometric configuration of the structures along a line assuming a maximum 1000 foot span length under a 6psf sustained transverse wind. The 3124 Line is spaced apart from adjacent lines as specified by PSNH standard and no span along the PSNH portion of the 3124 Line exceeds a 1000 foot length. Furthermore a span by span verification was completed assuming a 9psf sustained transverse wind to ensure the horizontal clearances above were exceeded.
- 0 kV OPGW Vertical Clearance – The design tension of the OPGW cable and conductor along the 3124 Line was selected such that the OPGW sags less than the twin-bundled 1590 ACSR “Falcon” conductor. Per PSNH standard, follow-up span by span verifications were also completed assuming the specified weather conditions above to ensure the required vertical clearance was maintained. The particular tensioning of the cables and follow-up verifications listed above ensure the required vertical clearances were exceeded.

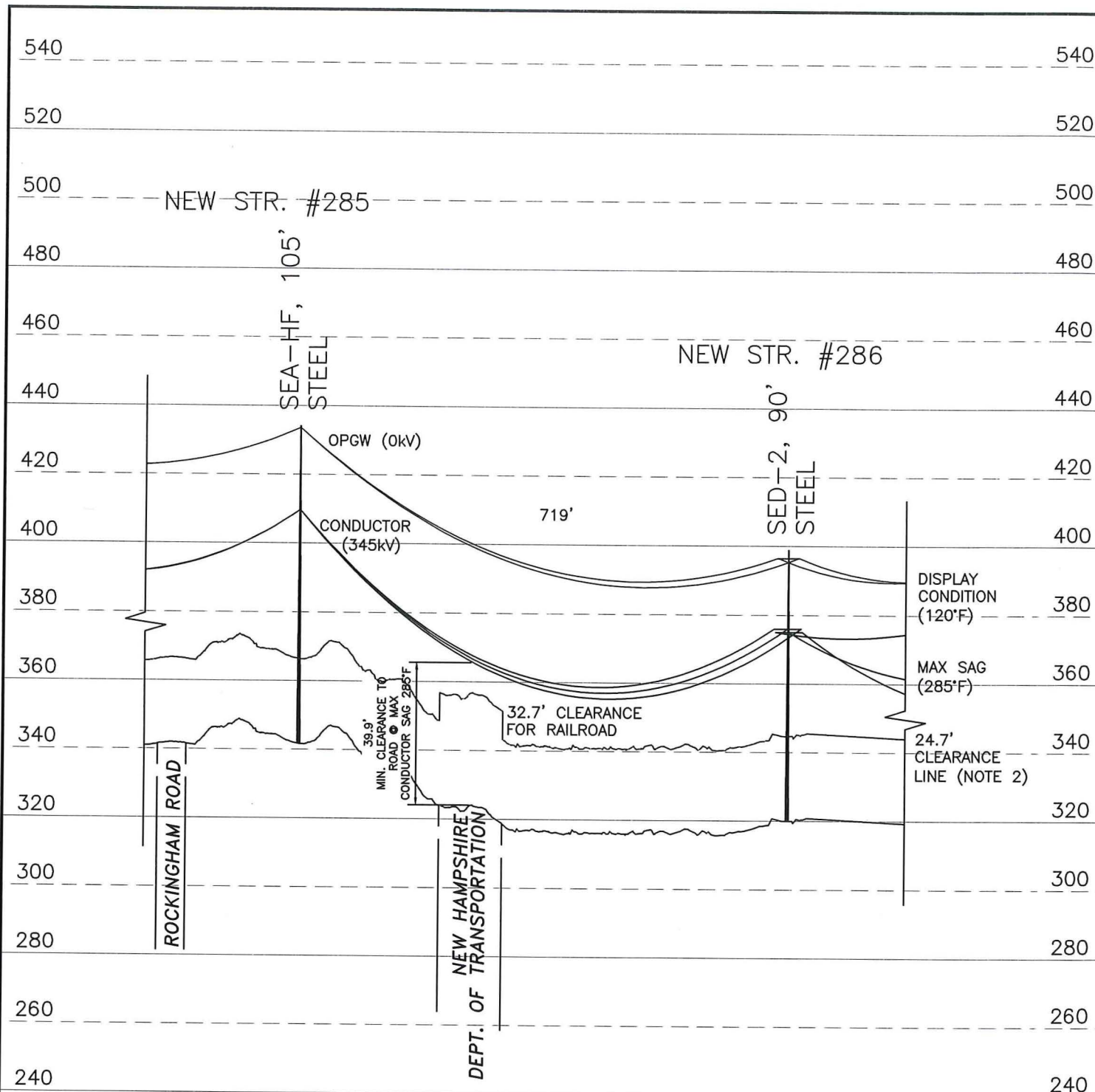


Scale:
1:12,000
1 inch = 1,000 feet

MERRIMACK VALLEY RELIABILITY PROJECT

Exhibit 4- Location Plan
Merrimack Valley Reliability Project 3124 Line (345 KV)
Public Land Crossings
Londonderry, New Hampshire

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- NOTES:
1. VERTICAL DATUM IS NAVD88 IN FEET.
 2. NESC MINIMUM RAILROAD CLEARANCE FOR 345 kV CONDUCTORS IS 32.7'.
NESC MINIMUM GROUND CLEARANCE OF VEHICLE ACCESSIBLE AREA FOR 345 kV CONDUCTORS IS 24.7'.
EVERSOURCE STANDARD DESIGN GROUND CLEARANCE FOR 345 kV CONDUCTORS IS 29'.
EVERSOURCE STANDARD DESIGN RAILROAD CLEARANCE FOR 345 kV CONDUCTORS IS 37'.

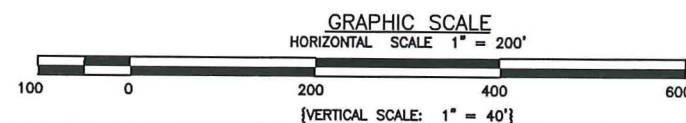
STRUCTURE LOCATION:

STR. #285 - LAT.= 42°54'03.943"N
LONG.= 71°20'49.215"W

STR. #286 - LAT.= 42°54'05.571"N
LONG.= 71°20'39.813"W

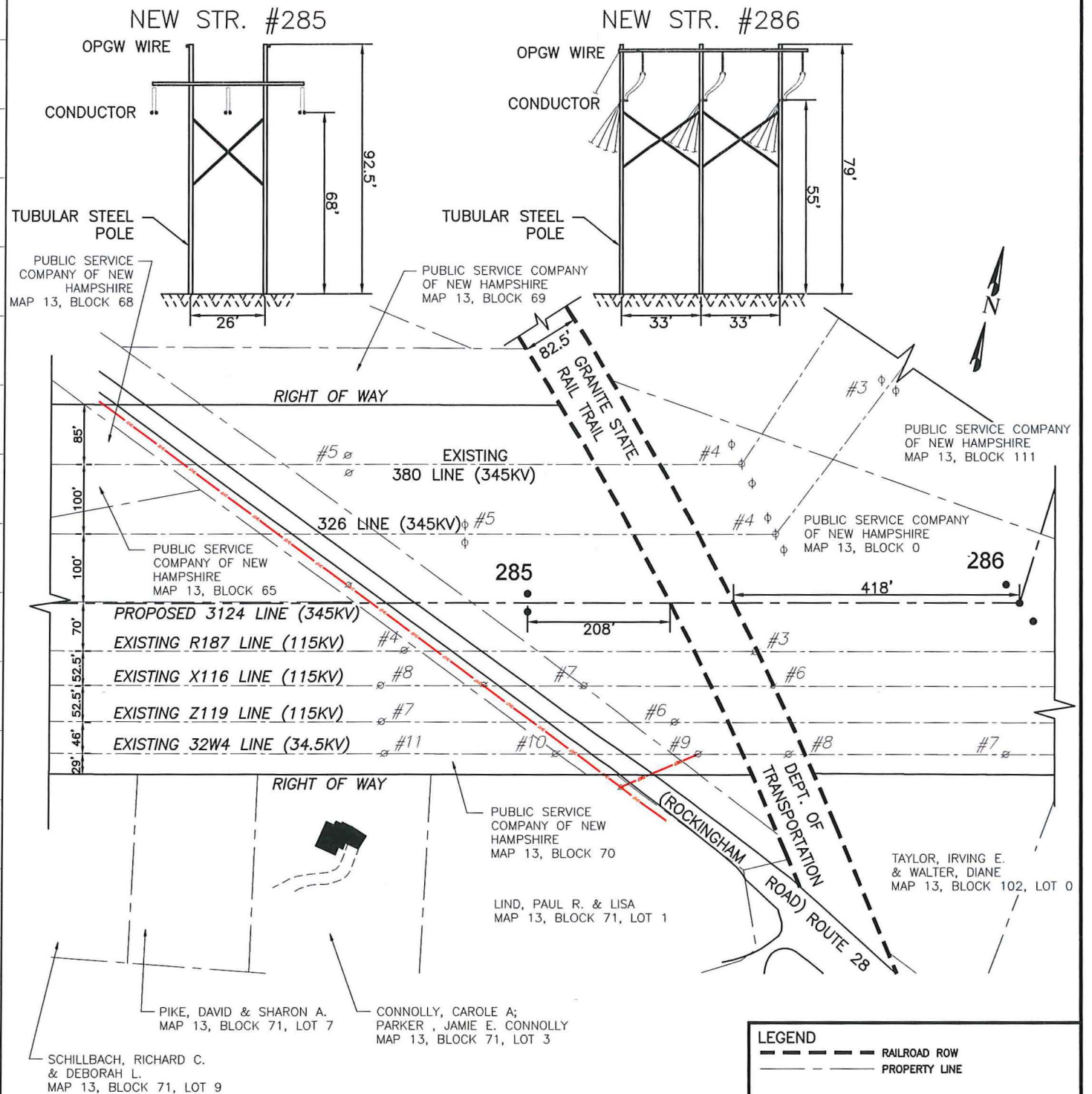
CABLE SCHEDULE:

WIRE	# OF CABLES	TYPE	DIA. (IN.)	WEIGHT/ 1000 FT	CABLE STRENGTH (LBS.)
NEW OPGW	2	BRUGG 48 FIBERS	0.650	407	17,618
NEW CONDUCTOR	6	1590 KCM 54/19 ACSR	1.545	2042.1	54,500



TRC 249 WESTERN AVENUE
AUGUSTA, ME 04330
PROJECT NO: 223027

TOWN OF LONDONDERRY



LEGEND
--- RAILROAD ROW
--- PROPERTY LINE

CONTRACT SERVICES	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	ISSUED FOR LICENSING		8/15/15	JUD	CRP	GEL
B	RE-ISSUED FOR REVIEW		5/7/15	RDW	CRP	GEL
A	ISSUED FOR REVIEW		3/8/15	JUD	CRP	GEL
REV						

EVERSOURCE ENERGY

LINE 3124 345kV TRANSMISSION
NHDOT CROSSING LICENSE DRAWING
EXHIBIT 5
MERRIMACK VALLEY RELIABILITY PROJECT

SCALE: N.T.S. FILE: S3124-P0007 SH.7.DWG
DATE: 11/21/14 DRAWING NO: S3124-P0007 SH.7