Pre-filed Direct Testimony of
Robert E. Carberry

COMMONWEALTH OF MASSACHUSETTS
ENERGY FACILITIES SITING BOARD

Western Massachusetts Electric Company	)	**EFSB 08-2/D.P.U. 08-105/D.P.U. 08-106**

PRE-FILED DIRECT TESTIMONY OF ROBERT E. CARBERRY

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

A. My name is Robert E. Carberry. I am the Project Manager, NEEWS Siting and Permitting for Northeast Utilities Service Company ("NUSCO") in Berlin, Connecticut. My business address is Northeast Utilities Service Company, P.O. Box 270, Hartford, Connecticut 06141-0270. NEEWS is the acronym which represents the New England East-West Solution, a group of four transmission projects in southern New England being planned cooperatively by ISO-NE, Northeast Utilities and National Grid. In my capacity as NEEWS Siting and Permitting Project Manager, I manage and supervise the processes for obtaining siting approvals and other permits and licenses required to be obtained by the Operating Subsidiaries of Northeast Utilities ("NU"), The Connecticut Light & Power Company ("CL&P") and Western Massachusetts Electric Company ("WMECO"), for the parts of the NEEWS projects to be constructed by CL&P and WMECO. In addition, my siting and permitting responsibilities extend beyond the NEEWS projects to other Connecticut and Massachusetts projects, both related and unrelated to NEEWS, that are currently being planned by those Operating Subsidiaries.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of Western Massachusetts Electric Company in this proceeding.

Q. Please summarize your professional and educational background.

A. I have been a professional electric power engineer for 36 years in the electric utility industry, including the last 35 years for NUSCO. After receiving my undergraduate and graduate degrees, I started my career at Bechtel Associates Professional Corp., doing load flow and voltage studies and other electrical design work on the Midland Station Nuclear Project. I joined NUSCO in 1974 and over the next ten years, I performed a large variety of transmission line engineering tasks which are described in more detail in my resume (attached hereto as Exhibit WMECO-REC-2). For the next 8 years, I concentrated on substation engineering and held manager positions for substation engineering and design during most of this time. I next held manager positions until 2001 in the areas of transmission line and civil engineering and transmission and distribution asset strategy. In 2001, I took on the task of Project Manager and then, Project Director, for CL&P's Bethel to Norwalk Transmission Project. In October 2004, I became Manager of Transmission Siting and Permitting and in February, 2008, Project Manager for NEEWS Siting and Permitting.

Since 1975, I have served as the Northeast Utilities' resident engineering expert on power-frequency electric and magnetic fields ("EMF"). Since 1990, I have led the NU EMF Task Force, and also served on the Edison Electric Institute ("EEI") EMF Task Force, although both task forces have been less active in the last ten years. Over the course of my career, I have been a member of, or advisor to, a number of industry committees, subcommittees and working groups associated with the EEI, the Institute of Electrical and Electronics Engineers ("IEEE"), and the Electric Power Research Institute ("EPRI"). My resume provides further details on these professional activities, as well as other professional experience and recognitions.

I am a Registered Professional Engineer in the states of Connecticut and Massachusetts. I received a Bachelor of Science, and a Master of Science, in Electric Power Engineering from Rensselaer Polytechnic Institute, Troy, New York, in 1972 and 1973, respectively.

Q. Please identify any regulatory proceedings in which you have testified.

A. As a part of my siting responsibilities, I have testified on various occasions in dockets before the Connecticut Department of Public Utility Control and the Connecticut Siting Council.

Q. What is your involvement and responsibility with respect to WMECO's proposed Greater Springfield Reliability Project ("Project")?

A. I have general responsibility for overseeing and assisting the Project Manager, Mr. Fortier, in developing and implementing the siting and permitting plan for the Project. As an additional part of my overall siting responsibilities, I jointly supervised the preparation of certain portions of the Petition filed by WMECO with the Board on October 27, 2008.

Q. For what portions of WMECO's EFSB Petition are you responsible?

A. Along with Allen W. Scarfone, I am responsible for Section 3 of the Petition for Approval to Construct 345-kV Transmission Lines, Re-Build 115-kV Transmission Lines, and Build and Upgrade Ancillary Facilities (the "EFSB Petition"), Project Alternatives (except for subsections on Costs and Environmental/Social Comparisons for which other witnesses will be responsible). Along with Dr. Bailey, whose testimony is Exhibit WMECO-WHB-1, I am also responsible for Section 5.3.10, Electric and Magnetic Fields, where the electric field strengths and the magnetic field levels for the proposed "all-overhead" Project were analyzed for the Preferred Northern and the Noticed-Alternative Southern Routes and for the discussions of magnetic fields in Section 7 of the EFSB Petition, where the alternative 115-kV underground lines are analyzed. The presentations in Section 7 set forth (i) the magnetic fields conservatively1 expected to result on the overhead corridor after certain of the planned overhead 115-kV lines are removed from the corridor on each of the specified eight corridor sections on the Northern Route from the Ludlow Substation to the Connecticut border, as well as from the "spur" from East Springfield Junction to the Fairmont Switching Station and (ii) the magnetic fields expected to result above ground after some sections of the previously

[1] It is assumed that all four NEEWS projects are built, that the Connecticut import is set at the maximum Connecticut import capability, and that measurements are taken at the midspan low point.

overhead 115-kV lines are placed underground along the shortest 115-kV underground routes identified in Section 6 of the EFSB Petition for each of the nine sections in question.

Q. For what information responses of WMECO in this proceeding are you responsible?

A. I am responsible for various information requests in this proceeding which cover the same topics, all of which are listed with my name, alone or with another, as the responsible witness.

Q. Were the materials referenced above prepared by you or under your supervision and control?

A. The materials above for which I am responsible were prepared by me or by others under my supervision.

Q. What is the purpose of this pre-filed testimony?

A. I have prepared this pre-filed testimony to improve the calculations of the estimated magnetic field levels presented in Section 7 of the EFSB Petition.

Q. Please explain how you have improved these magnetic field level calculations?

A. There are two basic improvements. The first improvement is a re-assessment of the current expected on the overhead 345-kV lines at Annual Peak Load (APL). The prior current as set forth in Table 7-3A of the Petition is 1,768 amps. This power flow has been re-assessed and is now modeled to be 1,658 amps. Please note in this regard that this re-assessment had already been applied to the calculations for the proposed "all-overhead" Project in Section 5 of the Petition. The lower revised current applies from the Ludlow Substation to the Agawam Substation. The decrease results from a change in the assumed peak-load dispatch of two plants, the Lake Road generator located in northeast Connecticut (modeled as 900 MW) and the RISE unit 3 generator (196 MW) located in Rhode Island. Previously, both were assumed to be dispatched "off-line" at the time of peak load in the year 2017 (when all of the NEEWS projects were completed and the Connecticut Import Limit had been increased to 3,600 MW). Now, under these conditions, the better assumption is that the Lake

Road plant will be dispatched on line, resulting in the modest decease in the power flows on the new GSRP 345-kV circuit to Agawam Substation. The lower current from Ludlow to the Agawam Substation results in a correspondingly lower power flow on the 345-kV circuit from the Agawam Substation to the North Bloomfield Substation. That lower flow is 1,492 amps, which applies to both section 2 on the corridor (from Agawam Substation to the South Agawam Junction) and on section 1 (from South Agawam Junction to the Connecticut border).

The second improvement enhances the method used to estimate the power flows on the circuits placed underground, as well as the related power flows on the 115-kV circuits which remained overhead. Previously, the method started with the 115-kV power flows which had been modeled when all of the circuits were assumed to be overhead for the proposed Project. The modeled "all-overhead" power flows were used to approximate the currents flowing on the 115-kV circuit(s) placed underground and on the remaining overhead circuit(s). Due to the lower impedances on the cable circuits, the underground flows were simply increased by 10% from the modeled "overhead" values for the same circuits. The remaining overhead circuit flows were simply decreased by 10% from the the modeled "overhead" values for the same circuits. This simple method was a first order approximation of how the flows would actually change on each section to reflect the change in impedances. Now, actual impedances for the shortest underground alternative route were first calculated for each section based on the route length and the planned underground cable configuration. The calculated impedances on the underground circuits were then used, along with the overhead line impedances, to model the resulting power flows on both the underground cable(s) and the remaining 115-kV overhead line(s) for each section. In short, the resulting underground and the overhead 115-kV power flows are now modeled numbers, rather than simple plus or minus approximations.

Q. How did the calculated power flows differ from the simple plus or minus 10% assumptions used as an approximation?

A. In some cases, the calculated currents and the approximated currents differed significantly. This fact proved the value of moving away from the simple approximation. See: Exhibit WMECO-REC-3 attached hereto where, in the last column, the calculated currents at APL are compared, side-by-side, to the plus and minus 10% currents for each of the overhead and underground circuit sections.

Q. What was done to Section 7 of the Petition with the improved current calculations?

A. The first change to Section 7 was to use the improved current calculations for the 345-kV circuits to recalculate Tables 7-3A and 7-3B. For Table 7-3A, the magnetic fields are calculated for the improved 345-kV currents and for a range of possible current values on the overhead companion 115-kV circuit. For Table 7-3B, the magnetic fields are calculated for the improved 345-kV current and there is no companion overhead 115-kV circuit. For Table 7-4 in the EFSB Petition, the improved underground 115-kV currents were used to re-calculate the magnetic field levels above ground for each of the different sections along the corridor from Ludlow to the Connecticut border. See: Exhibit WMECO-REC-4 attached hereto, where Tables 7-3A Revised, 7-3B Revised and 7-4 Revised are set forth.

Q. Please explain how the table revisions were done?

A. For the overhead 345/115-kV circuits sharing the common structures on the Northern corridor, the previously modeled magnetic field levels in Tables 7-3A were modeled again based on the revised currents on the 345-kV circuit and on a range of 115-kV circuit currents to produce the field levels shown in Table 7-3A Revised. For Table 7-3B, the previously modeled magnetic fields on the 345-kV circuit were changed more simply, by applying the ratio of the revised to the previous currents on the 345-kV circuit to each of the modeled levels in Table 7-3B to get the corrected levels in Table 7-3B Revised. Without the presence of a companion 115-kV circuit on the overhead structures in Section 1, the magnetic fields from the single source of the 345-kV circuit could be determined by proportionally adjusting the modeled fields by the current ratio.

Other changes were made in preparing Tables 7-3A Revised and 7-3B Revised, and certain observations on these two tables apply, as follows: (i) in Table 7-3A Revised, two new rows for section 2 were added at the bottom of the table and the lower current on the 345-kV circuit south of Agawam Substation (1,492 amps) was used in these two rows to calculate the magnetic field levels at the specified distances from the centerline for the combined effects of the 345-kV current and each of the possible power flows on the remaining overhead 115-kV circuit identified in each of the two rows2; (ii) the top eight (8) rows of Table 7-3A Revised apply to each of the corridor sections 3 through 5 and 7 through 9; and, for each of these six (6) sections, the modeled magnetic field levels were changed to reflect the combined effects of the revised power flow (1,658 amps) on the 345-kV circuit and of each of the eight (8) modeled power flows on the remaining overhead 115-kV circuits at the specified distances from the centerline; and (iii) Table 7-3B Revised applies only to section 1 where no overhead 115-kV circuit remains on the overhead line corridor; and in this table, the lower current on the 345-kV circuit south of Agawam Substation (1,492 amps) was used to adjust proportionately the previously modeled magnetic field levels at the specified distances from the centerline.

Please note that no row in either of the overhead line tables, Tables 7-3A Revised and 7-3B Revised, applies to section 6 since this section (on the "spur" from East Springfield Junction to the Fairmont Switching Station) has no 345-kV circuit, and the magnetic field from the power flows on the remaining two overhead 115-kV circuits were modeled directly based on the calculated currents given in Exhibit WMECO-REC-3. Also note that the magnetic field levels calculated for the overhead circuits in Tables 7-3A Revised assume, as was the case with the previous modeling, that the 345- and 115-kV circuits sharing the common structures are best phased for the current directions. In sections 3 through 5 and 7 through 9, this means that reverse phasing would be used for the same direction currents on the two circuits. For section 2, that means same phasing for the reverse direction currents on the two circuits.

[2] A two-value range of possible currents on the 115-kV circuit remaining overhead on the common structures for Section 2 (from Agawam Substation to South Agawam Switching Station) was chosen based on the 115-kV current flows expected south of Agawam Substation.

Finally, Table 7-4 Revised was created by re-doing the modeling of the underground circuits to calculate anew the magnetic field levels expected to be produced by the revised underground currents given in Exhibit WMECO-REC-3.

Q. Have the revised tables and the new calculations of magnetic field levels been used to update the magnetic field presentation in each of the nine (9) sections in Section 7 of the EFSB Petition?

A. Yes. Please see attached Exhibit WMECO-REC-5 where for each of the nine sections, the subsection in Section 7 of the Petition where the magnetic field levels are discussed is revised to show the results of the new calculations. In this regard, Exhibit WMECO-REC-5 sets forth revised tables showing magnetic field levels on the overhead line right-of-way and also contains a revised sentence summarizing the field levels above the underground routes. In the revised tables addressing the overhead circuits in each of the nine (9) sections, i.e., in Tables 7-6, 7-11, 7-16, 7-21, 7-26, 7-31, 7-37, 7-42, and 7-47, a new row has been added and highlighted in "yellow" to show how the newly calculated magnetic field levels at the edge of the corridor compare with the prior range of field levels which were based on the first order approximation of 115-kV currents. In the revised sentence, the newly calculated values in Table 7-4 Revised are summarized.

Q. Does this complete your testimony?

A. Yes.

March, 2009

Robert E. Carberry
Manager – Project Manager, NEEWS Siting and Permitting
Northeast Utilities Service Company
Hartford, Connecticut

Education:

Bachelor of Science in Electric Power Engineering, June, 1972, Rensselaer Polytechnic Institute, Troy, NY

Master of Engineering in Electric Power Engineering, June 1973, Rensselaer Polytechnic Institute, NY

Management Development Program, Hartford Graduate Center, 1989

Experience:

June 1973 to March 1974 - Bechtel Associates Professional Corp., electrical design of Midland nuclear plant including load flow and voltage studies.

March 1974 to March 1975 - NUSCO, Protection Engineering Section. Performed relay settings and assisted Transmission Line Engineering.

March 1975 to March 1984 - NUSCO, Transmission Line Engineering. Standards, investigations and studies for permanent and temporary grounding, radio and audible noise, electrical/biological effects of AC fields, special insulation, thermal rating studies and research projects, high phase order, HVDC, compact line design, insulated shield wires, and lightning performance.

March 1984 to April 1985 - NUSCO, Substation Project Engineering. Project conceptual development and management plus associated studies and standards activities.

April 1985 to March 1988 - NUSCO, Substation Project Engineering Manager.

March 1988 to November 1992 - NUSCO, Manager of Substation Engineering and Design.

December 1992 to June 1997 - NUSCO, Manager of Transmission Line and Civil Engineering.

June 1997 to October 2000 - NUSCO, Manager of T&D Asset Strategy.

October 2000 to September 2001 - NUSCo, Manager of Transmission Engineering.

September 2001 to March 2003 - NUSCO, Project Manager – Bethel to Norwalk Transmission Project.

March 2003 to October 2004 - NUSCO, Project Director – Bethel to Norwalk Transmission Project.

October 2004 to January 2008 – NUSCO, Manager – Transmission Siting and Permitting.

February 2008 to Present – NUSCO, Project Manager, NEEWS Siting and Permitting

NU's EMF expert 1975- present and leader of the NU EMF Task Force established in 1990.

Other Experiences:

Adjunct Faculty Member, University of Hartford, College of Engineering, January to May, 1987. Conducted portions of course in Power Systems Analysis.

T&D Emergency plan assignment as First Deputy to the Director, Electric, a liaison position with the CT Office of Emergency Management, 1985 to 2002.

Member of Advisory Committee serving the Connecticut Interagency EMF Task Force, 1991 to present.

Professional Engineering Registration: Connecticut and Massachusetts

Industry and Professional Society Activities/Senior Member, IEEE (1983)

IEEE Power Engineering Society, Transmission and Distribution Committee memberships.

1) Corona and Field Effects (C&FE) Subcommittee, Member 1976 to 1987, Vice Chairman 1983 to 1985.

2) C&FE Working Groups on AC Fields and Audible Noise, 1976 to 1987.

3) Chairman of C&FE Working Group on Design and Environmental Considerations, 1977 to 1985.

4) Secretary and Vice Chairman of Administrative Subcommittee's Coordinating Group on Environment, Safety and Public Affairs, 1981 to 1984.

IEEE Power Engineering Society, Substations Committee memberships

1) Substations Committee, member 1987 to 1995

2) Environmental Subcommittee and Associated Working Groups, member 1985 to 1995.

3) Various Working Groups of the Distribution Substations Subcommittee and the Gas Insulated Substations Subcommittee, member 1985 to 1995.

Edison Electric Institute - Chairman of the Electric Light and Power group delegation to the American National Standards Committee C63 on Electromagnetic Compatibility, 1980 to 1985.

Electric Power Research Institute - Industry advisor on project RP1591, Assessment of AC Transmission Line Field Effects, 1982 to 1984. NU representative on Transmission Line Business Unit Council, October, 1995 to December, 1996, and on EMF/RF Area Council, 2005-present.

International Electrotechnical Commission, CISPR C - Member of an advisory group assisting the Technical Advisor to the U.S. National Committee of the IEC on matters pertaining to interferences from overhead power lines, 1980 to 1988.

Edison Electric Institute - EMF Task Force, 1990 to present: EMF Steering Committee 1995 to 2003.

Professional Recognitions:

IEEE PES Working Group Recognition and/or Prize Paper Awards

- AC Fields Working Group (1992)
- Working Group on Design and Location of Substations for Community Acceptance (1992)
- "A Survey of Methods for Calculating Transmission Line Conductor Surface Voltage Gradients," 1980
- "Corona and Field Effects of AC Overhead Transmission Lines: Information for Decision Makers," 1986

Load Comparison with Modified Circuit Impedances

115-kV OH Circuit/Section	APL Current Modeled in Proposal	APL Current minus 10% for OH circuits	APL Current with UG Circuit Segments
1768/Section 1	189	170.1	186
1781S/Section 2	430	387	307
1781N/Section 2	354	318.6	233
1314/Section 3	102	91.8	59
1314/Section 4	102	91.8	59
1602/Section 5	289	260.1	302
1602 & 1603/Section 6	289 & 162	260.1 & 145.8	302 & 113
1603/Section 7	162	145.8	113
1845/Section 8	153	137.7	145
1845/Section 9	153	137.7	145

* each circuit, except in section 6, shares structures with a 345-kV line

115-kV UG Circuit/Section	APL Current Modeled in Proposal	APL Current plus 10% for UG circuits	APL Current with UG Circuit Segments
1782S/Section 2	477	524.7	605
1782N/Section 2	387	425.7	515
1230/Section 3	176	193.6	86
1601/Section 4	177	194.7	315
1601/Section 5	177	194.7	315
1601 & 1604/Section 6	177 & 1080	194.7 & 1188	315 & 1343
1604 Section 7	1080	1188	1343
1426 & 1481/Section 8	168 & 475	184.8 & 522.5	150 & 442
1481 & 1552/Section 9	475 & 371	522.5 & 408.1	442 & 351

Table 7-3A Revised: Applicable to Sections 2 through 5 and 7 through 9 where an overhead 115-kV circuit shares poles with a 345-kV circuit –

Magnetic Fields (mG) from Overhead Line at Distances from Centerline (feet) of Poles

Current on 345-kV[1]	Current on 115-kV	-100	-90	-80	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70	80	90	100
1658 Amps	100 Amps	19.8	22.4	25.3	28.8	32.8	37.3	42.4	47.9	53.4	58.4	62	63.7	63.1	60.3	55.9	50.8	45.4	40.3	35.6	31.4	27.7
1658 Amps	150 Amps	19.1	21.5	24.4	27.7	31.6	36.1	41.1	46.5	51.9	56.9	60.6	62.3	61.7	59	54.8	49.7	44.5	39.5	34.8	30.7	27.1
1658 Amps	200 Amps	18.3	20.7	23.4	26.7	30.4	34.8	39.7	45.1	50.5	55.4	59.1	60.9	60.4	57.8	53.6	48.7	43.6	38.6	34.1	30	26.5
1658 Amps	250 Amps	17.5	19.8	22.5	25.6	29.3	33.6	38.4	43.7	49.1	54	57.7	59.5	59.1	56.5	52.5	47.7	42.6	37.8	33.3	29.3	25.9
1658 Amps	300 Amps	16.8	19	21.5	24.6	28.2	32.3	37.1	42.3	47.6	52.6	56.3	58.2	57.8	55.3	51.4	46.6	41.7	36.9	32.6	28.7	25.2
1658 Amps	400 Amps	15.3	17.3	19.7	22.5	25.9	29.9	34.5	39.6	44.9	49.8	53.6	55.5	55.2	52.9	49.1	44.6	39.9	35.3	31.1	27.3	24
1658 Amps	500 Amps	13.8	15.6	17.8	20.5	23.7	27.6	32	37	42.2	47.1	50.9	52.9	52.7	50.5	46.9	42.6	38	33.6	29.6	26	22.9
1658 Amps	950 Amps	7.5	8.8	10.5	12.6	15.3	18.6	22.7	27.3	32.2	36.8	40.3	42.3	42.3	40.5	37.5	33.8	30	26.4	23.1	20.1	17.6
1492 Amps[2]	250 Amps[3]	15.4	17.4	19.8	22.5	25.8	29.6	33.9	38.6	43.4	47.9	51.2	52.9	52.5	50.3	46.7	42.4	37.9	33.6	29.6	26.1	23
1492 Amps	300 Amps	14.6	16.6	18.8	21.5	24.7	28.4	32.6	37.2	42	46.5	49.8	51.5	51.2	49	45.6	41.4	37	32.7	28.9	25.4	22.4

Table 7-3B Revised: Applicable to Section 1 where no overhead 115-kV circuit shares poles with a 345-kV circuit –

Magnetic Fields (mG) from Overhead Line at Distances from Centerline (feet) of Conductors

Current on 345-kV	-200	-190	-180	-170	-160	-150	-140	-130	-120	-110	-100	-90	-80	-70	-60	-50	-40	-30	-20	-10	0
1492 Amps	8.50	9.35	10.34	11.49	12.83	14.41	16.27	18.49	21.18	24.44	28.44	33.40	39.63	47.51	57.57	70.46	86.89	107.18	130.21	150.90	159.75

Current on 345-kV	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
1492 Amps	159.75	150.90	130.21	107.18	86.89	70.46	57.57	47.51	39.63	33.40	28.44	24.44	21.18	18.49	16.27	14.41	12.83	11.49	10.34	9.35	8.50

[1] 345-kV circuit is located on the plus distance side of the ROW.
[2] The bottom two rows with 1492 Amps apply only to section 2 of the corridor from Agawam Substation to South Agawam Switching Station.
[3] For section 2, the range of values shown in the last two rows, 250 and 300 Amps, cover the expected range of currents on the overhead circuit remaining on the shared structures.

Table 7-4 Revised: Magnetic Fields (mG) from Underground Cables at Distances from Centerline (feet) of the Duct Bank

Cross-section	-100	-90	-80	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70	80	90	100
Section 1: CT Border to South Agawam Switching Station (XS-4 Alt, 5 Alt, 6 Alt)	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	2.1	9.1	46.5	21.3	9.2	5.4	3.7	2.8	2.2	1.8	1.6	1.4	1.2
Section 2: South Agawam Switching Station to Agawam Substation (XS-7 Alt)	2.7	2.9	3.1	3.4	3.8	4.2	4.5	4.9	6.8	29.8	151.3	69.2	29.8	17.4	12.0	9.0	7.2	6.0	5.1	4.4	3.9
Section 2: South Agawam Switching Station to Agawam Substation (XS-8 Alt, 9 Alt)	2.3	2.5	2.7	2.9	3.2	3.5	3.9	4.2	5.8	25.3	128.8	58.9	25.3	14.8	10.2	7.7	6.1	5.1	4.3	3.8	3.3
Section 3: Agawam Substation to Piper Substation (XS-10 Alt)	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	1.0	4.2	21.5	9.8	4.2	2.5	1.7	1.3	1.0	0.8	0.7	0.6	0.6
Section 4: Piper Substation to Chicopee Substation (XS-11 Alt)	1.4	1.5	1.6	1.8	2.0	2.2	2.4	2.6	3.5	15.5	78.8	36.1	15.5	9.1	6.2	4.7	3.8	3.1	2.7	2.3	2.0
Section 5: Chicopee Substation to East Springfield Junction (XS-12 Alt)	1.4	1.5	1.6	1.8	2.0	2.2	2.4	2.6	3.5	15.5	78.8	36.1	15.5	9.1	6.2	4.7	3.8	3.1	2.7	2.3	2.0
Section 6: East Springfield Junction to Fairmont Switching Station (XS-18 Alt)	0.3	0.3	0.4	0.5	0.7	1.2	2.2	5.1	16.9	83.5	67.4	72.5	14.0	5.2	3.1	2.2	1.6	1.3	1.1	0.9	0.8
Section 7: East Springfield Junction to Shawinigan Switching Station (XS-13 Alt, 14 Alt, 15 Alt)	1.2	1.3	1.5	1.8	2.1	2.6	3.4	5.0	8.9	24.4	71.2	19.3	6.0	3.4	2.5	2.0	1.6	1.4	1.3	1.1	1.0
Section 8: Shawinigan Switching Station to Orchard Junction (XS-16 Alt)	1.0	1.1	1.3	1.4	1.7	2.1	2.7	3.8	6.2	13.5	19.2	11.3	5.5	3.4	2.5	2.0	1.6	1.4	1.2	1.1	1.0
Section 9: Orchard Junction to Ludlow Substation (XS-16 Alt)	0.6	0.7	0.8	0.9	1.1	1.4	1.8	2.7	5.0	13.0	19.7	6.0	2.9	1.9	1.4	1.1	0.9	0.8	0.7	0.6	0.5

Table 7-6 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 1

Cross-Section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-4	Pre Underground	49.4	5.6
XS-4 ALT	Post Underground Original	56.7-69.3	9.0-11.0
	Post Underground Revised	57.6	5.98
XS-5	Pre Underground	49.4	65.7
XS-5 ALT	Post Underground Original	69.3-84.7	69.3-84.7
	Post Underground Revised	70.47	70.47
XS-6	Pre Underground	49.4	65.7
XS-6 ALT	Post Underground Original	69.3-84.7	69.3-84.7
	Post Underground Revised	70.47	70.47

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 1: the maximum level above the centerline was 46.5 mG and levels fell to single digits within 20 feet of the centerline on one side and 20 feet on the other.

Table 7-11 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 2

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-7	Pre Underground	8.3	5.9
XS-7 ALT	Post Underground Original	14.1-17.6	7.2-8.8
	Post Underground Revised	14.6	7.5
XS-8	Pre Underground	24.5	61.8
XS-8 ALT	Post Underground Original	31.5-38.5	35.1-42.9
	Post Underground Revised	32.1	36.1
XS-9	Pre Underground	19.6	62.0
XS-9 ALT	Post Underground Original	17.1-20.9	34.2-41.8
	Post Underground Revised	19.0	36.1

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 2: the maximum level above the centerline was 151.3 mG and levels fell to single digits within 20 feet of the centerline on one side and 50 feet on the other.

Table 7-16 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 3

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-10	Pre Underground	53.2	79.8
XS-10 ALT	Post Underground Original	24.3-29.7	41.4-50.6
	Post Underground Revised	23.0	43.8

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 3: the maximum level above the centerline was 21.5 mG and levels fell to single digits within 10 feet of the centerline on one side and 10 feet on the other.

Table 7-21 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 4

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-11	Pre Underground	37.2	79.7
XS-11 ALT	Post Underground Original	24.3-29.7	41.4-50.6
	Post Underground Revised	23.0	43.8

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 4: the maximum level above the centerline was 78.8 mG and levels fell to single digits within 20 feet of the centerline on one side and 30 feet on the other.

Table 7-26 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 5

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-12	Pre Underground	29.9	72.2
XS-12 ALT	Post Underground Original	19.8	38.7-47.3
	Post Underground Revised	20.3	39.3

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 5: the maximum level above the centerline was 78.8 mG and levels fell to single digits within 20 feet of the centerline on one side and 30 feet on the other.

Table 7-31 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 6

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-18	Pre Underground	12.1	62.9
XS-18 ALT	Post Underground Original	2.7-3.3	1.8-2.2
	Post Underground Revised	5.44	1.91

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 6: the maximum level above the centerline was 67.4 mG and levels fell to single digits within 30 feet of the centerline on one side and 30 feet on the other.

Table 7-37 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 7

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-13	Pre Underground	46.2	71.8
XS-13 ALT	Post Underground Original	36.9-45.1	40.5-49.5
	Post Underground Revised	39.6	42.6
XS-14	Pre Underground	26.9	74.0
XS-14 ALT	Post Underground Original	22.5-27.5	40.5-49.5
	Post Underground Revised	24.6	42.6
XS-15	Pre Underground	72.8	49.7
XS-15 ALT	Post Underground Original	30.6-37.4	61.2-74.8
	Post Underground Revised	31.6	63.98

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 7: the maximum level above the centerline was 71.2 mG and levels fell to single digits within 20 feet of the centerline on one side and 20 feet on the other.

Table 7-42 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 8

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-16	Pre-Underground	70.2	5.6
XS-16 ALT	Post Underground Original	54-64	5-15
	Post Underground Revised	42.1	13.0

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 8: the maximum level above the centerline was 19.2 mG and levels fell to single digits within 20 feet of the centerline on one side and 20 feet on the other.

Table 7-47 Revised: Magnetic Fields on the Overhead Line ROW Before/After Placing the 115-kV Circuit(s) Underground for Section 9

Cross-section	Post-NEEWS (2017 APL)	-ROW edge (mG)	+ROW edge (mG)
XS-17	Pre Underground	61.8	32.4
XS-17 ALT	Post Underground Original	37.8-46.2	20.7-25.3
	Post Underground Revised	39.6	21.6

The following results (shown in greater detail in Table 7-4 Revised) were found for the underground line configurations planned for Section 9: the maximum level above the centerline was 19.7 mG and levels fell to single digits within 20 feet of the centerline on one side and 10 feet on the other.