STATE OF CONNECTICUT

SITING COUNCIL

DOCKET NO. 424 - The Connecticut Light & Power Company application for a Certificate of Environmental Compatibility and Public Need for the Connecticut portion of the Interstate Reliability Project that traverses the municipalities of Lebanon, Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam, Thompson, and Windham, which consists of (a) new overhead 345-kV electric transmission lines and associated facilities extending between CL&P's Card Street Substation in the Town of Lebanon, Lake Road Switching Station in the Town of Killingly, and the Connecticut/Rhode Island border in the Town of Thompson; and (b) related additions at CL&P's existing Card Street Substation, Lake Road Switching Station, and Killingly Substation.	**DOCKET NO. 424** May 21, 2012

DIRECT TESTIMONY OF ROBERT E. CARBERRY, JOHN C. CASE, AND ANTHONY P. MELE

CONCERNING ENGINEERING, DESIGN, SITING, CONSTRUCTION, MUNICIPAL CONSULTATIONS, OUTREACH AND EMF CHARACTERISTICS OF THE CONNECTICUT PORTION OF THE INTERSTATE RELIABILITY PROJECT

TABLE OF CONTENTS

1.0 INTRODUCTION

Q. Please identify yourself and the other members of the panel who may assist you in responding to cross examination.

A. We are Robert E. Carberry, John C. Case, and Anthony P. Mele, all of Northeast Utilities Service Company ("NUSCO"). Our resumes, and those of our colleagues from NUSCO and our engineering consultant Burns & McDonnell who might be called upon to provide additional information concerning the subjects of our testimony, are provided in the accompanying Resume Volume. The Resume Volume also includes the qualifications of Dr. William H. Bailey, who will be available at certain hearing dates to respond to any questions concerning EMF health science issues.

Q. What are your positions in NUSCO?

A. [Mr. Carberry] I am Project Manager, NEEWS Siting and Permitting. [Mr. Case] I am Project Manager, NEEWS Engineering. [Mr. Mele] I am Project Manager of the Interstate Reliability Project.

Q. What is the relationship of NUSCO to the applicant, The Connecticut Light and Power Company (CL&P)?

A. NUSCO and CL&P are both wholly-owned subsidiaries of Northeast Utilities. NUSCO provides administrative and engineering services to the NU operating subsidiaries, including CL&P. NUSCO has provided the in-house resources for the development of the Connecticut portion of the Interstate Reliability Project.

Q. Has NUSCO engaged other organizations and individuals to assist with the design of this project and the preparation of the application now before the Council?

A. Yes, NUSCO has called upon many outside organizations and individuals for assistance, principally Burns & McDonnell, an international engineering consulting firm and its subconsultants. Burns & McDonnell's areas of core competence include the engineering, design, and construction of electric transmission facilities. Several Burns & McDonnell representatives are with us, and may assist us in responding to some questions. We have already referred to Dr. Bailey of Exponent, Inc. (Exponent), who provided consulting services concerning EMF. In addition, Louise Mango of Phenix Environmental, Inc. worked extensively on the environmental sections of the application, and will be the principal CL&P witness on environmental effects of the proposed project and of alternate transmission routes and route variations.

Q. What personal responsibility have each of you had with respect to the application to the Connecticut Siting Council ("Council") that is the subject of Docket 424 (the "Application")?

A. [Mr. Carberry] I have supervised the preparation of the entire Application, drafted portions of it myself, have reviewed the entire Application as it was prepared, and approved it for filing with the Council.

[Mr. Case] I have supervised the selection and design of the proposed transmission facilities and have written or supervised the sections of the Application concerning the technical aspects of the proposed facilities and the cost estimates presented in the Application.

[Mr. Mele] I have managed all aspects of this project, including scope, schedule and budget, have reviewed the entire Application as it was prepared, and approved it for filing with the Council.

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to provide a high-level summary of the key information presented to the Council in the 11-Volume Application concerning the engineering, design, siting, construction, municipal consultations, outreach and EMF characteristics of the Connecticut portion of the Interstate Reliability Project (which we sometimes will refer to as "Interstate" or the "Project") and their compliance with the Council's EMF Best Management Practices.

2.0 DESCRIPTION OF PROPOSED INTERSTATE FACILITIES

Q. What are the elements of the Interstate Reliability Project?

A. The principal element of the project is a set of new 345-kV lines connecting substations and switching stations in Connecticut, Rhode Island, and Massachusetts, together with related substation and switching station improvements in all three states. In addition, a 345-kV line in Rhode Island will be reconductored and 115-kV facilities in Rhode Island will be upgraded.

Q. Who will construct, own, and operate the facilities of the Interstate Reliability Project?

A. The facilities in Rhode Island and Massachusetts will be constructed, owned, and operated by operating subsidiaries of National Grid USA (National Grid). The Connecticut facilities will be constructed and operated by CL&P, and CL&P will initially own all of them. However, CL&P expects to transfer ownership of some of these facilities to The United Illuminating Company when they enter commercial operation, pursuant to the "Agreement Re:

Connecticut NEEWS Projects," a copy of which has been filed with the Council pursuant to section 16-50o(c) of the General Statutes.

Q. How does the construction scope of the Connecticut portion of Interstate compare with that of the Rhode Island and Massachusetts portions?

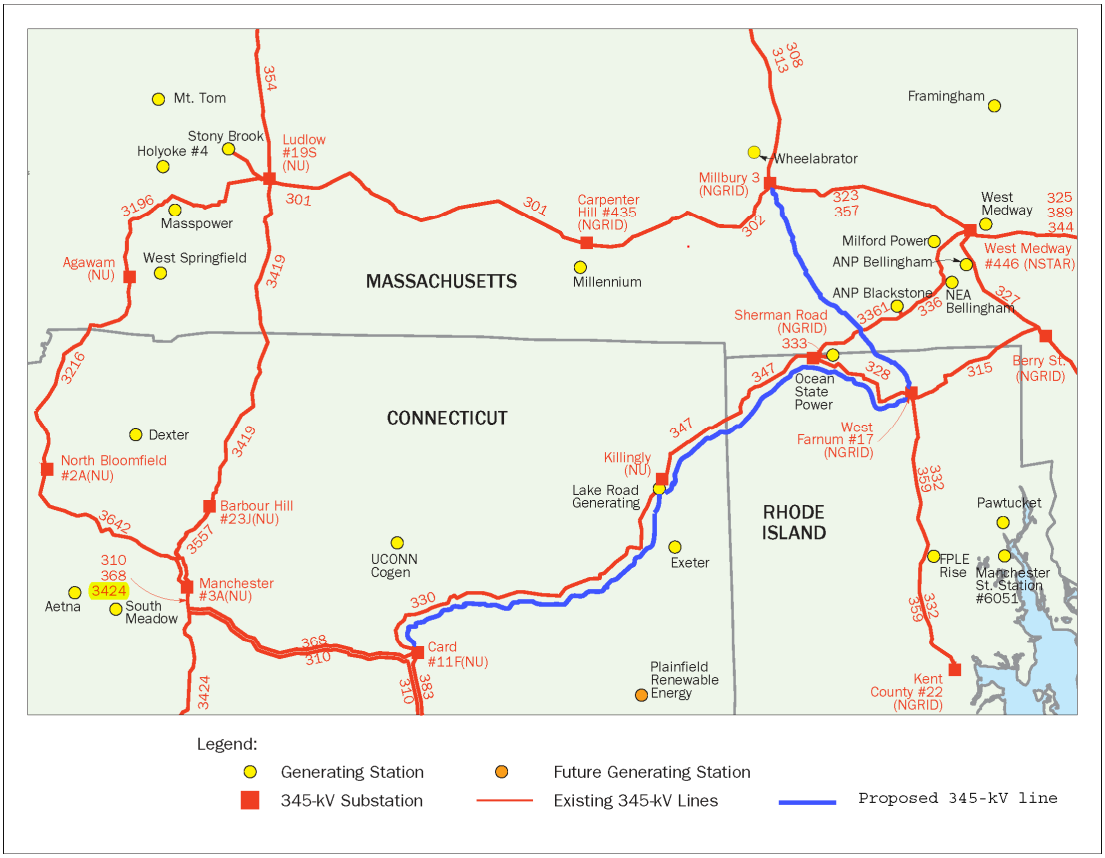
A. The entire Interstate Reliability Project would involve the construction and operation of 74.7 miles of new 345-kV lines, along with related substation and switching station improvements and 115-kV line work. Approximately 36.8 miles (49%) of new 345-kV lines would be installed in 11 Connecticut towns, 22.5 miles (30%) in two Rhode Island towns and 15.4 miles (21%) in five Massachusetts towns. Proposed substation and switching station modifications include two substations in Connecticut and one each in Massachusetts and Rhode Island and one switching station in each state. Additionally, a 9-mile-long 345-kV line in Rhode Island would be rebuilt/reconductored.

Of the total estimated project cost of $511 million, approximately $293 million (57%) is estimated for National Grid's work and facilities in Rhode Island and Massachusetts, and approximately $218 million (43%) is estimated for CL&P's work and facilities in Connecticut.

Q. Please indicate the planned location of the new 345-kV lines.

A. Figure CCM-1 shows the new 345-kV lines proposed by the Interstate project as a blue line.

Figure CCM-1: Existing and Approved 345-kV Lines and Proposed New 345-kV Line



The 345-kV lines shown as "existing" are those that will be in place before the Interstate lines are constructed. These include the Rhode Island Reliability Project, the Greater Springfield Reliability Project, and the Manchester to Meekville Junction Project, which are now under construction.

2.1 The Proposed 345-kV Lines extending between Card Street Substation, Lake Road Switching Station and the Connecticut/Rhode Island border

Q. Please illustrate the Connecticut portion of the Project in more detail.

A. The Connecticut portion of the Project is well illustrated by Figure 1-2 in the Application. A copy of that 8.5" x 11" figure is provided as Attachment CCM-1 to this testimony.

Q. Please briefly describe the 36.8 miles of new 345-kV transmission lines in Connecticut.

A. The two new 345 kV transmission lines would be constructed overhead, adjacent to CL&P's existing transmission lines. One line would extend from Card Street Substation to Lake Road Switching Station (approximately 29.3 miles), and the other line would extend from the Lake Road Switching Station to the Connecticut/Rhode Island border (approximately 7.5 miles).

Q. What towns will the Connecticut section of the proposed new 345-kV line routes traverse?

A. As shown in Attachment CCM-1, the proposed 345-kV line routes in Connecticut would extend along existing transmission line rights-of-way ("ROWs") through portions of Lebanon, Columbia, Coventry, Mansfield, Chaplin, Hampton, Brooklyn, Pomfret, Killingly, Putnam and Thompson, to the Connecticut/Rhode Island border.

Q. Please briefly describe the ROW where the new 345-kV line would be constructed.

A. The ROW was established in the early 1970s. It varies in width, ranging from 250 to 400 feet, except for two segments that are 150 feet wide in the Mansfield Hollow area in Mansfield (0.9 mile) and Chaplin (0.5 mile). The ROW traverses CL&P-owned property for approximately 5 miles. On CL&P-owned property, the ROWs do not have a legally defined width. For its entire length from Card Street Substation to the state border, the ROW is occupied by a 345-kV line. On some segments of the ROW, there are additional transmission lines (a double-circuit 69-kV line in one segment and two 115-kV lines in three other segments); and on

one segment there is a 23-kV distribution line. Finally, there are two existing 345-kV lines on a very short segment of ROW leading to the Lake Road Switching Station.

Q. What transmission support structures are currently on the ROW?

A. The existing 345-kV line is typically supported on wood pole H-frame structures, that are approximately 80 feet tall. The H-frame tangent structures have two poles, and three-pole structures are used at angles (turns in the ROWs). On a short section of ROW in Mansfield, where the ROW is 150 feet wide, the line is supported in a Delta configuration by steel monopoles.

Q. Are the existing ROWs wide enough to accommodate the proposed 345-kV lines?

A. Yes, with two small but important exceptions. For approximately 35.4 miles of the 36.8 miles in Connecticut (96%), there is ample room on the existing ROW for the new 345-kV line. The exception is the two segments in the Mansfield Hollow area in Mansfield and Chaplin mentioned above. The ROWs for these two segments would have to be widened by the acquisition of additional easement rights across a total of 1.4 miles of federally-owned properties in order for the new line to be constructed alongside the existing 345-kV line. The options for construction in this area, and the discussions that CL&P has had with the United States Army Corps of Engineers (USACE) concerning it, are reviewed in a later section of this testimony.

Q. What types of support structures will be used for the new line?

A. The typical support structure will be an H-frame structure, approximately 85 feet high, made of laminated wood or steel. Taller steel monopoles would be used over the USACE property where the existing line is on steel monopoles with the conductors arrayed in a Delta configuration; and along any ROW segments where the Council orders such construction as an

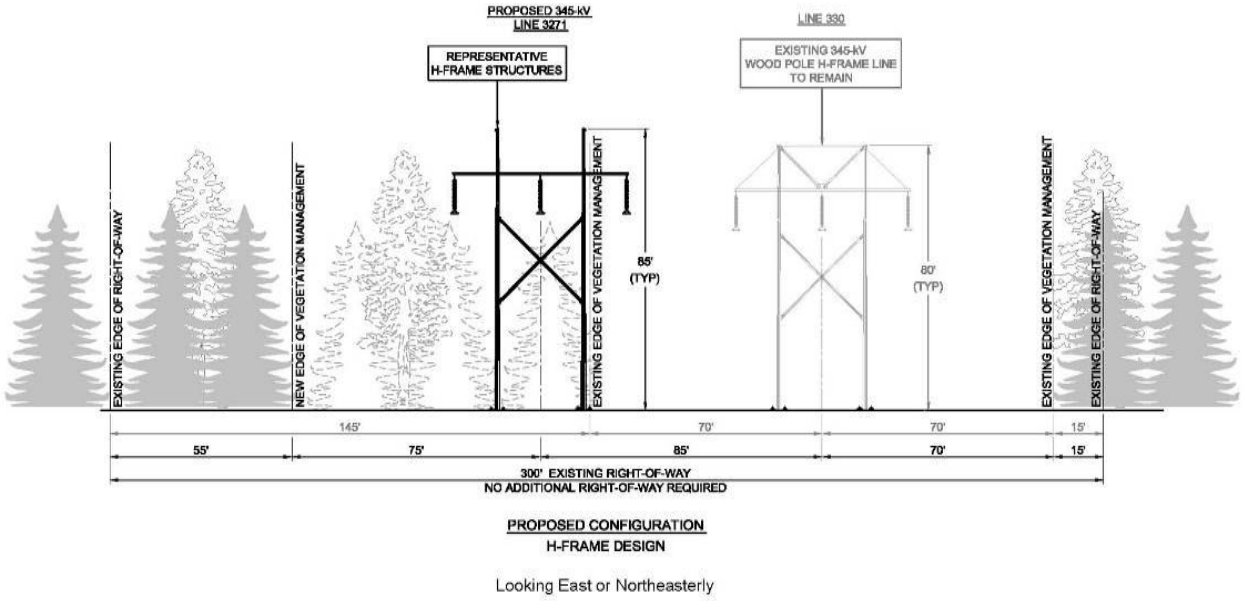
EMF Best Management Practice. In addition, taller monopoles will be necessary for the entry into the Lake Road Switching Station.

Q. What will the typical appearance of the existing ROWs be after the new line is installed?

A. For approximately 21.2 miles of the 36.8-mile length of the Connecticut route, there will be two parallel 345-kV H-frame lines within a 300 foot wide ROW. While there will continue to be additional lines on some other segments; and the ROW in some segments will be less than 300 feet wide, this configuration of side-by-side H-frames of similar height on a 300-foot-wide ROW will be by far the most common. This configuration is illustrated by Figure CCM-2 below. Each of the several other different combinations of existing and proposed new lines is illustrated in Appendix 3A to Section 3 of the Application. For approximately 10.1 miles of ROW, there would be two parallel H-frames as well as one or two existing lower voltage lines on a ROW that is wider than 300 feet. In other locations, monopole line configurations are proposed alongside existing lines.

FIGURE CCM-2: MOST COMMON ROW CROSS SECTION

Looking Northeast or East



Q. How were the locations of the proposed new structures determined?

A. The proposed structures were initially aligned adjacent to the existing structures to maximize the use of existing on-ROW access roads, minimize changes to the visual environment, and mimic existing span lengths. This alignment also avoids potential increases in the spacings between lines that may be required by the National Electrical Safety Code under certain high-wind conditions. After further evaluation by CL&P, including potential environmental effects and constructability, some structure locations were shifted. As a result, of the 57 proposed structures that would be in wetlands if constructed adjacent to existing structures, 33 were shifted to uplands; the remaining 24 structures could not be shifted to uplands.

Q. What additional clearing and maintenance of vegetation on the ROWs would be required for the new lines?

A. Along the most common ROW segments, where there will be two 345-kV lines supported on H-frames within a 300-foot-wide ROW, CL&P presently manages (on average) a 140-foot-wide area beneath and adjacent to the existing 345-kV line. The proposed 345-kV line on H-frame structures would require (typically) an additional 90-foot width of new vegetation clearing and management.

Where steel monopoles are used with Delta conductor configurations, a slightly smaller width (typically 70 feet) of additional clearing and management would be required, and in some areas, no additional vegetation clearing and management width would be required. Table 4-2 on page 4-13 of the Application summarizes the total ROW widths, the typical ROW-managed widths and estimated additional clearing widths. As explained in Section 5.0 of this testimony, the estimated width of new vegetation clearing in Table 4-2 for XS-3 and XS-5 will be reduced with CL&P's use of the 4.8-Acre Minimal ROW Expansion Option over the federally-owned lands in Mansfield Hollow.

2.2 The Proposed Substation and Switching Station Additions

Q. What substation and switching station improvements will be required in Connecticut for the Project as proposed?

A. Additions will be required to the Card Street Substation on Card Street in Lebanon, the Lake Road Switching Station in Killingly, and the Killingly Substation in Killingly. All of these additions can be made within their existing fenced areas. Preliminary plan and section views for each of the substations and switching stations are provided in Volume 7 of the Application. These preliminary plans will be updated as the design process proceeds.

2.2.1 Card Street Substation

Q. Please describe the required additions to the Card Street Substation.

A. The Card Street Substation is located within a 150-acre property owned in fee by CL&P, which has frontage on Card Street. The substation occupies approximately 10 acres. There has been a substation at that site since the 1960s, and 345-kV equipment has been in operation there since 1969. The Project as proposed would add to the existing equipment: a new 345-kV transmission line terminal structure, three new 345-kV circuit breakers, lightning masts, four 345-kV disconnect switches, bus work and control cable trenches, three surge arresters, three coupling capacitor voltage transformers (CCVT), and one wave trap. New protection and control equipment would be installed within the existing relay/control enclosure, and some other work will occur to ensure that existing primary and backup protection and control equipment in the relay/control enclosure complies with requirements for proper separation. We have also determined that some additional equipment not described in the Application will be needed. Specifically, several 345-kV disconnect switches will be replaced to increase their current ratings.

Q. What is the tallest height of any of these new structures at Card Street?

A. The tallest proposed structures to be constructed within the fenced-in substation area will be approximately 110 feet in height, consisting of the new line terminal structure and four new lightning masts. These are 15 feet lower than the height of the existing 330 terminal line structure, which has a total height of 125 feet, including the lightning mast.

2.2.2 Lake Road Switching Station

Q. Please describe the required additions to the Lake Road Switching Station.

A The Lake Road Switching Station is located in the northwestern potion of the Town of Killingly, on private property off Alexander Parkway, and adjacent to the Lake Road Generating Station. The switching station occupies an easement area of approximately 3.5 acres. It was developed and interconnected in 2001. The Project would add to the existing facilities: three 345-kV circuit breakers, six 345-kV disconnect switches, bus work, six surge arresters, ten CCVT, four potential transformers, and new protection and control equipment within the existing control house.

2.2.3 Killingly Substation

Q. Please describe the required additions to the Killingly Substation.

A The Killingly Substation is located in the northwestern portion of the Town of Killingly on CL&P's 29.4-acre property located on Tracy Road. It was completed in 2006 and occupies approximately 5.6 acres. Because the new line would simply pass over the substation, no new switchyard equipment is required. The project as proposed would require only the installation of two 345-kV transmission line terminal structures within the existing fenced area to support the new 345-kV line conductors as they pass over the substation.

Q. How will the appearance of the new structures compare to that of existing facilities at the Killingly Substation?

A. The proposed two structures will be approximately 110 feet high, and will be similar in appearance to the two existing line terminal structures.

Q. What will be the construction sequence for the substation and switching station improvements?

A. We anticipate that the construction sequence would be as follows:

- Site preparation: installing temporary soil erosion and sedimentation controls, vegetation clearing, creating temporary access, grading, excavating unsuitable soils, installing fencing
- Foundation construction: excavation, form work, steel reinforcement, construction of transformer sumps, concrete placement
- Erection of structures, bus and equipment, including control-cable trenches, ground grid and conduits and control cables
- Testing and interconnections
- Final cleanup, site security and landscaping

A final detailed construction sequence will be developed for the Development and Management (D&M) Plan that must be submitted to the Council and approved before construction may begin.

2.3 Line Construction Process

Q. What construction steps will be followed for construction of the new 345-kV lines on the ROWs between the Card Street Substation and the Connecticut/Rhode Island border?

A. The overhead transmission line construction will occur in several stages and will generally consist of the following activities:

- Survey/marking of features
- Establishment of construction work areas and soil and erosion control measures
- Clearing
- Construction or improvement of access roads
- Work area preparation
- Excavation and construction of foundations
- Erection/assembly of new structures

- Wire stringing
- Testing, commissioning and restoration

The process is outlined in detail in Section 4 at pages 4-2 to 4-4 of the Application.

Q. What temporary uses of land will be needed as part of the proposed construction process for the transmission facilities?

A. Storage areas generally 2 to 5 acres in size will be needed to store mobile construction offices, construction materials, equipment and supplies, and for parking. They would be located near active work locations and would be moved as the construction progresses. Staging areas, generally less than 2 acres in area, would be used for temporarily stockpiling components of the transmission line structures. Laydown areas, typically located within the ROW, would be used for the placement of materials and equipment associated with the dismantlement of existing structures or the erection of new structures. To the greatest extent practical, CL&P would use its own property for these purposes. When these areas are no longer needed for the construction effort, they will be restored.

Q. Has CL&P identified potential storage and staging areas?

A. Yes, potential storage or staging areas on the property of CL&P identified to date are listed in Table 4-1 on page 4-5 of Volume 1 of the Application. Additional areas may be necessary on property of third parties. To the extent possible, such areas would include previously developed sites (such as paved parking lots), vacant land or properties previously used for construction support, depending on the parcel size requirements and location in relation to the Project routes. Final locations will be identified in the D&M Plan.

Q. What ROW access does CL&P require to construct the new line?

A. Crews must have access from public highways or private roads to each location on the ROWs where a structure will be located, both to build it and for future maintenance. Although it will not be necessary for all construction vehicles and heavy equipment to be able to travel everywhere along the ROW, vegetation clearing crews must access all areas of the ROW where vegetation removal is required to construct the new 345-kV transmission lines or to remove trees that could grow to interfere with line operation. The areas along the ROW where vegetation typically may have to be cleared are illustrated on the Volume 11 maps in the Application. In addition, clearing crews will have to access some areas outside of the defined limits of clearing to remove "danger trees" that could pose risks to the 345-kV lines.

Q. How will construction vehicles and equipment gain access to the portions of the ROWs where the construction work will be performed?

A. Construction vehicles will access work sites using defined on-ROW access roads. As part of the Project planning, CL&P has identified the anticipated locations of on-ROW access roads; these access roads will be refined as the final design of the Project proceeds. Construction vehicles and equipment will use public roads to reach on-ROW access roads. Along most portions of the Project ROWs, existing access roads have been established to provide ingress/egress for maintaining the existing CL&P transmission lines and ROWs. However, most of these on-ROW access roads have been in existence for approximately 40 years and will have to be improved, widened or otherwise modified to accommodate the modern heavy construction equipment that will be required to install the new 345-kV transmission lines. Where existing access roads cannot be used to reach the new 345-kV structure locations, new on-ROW access roads will be developed.

Based on CL&P's recent experience on other 345-kV construction projects and taking into consideration the terrain along the Interstate ROWs, existing on-ROW access roads (which are nominally 12 feet wide) will have to be widened to provide a minimum 16-foot-wide travelway, and in some places a 20-foot-wide travelway with a total affected width (including road shoulders) of approximately 25 feet. New on-ROW access roads will similarly be developed to provide the same travelway width. Typically, access roads must have grades of 10% or less to safely accommodate construction equipment. In certain locations, such as where slopes must be graded or equipment turning radii must be accommodated, access road travelway widths will have to be wider.

Q. How are the locations of new access roads determined?

A. The areas to which access is required and for which there are no existing access roads are first identified. Then locations for roads are selected based on suitable terrain, avoidance or minimization of crossings of sensitive environmental resources, and minimization of construction traffic disturbances to nearby property owners. Where access roads must extend across environmentally sensitive locations, such as wetlands and streams, the length of the access road crossing will be minimized to the extent practicable, and the roads will be temporary (i.e., used during construction and then removed). Typically, timber mats, corduroy roads (log riprap), or equivalent will be used to construct these access roads.

Q. Where will new access roads be needed?

A. Table 4-3 on page 4-20 of the Application lists the potential public road access to ROWs that have been identified so far. In addition, there may be existing private ways, such as farm roads or logging roads that could be used as access roads if the owner agrees. These potential access roads are not identified on any of the maps in the Application because CL&P has

not yet contacted the owners for this purpose. All new access roads will be designated in the D&M Plan.

Q. How are the ROWs used for access roads?

A. Roads that provide access from off the ROWs of course extend into the ROWs to the construction site itself. In addition, where access to a construction site from an off-ROW access road is not available, a roadway sufficient to support the construction vehicles and equipment must be established within the ROW, between the access point and the construction site. Because the ROWs that will be used for this project are in relatively remote areas with infrequent access points from public highways, on-ROW access roads will likely be required in many locations. These locations will be identified after the off-ROW access roads have been determined, and will be designated in the D&M Plan.

2.4 Appearance of the ROWs After Construction of the Lines

Q. How can the Council visualize what the Interstate ROWs will look like after the proposed construction is complete?

A. We have provided several visual aids for this purpose. First, Volume 10 of the Application includes drawings exemplified by Attachment CCM-2 to this testimony. These are preliminary plan and profile drawings, based on aerial photography from 2007 and survey data, which show a view from overhead and an elevation view from the side. The elevation view represents both the conductor and structure elevations above ground and the horizontal distance along the ROWs, along with vegetation abutting the ROWs. The structure heights appear taller on these drawings due to the dual scale of 1 inch = 80 feet in the vertical direction and 1 inch = 400 feet in the horizontal direction. In addition, Volumes 8 and 10 also include photographs of the ROWs and the existing facilities on it, together with corresponding photosimulations of the

same parts of the ROWs as they will appear when construction is complete. An example of one of these pairings of photographs and photosimulations, relating to the Card Street Substation to Babcock Hill Junction section of the ROW in Lebanon and Columbia, is provided with this testimony as Attachment CCM-3.

Q. Are the photosimulations in Volumes 8 and 10 reasonably accurate?

A. Yes. The photosimulations were prepared by a company specializing in computerized simulations. Based on our own knowledge of the proposed construction, and our experience with such construction, we are satisfied that they are reasonably accurate.

3.0 COST AND SCHEDULE

Q. What is the estimated cost of the Interstate Reliability Project?

A. The estimated cost for the entire project is $511 million, assuming all overhead line construction and including $4.3 million of assumed extra costs for EMF BMP line configurations. That estimate includes "all-in" capital cost, escalated to future years of spending (assuming an in-service date of 2015). Approximately $218 million of that cost is attributable to facilities in Connecticut. Cost estimates are being continually reassessed as the project design becomes more detailed and we learn more about specific conditions. The specific elements of the estimated cost may increase and/or decrease as we go forward. However, the overall total of $511 million continues to be a good estimate.

Q. What is the anticipated timetable for the Interstate Reliability Project construction?

A. Construction on the Project is expected to start in 2014.

Q. What is the tentative in-service date for the Interstate Reliability Project?

A. We hope to have the Project in service by the end of 2015 - before the 2016 summer peak.

4.0 MUNICIPAL CONSULTATIONS

Q. Has CL&P complied with the municipal consultation requirement of section 16-50*l*(e) of the General Statutes?

A. Yes, we initiated the municipal consultation process in 2008 and then renewed it in 2011, after the results of ISO's *Needs Reanalysis* were announced. We included in our consultation process all of the towns through which the proposed route, or its variations, would pass as well as the towns within 2,500 feet of any portion of those routes. Accordingly, we served municipal consultation packages (2008) and supplemental municipal consultation packages (2011) on a total of 12 towns. In fact, municipal consultation activities related to the Interstate Reliability Project have been on-going since 2007, including more than forty Project briefings made to municipal officials and/or local boards or commissions in 2011 prior to the submission of the Application on December 23, 2011. Additionally, chief elected officials and staff were provided periodic Project updates, drawings and information as developments warranted. Table 9-3 on page 9-8 of the Application lists the meetings with municipal officials, and on page 9-9 of the Application lists meetings with other stakeholder groups. CL&P's Bulk Filing #2 (January 6, 2012, and updated on February 3, 2012) provides copies of the municipal consultation materials, including presentations and mailings, and Bulk Filing #3 (January 6, 2012, and last updated on February 21, 2012) provides comments received from the municipalities and others in the course of that process.

Q. Did CL&P seek any municipal location reviews pursuant to section 16-50x(d) of the General Statutes for any of the proposed substation or switching station improvements?

A. Yes. The formerly proposed 310 Line Loop into the Card Street Substation would have included substantial additions to the Card Street Substation, which would have required a location approval process. Accordingly, when that construction was still part of the proposed Project, CL&P filed location review submissions with the Lebanon Inland Wetlands Commission and the Planning & Zoning Commission. However, as finally proposed, the Project does not entail any construction outside the fence lines of existing substations or switching stations in Connecticut, so no municipal location reviews are required.

Q. Have your consultations with interested Connecticut stakeholders continued since the filing of the Application?

A. Yes. We have used the relationships and communications channels we established during our municipal consultation and pre-application filing outreach to conduct follow up discussion with a number of interested stakeholders, including:

- Putnam's new Mayor, Richard "Peter" Place, for whom we provided a Project briefing on January 5, 2012.
- Columbia's Inland Wetlands and Watercourses Commission for whom, on January 11, 2012, we provided a briefing on CL&P's practices related to the protection of wetlands and vernal pools from Project impacts.
- State Senator Don Williams and State Representative Greg Haddad, on February 23, 2012, to brief them on the status of the Project and the schedule for public field hearings in their districts.
- The USACE, with whom we have had an ongoing discussion regarding the alignment of the Project across the federally-owned properties in Mansfield Hollow. Our post-application interactions with the USACE have included a field walkdown with USACE representatives on February 29, 2012.

- Chaplin's Planning and Zoning Commission for whom, on March 8, 2012, we provided a briefing on the Project's profile in Chaplin.

- The Connecticut Department of Energy and Environmental Protection (CT DEEP) and the Connecticut State Historic Preservation Office (SHPO), with whom we have worked on Project related matters, including potential impacts in the Mansfield Hollow State Park and Wildlife Management Area.

- Commissioner Steven Reviczky, of the Connecticut Department of Agriculture, on March 16, 2012, to provide a project briefing, including an overview of CL&P's policies and procedures related to potential impacts to and remediation of agricultural land, and to discuss the Project team's contacts with members of the agriculture community in Project towns.

- Connecticut Forest & Park Association on March 30, 2012 to discuss Project footprint and profile near their blue-blazed trail system.

- Representatives from the Windham Region Chamber of Commerce, the Northeast CT Chamber of Commerce, and the Eastern CT Chamber of Commerce on March 7, 13 and 16, 2012 respectively, to update them on the status of the Project and to discuss the opportunity for public input at the upcoming Council public field hearings.

- Representatives from The Last Green Valley on April 12, 2012 to update them on the status of the Project and to discuss the opportunity for public input at the upcoming Council public field hearings.

- Town of Thompson's Wetlands Agent on April 13, 2012, who requested a walk down to review the current condition of the ROW in Thompson.

5.0 PUBLIC NOTICES, OUTREACH AND COMMENTS

Q. What measures were undertaken by CL&P to inform the public and property owners along the routes of the Project, and to obtain their input?

A. CL&P sponsored or participated in open houses, town-wide public meetings, neighborhood meetings, and meetings with individual landowners and groups of landowners. As required by section 16-50*l*(b) of the General Statutes, bill inserts with Project information were mailed to customers. Notices were provided to community organizations and water companies as required by the Council's Application Guide, and to abutters of the Card Street Substation,

Killingly Substation and Lake Road Switching Station as required by section 16-50*l*(b) for new or substantially modified substations and switching stations. Legal notices of the Application were published in local newspapers as required by section 16-50*l*(b). Copies of the Municipal Consultation Report and Supplemental Municipal Consultation Report were placed in local libraries and on the Project website (www.NEEWSprojects.com), and comment cards, both hard copies and an online version, were made available for the public to provide input. In addition to the development and management of a Project website (www.NEEWSprojects.com), a Project hotline (1-866-99NEEWS) and dedicated Project email address (NEEWS@nu.com) were established through which residents and other stakeholders can communicate with Project management, a system of "push" emails was established for those requesting this service, public open houses were held with personal invitations mailed to those residents near the proposed Project, and other extensive, proactive outreach was implemented as part of the comprehensive effort to inform stakeholders and solicit their feedback regarding the Project.

Q. How was information presented at the open houses?

A. In 2008, the public open houses were organized into four clusters of information stations, staffed by knowledgeable representatives from CL&P and its consultants, including Burns & McDonnell and Exponent. The information stations included: a "Welcome" station with an information kit (including a graphic explaining how to participate in the siting process) and a route locator station to respond to the question "Where?"; a "Why?" station, which provided materials including the need for the Project, electric industry information and other collateral material; a "How?" station providing materials including photosimulations, structure design drawings and samples of conductors and insulators; and, a "What About?" station providing materials on topics including environmental management, EMF and ROW information.

In 2011, the public open houses were similarly staffed by knowledgeable representatives from CL&P and its consultants and focused on topics of interest, organized into the following information stations: Needs and Benefits; Proposed Upgrade; Transmission Construction; Mansfield Hollow; EMF; Understanding ROWs; and Public Participation in the siting process. In addition, several Route Locators (using a Google Earth interface) were available so that residents could learn more about plans for their particular property. Comment cards were made available for attendees to provide input on the Project as part of the Municipal Consultation Filing (MCF) process which could be dropped in designated kiosks or mailed back to CL&P in the pre-addressed, postage-paid mailer.

Q. Please describe CL&P's contacts with Connecticut stakeholders, including government entities, interested organizations, landowners and other individuals interested in or concerned about the Project, since you began your public outreach efforts.

A. As noted above, over the past four years, beginning prior to the filing of a Municipal Consultation document in the summer of 2008, CL&P has developed and executed a comprehensive communications and community relations campaign to inform the public, solicit feedback, and engage interested parties in a dialogue about the Project. CL&P has conducted outreach to over 1,400 nearby property owners who may be visually or audibly affected by the Project, including the nearly 420 property owners directly abutting the Project route, who are regularly kept informed of Project activities. And in addition to providing information and updates to property owners, the Project team has proactively briefed:

- elected officials (U.S. Senators Lieberman and Blumenthal, Congressman Courtney, CT Attorney General Jepsen, members of the state legislative delegation from Project towns and relevant legislative committees, and all of the chief elected officials from the 12 Project towns);

- state regulators (including the Commissioners/staff of the Departments of Agriculture and DEEP, the Office of the Consumer Counsel);
- business associations (more than a dozen regional and statewide organizations);
- environmental organizations of appropriate interest (including The Last Green Valley, CT Forest & Parks, League of Conservation Voters, CT Audubon); and,
- special interest groups (e.g., Friends of Mansfield Hollow), as well as individual businesses and other members of the Project communities.

This outreach has taken the form of group and individual meetings and presentations, written correspondence, six Open Houses, phone calls, emails, and postcards. In fact, CL&P has had over 500 contacts to-date with property owners and other stakeholders as a result of inquiries that have come through our various outreach efforts.

CL&P also notified wetlands commissions in the Interstate towns of the Application and promptly responded to letters from any local agencies/commissions.

We also have had extensive interaction with the Real Estate Division of the USACE, which manages the federally-owned lands in the Mansfield Hollow area where we are seeking an expanded ROW, and with a group of landowners on Hawthorne Lane in Mansfield who are requesting an alternative to the proposed route through their neighborhood.

Q. Were signs posted informing the public of the Council's three public comment hearings to be held in Lebanon, Brooklyn and Mansfield on April 18, 19 and 24, respectively, in advance of those hearings?

A. Yes. On April 4 and 5, 2012, twenty-two 4-foot by 6-foot signs notifying the public of all three hearings were posted by members of the Project team at various locations throughout the 11 towns included in the proposed Project route. The signs were posted predominately at ROW crossings, on land owned by CL&P, except for three locations on land of

private parties, for which permission was obtained. All signs were removed on April 25 and April 26, 2012. An example of one of the posted signs is included as Attachment CCM-4.

5.1 USACE Public Lands in Mansfield

Q. Please summarize the issues with respect to the public lands in Mansfield where CL&P is proposing to widen the ROW.

A. There are two non-contiguous segments of CL&P's existing ROW in Mansfield and Chaplin that traverse federal public lands managed by the USACE and leased to the CT DEEP. These locations are illustrated in Figure 10-1 of the Application, a copy of which is Attachment CCM-5 to this testimony. "Segment 1" traverses federally-owned lands in the Town of Mansfield for a distance of approximately 0.9 mile, including across a portion of Mansfield Hollow State Park, an approximately 600-foot span of Mansfield Hollow Lake, and a portion of the Mansfield Hollow Wildlife Management Area (WMA) on the eastern side of the lake, in Mansfield. "Segment 2" traverses a second portion of the WMA for approximately 0.5 mile across and in the vicinity of the Natchaug River, in Chaplin. Across these federal properties, CL&P's existing ROW is 150 feet wide. In Segment 1, CL&P's existing 345-kV transmission line employs steel monopoles typically 115 feet high, with the conductors arrayed in a Delta configuration. Across Segment 2, the line employs H-frame structures that are typically 80 feet high. The existing structures are generally positioned in the center of each of these ROW segments. Because of conductor separations required for safety and reliability, a new 345-kV line can not be built alongside the existing line within the existing 150-foot-wide ROW. And because CL&P's eminent domain powers do not extend to federal land, any widening can only occur through a voluntary grant by the USACE. We are in negotiations with the USACE

concerning a voluntary conveyance of additional ROW along both Segments 1 and 2, and the ultimate configuration of the new line on these segments of ROW is entirely dependent on the outcome of these negotiations.

Q. What efforts has CL&P made to obtain additional ROW width in these areas?

A. CL&P has been engaged in consultations with the USACE concerning the ROW across the Mansfield Hollow properties since 2007. CL&P also has kept the CT DEEP informed of the Project and the configuration options across Mansfield Hollow. In September 2011, CL&P submitted a request for an additional grant of easement to the USACE New England District's Real Estate Division. In order to obtain a conveyance from the USACE, CL&P must satisfy the Real Estate Division that the additional easement width is required for construction that represents the least environmentally damaging practicable alternative. As it happens, that is the same showing that we need to make to the Regulatory Division of the USACE with respect to all portions of the Project that affect federal water resources, in order to obtain a permit under section 404 of the Water Quality Act. It is also the same showing we need to make to the CT DEEP with respect to water resources in order to obtain a section 401 Water Quality Certificate, which is an essential predicate to the USACE's issuance of a section 404 permit. To support its decision to grant additional ROW width, the Real Estate Division issues an Environmental Assessment (EA) of the proposed real estate transaction (i.e., easement expansion) to confirm consistency with the National Environmental Protection Act.

CL&P, as the applicant for this action, provides a proposed draft of the EA after consultation with the Division. We have been in consultation with the USACE Real Estate

Division, the Regulatory Division, and the CT DEEP concerning this conveyance for years, and as the outcome of these consultations, we submitted a draft EA on May 2, 2012.

Q. What alternatives for building the new line on these ROW segments has CL&P developed and presented to the USACE?

A. CL&P has presented three alternatives to the USACE. The "11-Acre ROW Expansion Option," which is identified as the "Proposed Configuration," in the Application, would construct the new line on structures of the same type as the existing line structures. In order build this configuration, CL&P would need an additional 55 feet of easement width in Segment 1 and an additional 85 feet in Segment 2. The total additional ROW required by this option would be 11 acres. Of the three options considered, this one would have the lowest cost and would require the lowest height for the new structures.

In Section 10 of the Application, CL&P also identified a "Minimal ROW Expansion" option, which would reduce the amount of additional easement required from the USACE to approximately 4.8 acres. This reduction would be achieved by using steel monopoles with vertically arranged conductors to support the new line. This configuration is also referred to as the "4.8-Acre Minimal ROW Expansion Option". With this option, the required additional ROW could be limited to 25 feet in Segment 1 and 35 feet in Segment 2. This option would cost approximately $1.3 million more than the 11-Acre ROW Expansion Option.

If CL&P were forced to construct the new line entirely within the existing ROW, it could do so by removing the existing line and constructing steel monopoles with vertically arranged conductors for both the existing line and the new line in both segments. This approach is referred to as the "No ROW Expansion Option." This approach would require complex construction sequencing and line outages, the installation of the tallest structures, and it would

increase project cost by approximately $16 million. Also, although no new easement width would be acquired for this option, additional vegetation clearing to both ROW edges is necessary.

The three options and their approximate costs are illustrated in Attachment CCM-6 to this testimony.

Q. What is the relationship of the Willimantic South Overhead and Underground Variations to the negotiations with the USACE?

A. CL&P identified these two route variations, (refer to Section 15 in Volume 1A of the Application), to avoid the Mansfield Hollow area entirely, in case it could not obtain any additional ROW from the USACE. At the time, CL&P was unsure that it would be able to fit both the new and existing lines within the ROW across the federal lands. However, CL&P has since developed the No ROW Expansion Option which would allow it to do so. Although this option would be very costly, it would still cost less than the Willimantic South options. Moreover, for the reasons detailed in Section 15 of the Application, the Willimantic South options are undesirable. The Town of Windham, which would be traversed by both of these route variations, has also expressed a preference for an alignment following CL&P's existing ROW across the federal properties. Accordingly, CL&P does not recommend either of the Willimantic South options.

Q. What is the current status of CL&P's negotiations with the USACE Real Estate Division?

A. After CL&P submitted its Application to the Council on December 23, 2011, CL&P consulted further with the USACE and the CT DEEP regarding the configuration options in Mansfield Hollow. Specifically, USACE representatives expressed a preference for the 4.8-

Acre Minimal ROW Expansion Option during the February 29, 2012 field review of Segments 1 and 2. Additionally, the CT DEEP filed comments with the USACE in late February favoring the 4.8-Acre Minimal ROW Expansion Option over the 11-Acre ROW Expansion Option presented in the Application in Segment 2 due to lower environmental impacts. (*See,* Attachment CCM-7) In addition, on May 16, 2012, Michael J. Salter of the DEEP stated that the DEEP has no objection to the 4.8-Acre Minimal ROW Expansion Option for Segment 1. Accordingly, CL&P has modified its request to the USACE for a grant of easement to reflect the use of the 4.8-Acre Minimal ROW Expansion Option. We believe that the Real Estate Division will convey sufficient additional ROW width for the 4.8-Acre Minimal ROW Expansion Option. However, the USACE will conduct further evaluations of this option to confirm that it represents the least environmentally damaging practicable alternative. Specifically, the USACE must complete an EA, as noted earlier.

Q. What do you propose that the Council approve with respect to the configuration of the lines on the ROW over the USACE properties?

A. Because the USACE will only enable the route and configuration that it determines to be the least environmentally damaging practicable alternative, and because CL&P will have no choice but to accept the USACE's determination, CL&P respectfully requests that the Council approve the USACE's choice. At present, this appears to be the 4.8-Acre Minimal ROW Expansion Option. Accordingly, in its response to the Council's Interrogatory Q-CSC-038, CL&P has withdrawn its request for approval of the 11-Acre ROW Expansion Option. If the Council considers that it should specify a specific configuration in its Decision and Order, CL&P asks that the Council approve the 4.8-Acre Minimal ROW Expansion Option. However, since the USACE will likely not make a final determination until after the record of this

proceeding closes, and it is possible that the USACE will decline to grant any additional ROW, CL&P's first choice would be for the Council to approve the proposed route over the federal properties, while deferring approval of the specific configuration of the lines to the D&M Plan stage. Thus, if the USACE were to deny CL&P's request for ROW expansion, leaving CL&P only with the No-ROW Expansion Option, CL&P would be able to proceed with that option without coming back to the Council for an amendment of the Decision and Order in this Docket.

5.2 Hawthorne Lane

Q. Please describe CL&P's interaction with the Hawthorne Lane landowners and the issues presented to the Council with respect to the segment of the proposed line that would traverse their properties.

A. Hawthorne Lane is a cul-de-sac in Mansfield, which is crossed by CL&P's existing 300-foot-wide ROW. The owners of four homes that are served by driveways from this cul-de-sac approached CL&P in 2008 to propose a shift of the ROW in connection with the construction of the new line, and we have worked extensively with these landowners to assist them in understanding what would have to happen in order for their objectives to be realized. This interaction resulted in the identification of BMP Alternative 7 for Focus Area C, also known as the "Hawthorne Lane ROW Shift." This alternative is presented in Section 7B of the Application, the EMF Best Management Practices Field Management Design Plan (FMDP). However, as that discussion acknowledges, it was the avoidance of tree clearing and associated visual improvements that first elicited the landowners' interest in moving the ROW. Given that significant driver for this alternative, and its origin as a landowner proposal, it is appropriate to present the alternative at this point, as well as in the discussion of the BMP alternatives. In essence, in considering the Hawthorne Lane ROW Shift, the Council will need to determine

whether to approve an alternative that would provide, as compared to CL&P's proposed construction, significant visual improvement and a modest reduction of already low magnetic fields, at an incremental cost of approximately $1.8 million. This amount does not include any allowance for purchasing additional ROW, because the landowners would provide the needed additional ROW. If the Council were inclined to approve this alternative, it should do so with conditions that would assure that CL&P would be able to build the line as originally proposed, in the event that one or more of the landowners or others from whom performance would be necessary should prove unable to perform within the time required.

Q. Please describe the Hawthorne Lane ROW Shift.

A. At present, the view of the lines from each of four homes served from Hawthorne Lane is substantially screened by intervening trees, which are mostly on the northerly portion of the CL&P ROW. The driveways to these houses cross under the existing line. As proposed, the new line would be constructed to the north of the existing line, which would mean that many of the trees currently screening the view of the ROW from the homes would be removed, and views of the existing and new lines would be opened up.

The Hawthorne Lane landowners proposed to preserve all of their existing tree screen (and lower magnetic fields at their homes) by enabling the new line to be built to the south of where it is proposed. To effect this change, they would grant new easement rights to CL&P over a triangular shaped area that would extend the easement to the south by approximately 225 feet at its widest point, in exchange for a release of roughly equivalent acreage from the northerly portion of the existing easement. Then the existing line would be relocated to the south on this new easement, and the new line would be built adjacent to it, with both lines on steel monopoles and the conductors of each line in a vertical configuration. This shift would require the

relocation of one span and a shortening of another span of the existing line, in addition to the construction of the new line.

Drawings illustrating the Hawthorne Lane ROW Shift are provided as Attachment CCM-8. Attachment CCM-8A shows the location of the existing ROW and the existing and proposed lines in relation to the Hawthorne Lane properties. Attachment CCM-8B shows the relocation of the ROW and the lines contemplated by the landowners' proposal.

Q. What conditions would need to be fulfilled in order for the Hawthorne Lane ROW Shift to be achieved?

A. There are several key conditions that would need to occur. Each of the four landowners would, of course, need to effect the exchange of easement rights necessary to create the new ROW. In addition, each of the mortgagees of the four properties would need to subordinate their mortgages to CL&P's new easement. There is also a conveyance from the Town of Mansfield that would be required. When the Hawthorne Lane subdivision was created in 2002, a conservation restriction was established with the Town as grantee. A 0.32-acre portion of the property subject to the shifted ROW would overlap with, and be inconsistent with, this conservation restriction. Thus, the conservation restriction would need to be modified so as not to burden the land that would become subject to the shifted ROW.

Q. To your knowledge, what is the Town's position with respect to relocating its conservation restriction?

A. The Town has taken necessary action to authorize an amendment of the conservation restriction to remove the area that would be crossed by the relocated transmission lines, to be finalized if the Hawthorne Lane ROW Shift is ordered.

Q. What is CL&P's position with respect to the Hawthorne Lane ROW shift?

A. CL&P has devoted significant time and resources to assisting the Hawthorne Lane landowners in the development of this alternative, which we recognize offers them visual benefits. In addition, CL&P is not as adamantly opposed to this alternative as it has been to other relocations suggested by landowners, because this relocation could be implemented with minor additional steps during construction, instead of a complex process requiring extended outages of the existing line. Should the Council select this alternative, CL&P would be prepared to implement it. However, the alternative would add approximately $1.8 million in incremental cost, and, as discussed later on in this testimony, the 4% benchmark for "low cost" EMF-reducing line designs would be exceeded if this alternative were to be adopted as a BMP measure as well as all of the other CL&P-preferred alternatives identified in Section II.6 of the FMDP. Accordingly, CL&P does not recommend the Hawthorne Lane ROW Shift alternative for EMF BMP purposes.

Above all, CL&P urges the Council not to put it in the position of being ordered to execute the Hawthorne Lane ROW Shift and then being unable to do so, because one of the landowners, mortgagees, or the town does not perform within the time required for CL&P's construction schedule.

Q. How does CL&P propose to avoid the position of being ordered to execute the Hawthorne Lane ROW Shift and not being able to do so?

A. We have advised the landowners that, in order to consider the alternative practical and feasible, CL&P would need to have all of the legal documents necessary to effect the ROW shift deposited into an escrow before the evidentiary hearing phase of this Docket is over. If that were to occur, CL&P would inform the Council that it considered the Hawthorne Lane ROW Shift to be a feasible alternative, although not one it supported. If that did not occur, CL&P

would inform the Council that it considered the alternative to be not practical or feasible, and that it would object to the selection of that alternative, because its selection would at a minimum cause project delay and could cause that portion of the Project to be not constructable at all.

5.3 Town of Mansfield Recommendations

Q. Elizabeth Patterson, Mayor of the Town of Mansfield, submitted a letter to the Council dated April 24, 2012, requesting certain mitigation measures if the Council approves the Project. What is CL&P's position as to each of such mitigation measures?

A. CL&P's position as to each of such mitigation measures is explained below:

- **Relocation of Pole 39 (Highland Ridge Golf Range)**: CL&P does not support this proposal, which it estimates would add approximately $350,000 to the cost of the Project, all of which would be borne by Connecticut consumers. The relocation would also result in some incremental environmental impact, due to additional required clearing, some of which appears to be in wetlands. Finally, although the landowner has offered to provide an easement for the necessary relocation without charge, CL&P has determined that, in order to maintain the same usable width as that of the existing ROW, an additional easement over adjacent land in different ownership would be required. The proposed relocation is depicted in the drawing attached as Attachment CCM-9A. CL&P also prepared a preliminary redesign of a relocation that would not require as much additional clearing or additional wetland impacts, and would not require rights over adjacent land. This alternate relocation is also depicted in Attachment CCM-9B. However, CL&P does not know if this design would be acceptable to the owner. The cost of this alternative would be approximately $10,000 - $25,000; however,

CL&P would not support it unless the landowner agreed to bear the incremental cost. CL&P is willing to continue to discuss potential solutions with the landowner.

- **Use of the Mansfield Underground Variation and a modified Mount Hope Underground Variation:** CL&P does not support the Mansfield Underground Variation for the reasons set forth in detail in Section 15.2 of the Application and summarized in Section 7 of this testimony. Simply stated, this variation would cause greater long-term impacts to environmental resources, pose transmission line operating complexities and substantially increase Project costs without providing any significant advantages with respect to magnetic fields. Thus, it would be unreasonably burdensome to consumers.

CL&P does not support the Mount Hope Underground Variation for the reasons set forth in detail in Section 15.3 of the Application. CL&P has identified underground variations where statutory facilities exist. The Town's proposed modification of the Mount Hope Variation calls for undergrounding where there are no statutory facilities. There are no residential neighborhoods adjacent to this modified underground variation; the distance to the nearest homes on Sawmill Brook Lane would be 215 feet from the south edge of the ROW. CL&P is building on the north side, and there is an intervening property. The distance from nearest conductor of the new line to the nearest home is approximately 360 feet. In any case, use of this variation would not produce large reductions in MF

levels along the edge of the ROW or at any homes. The additional cost to consumers would therefore be unreasonable.

Relocating the western transition station farther to the west and the eastern transition station from the east to the west side of Storrs Road would place both transition stations in areas of rugged topography so that significant grading would be required, and potentially, significant amounts of bedrock would have to be removed. Also, the relocated western transition station would be proximate to residences along Sawmill Brook Lane, just east of Town open space and Joshua's Land Trust Wolf Rock Nature Preserve and closer to Sawmill Brook and the Nipmuck Trail, West Branch, crossing of the ROW, thereby increasing the visibility of the western transition station.

- **Use of EMF Best Management Practices Poles between Route I95 and Mansfield Hollow:** This area is contained within Focus Area B. In our discussion, we considered the use of a Delta configuration and determined that the BMP design is an H-frame configuration, as explained in the FMDP. Note that this Focus Area should be re-defined in light of the discontinuance of daycare activities at Come Play with Me Daycare.

- **Relocation of the Mount Hope Montessori School**: The only reason to consider relocation of Mount Hope Montessori School would be to avoid application of the statutory presumption in favor of undergrounding. However, in this case, the statutory presumption has been clearly rebutted because construction of the lines

overhead will actually reduce pre-project MF levels to levels that are indistinguishable from levels with the underground cable variation and to typical background levels in most homes. Thus, the very large incremental cost of underground line construction would impose an undue burden on Connecticut consumers of electricity.

- **Facilitation of a Land Transfer between Diane Dorfer/Green Dragon Daycare and Northeast Utilities**: CL&P has every intention of continuing the license arrangement with Ms. Dorfer and Mr. Connolly (co-owner) which was entered into on May 18, 2011, for which no fee is paid to CL&P. As discussed in its response to the Council's Interrogatory Q-CSC-041, Ms. Dorfer's request to swap a portion of her land for an adjacent portion of CL&P-owned land is unrelated to Project facilities. Furthermore, the CL&P-owned parcel is subject to an April 12, 2000 Memorandum of Understanding (MOU) between the then CT DEP (now DEEP), CL&P and CL&P's affiliate, The Rocky River Realty Company, whereby first DEEP, then the Town of Mansfield and then any interested land trust has the opportunity to acquire the property if CL&P wishes to dispose of it to any person (i.e., Ms. Dorfer and Mr. Connolly) or any non-affiliate of CL&P. That process can take up to 270 days. In addition, such a transaction would be subject to regulatory process requirements in Connecticut General Statutes Section 16-43(a) (requiring PURA approval for disposition of unimproved land with a value of $50,000 and above) and Section 16-50c (providing town and DEEP an option on unimproved property of 3 acres or more

or a portion of such property). There would be no certainty that CL&P's parcel would not be acquired or leased by one of these parties and thus be unavailable to Ms. Dorfer. Accordingly, the license agreement actually provides Ms. Dorfer with the best opportunity to use the CL&P-owned land as part of her day care educational activities.

This license allows Ms. Dorfer the opportunity to maintain the garden area under the lines and to develop a new garden area in the licensed area located on the CL&P-owned land.

- **Use of the Hawthorne Lane Alternative**: CL&P has presented information in Section 5.2 of this testimony concerning the Hawthorne Lane alternative. CL&P will await further direction from the Council in its decision.

- **Use of Design Option 2 for Mansfield Hollow**: The design that the Town refers to as "Design Option 2" is the No ROW Expansion Option (identified and discussed at length in Section 5.1 of this testimony). The USACE, which has authority to decide this issue, is currently considering the options. We believe that the USACE's preference is for the 4.8-Acre Minimal ROW Expansion Option and as discussed, their preference will control.

- **Protection of Active Farmland**: CL&P is committed to protecting active farmland. It will suggest specific measures for doing so in its proposed D& M Plan and will consider, as practicable, the Town's recommendations.

- **Location of Construction Access Roads**: CL&P will address the location of construction access roads in the D&M Plan and will consider the comments of the Town, if practicable. As to AR 87, we note that any movement of this access road will affect farmland. As to AR 107, CL&P will explore options with its electrical contractor to determine whether relocation is feasible.

5.4 Other Suggestions Made at the Public Comment Hearings

Q. At the public comment hearing in Brooklyn, Mrs. Lynn Landry, 33 Randall Road, Thompson, requested that CL&P relocate Pole #324 to the west side of Quaddick Town Farm Road. Is CL&P willing to consider this request?

A. CL&P plans to address this request in the D&M Plan. Our preliminary evaluation is that the request is reasonable. The new location, which would be on CL&P-owned property, appears to be technically feasible and to have no incremental environmental or cost effect.

6.0 ELECTRIC & MAGNETIC FIELDS

Q. Mr. Carberry, what are electric and magnetic fields?

A. Electric and magnetic fields are invisible lines of force that are associated with all electric conductors and devices. Electric fields ("EF") are produced when a voltage is applied to a conductor. The level of an electric field at a given location near to a power line depends on the magnitude of the voltage applied, the spacing of the conductors and the distance from the conductors to the location.

Magnetic fields ("MF") are produced when electric current flows on a conductor. The level of a magnetic field at a given location near to a power line depends on the magnitude of the current, the spacing of the conductors, and the distance from the conductors to the location.

EF and MF are collectively referred to as "EMF". Levels of each field fall off quickly as the distance from the conductor source is increased. Objects such as trees or building walls weaken or block electric fields, but magnetic fields are not affected by most materials. In the case of parallel lines of circuit conductors, the levels of EF and MF also depend upon the phasing of the circuit conductors and, for MF, the directions of current flow.

Q. Mr. Carberry, has CL&P evaluated the effect of the Project on the current range of levels of EF and MF along the Interstate ROWs?

A. Yes. Section 7 of the Application provides a thorough analysis of the effect of the Connecticut portion of the Project on EF and MF levels. The work supporting this section of the Application was done by engineers at Exponent and Burns & McDonnell under my supervision.

Q. Has the CL&P considered the Council's EMF Best Management Practices?

A. Yes. The design of the Project will incorporate line designs that are consistent with the Connecticut Siting Council's Electric and Magnetic Field Best Management Practices

For the Construction of Electric Transmission Lines in Connecticut, December 14, 2007 (the BMP).

Q. Mr. Carberry, who was primarily involved on behalf of CL&P in the Council's process leading to the adoption of the current version of the BMP?

A. I was.

Q. What was the nature of your involvement, Mr. Carberry?

A. As CL&P's EMF issues manager, I closely followed the proceedings and actively participated in the drafting of the CL&P/UI comments on draft documents developed by the Council. In addition, I testified on a joint CL&P/UI witness panel at the Council's public hearing held on January 9, 2007. Finally, I worked with counsel and the Connecticut Department of Public Health on the development of a joint proposal to the Council.

Q. Please explain the process for the development of the current version of the BMP.

A. In 2005, the Council initiated a proceeding to revise its BMP, which had been in place since 1993. To assist it in evaluating the relevant data, the Council retained an independent scientist, Dr. Peter Valberg, of Gradient Corporation. The Council also considered evidence from a panel of scientists presented by the Connecticut Department of Public Health and evidence from scientists presented by CL&P and The United Illuminating Company, including Dr. Michael Repacholi, the then-recently retired coordinator of the World Health Organization's Radiation and Environmental Health Unit.

Q. What was the outcome of the proceeding?

A. The Council concluded that "the weight of scientific evidence indicates that exposure to electric fields, beyond levels traditionally established for safety, does not cause

adverse health effects" and that scientific literature "reflects the lack of credible scientific evidence for a causal relationship between MF exposure and adverse health effects". Nevertheless, the Council adopted new requirements based on a precautionary policy previously implemented by the State of California, which are set forth in the Council's revised BMP. Among other things, the BMP require transmission line applicants to adopt "no cost" line designs for lowering magnetic fields from new or reconstructed lines, and to identify "low cost" opportunities for making further reductions. The BMP establish a "benchmark" for "low cost" field reduction measures of 4% of the project cost, including substation and switching station costs. (In a case such as this, where the overall project would be located in several states, only the Connecticut project cost is considered in calculating the 4%.). "Low cost" measures for reducing magnetic fields are required to achieve at least a 15% reduction in the fields that would be associated with the "base line" construction that would be consistent with standard good utility practice and no-cost field reduction measures.

Another requirement is that an electric transmission applicant present evidence of any new developments in scientific research addressing the potential health effects of transmission line magnetic fields or changes in scientific consensus group positions regarding them.

Q. Has CL&P provided such an analysis of new developments in scientific knowledge concerning potential health effects of MF or position changes regarding MF in its Application?

A. Yes. CL&P retained William H. Bailey, Ph.D. of Exponent to perform such an analysis. Appendix 7D to the Application is a report by Dr. Bailey of his systematic literature review critical evaluation of epidemiology and *in vivo* studies published from January 1, 2006

through May 1, 2011. Dr. Bailey will be available to answer questions with respect to later publications later in this proceeding.

Q. What was Dr. Bailey's conclusion?

A. Dr. Bailey concluded that the updated research does not provide sufficient evidence to alter the basic conclusion of the World Health Organization and other health and scientific agencies that the scientific evidence is insufficient to conclude that EF or MF are a cause of cancer or any other disease at the levels we encounter in our everyday environment.

6.1 Pre- and Post-Project EMF Values for Proposed Base Line Construction

Q. What are the major sources of EMF associated with the Project?

A. The proposed and existing transmission lines on the existing ROWs are the major sources of EMF nearby. Transformers and other equipment within the associated substations and switching station are also potential EMF sources, but would have little or no impact on exposure to the general public experience indicates that EMF levels from substations and switching stations attenuate sharply with distance and will often be reduced to a general ambient level at the substation property lines. The exception is where transmission and distribution lines enter the substation property.

Q. Has CL&P arranged for measurements of existing electric and magnetic field levels along the existing ROWs to be made, as required by the BMP?

A. Yes. Spot measurements of electric and magnetic fields were taken by Exponent on July 7 - 8, 2011 at several locations along and adjacent to the existing ROW along the Proposed Route and sections of the potentially viable route variations described in Volume 1A, Section 15, in accordance with standard industry protocol. The measurements were focused on sections where groups of residences are near the ROW or where potential statutory facilities are

nearby**,** as described in the Council's Application Guidelines. The measurement results are provided in Tables 7-3, 7-5, 7-7, 7-13 and 7-21 of the Application**.** Additional measurements were taken at the same locations on December 16, 2011. The measurements taken on both occasions are set forth in Table CCM-1 below.

Table CCM-1
Spot Measurements of Magnetic Fields in 2011

	West/North ROW Edge		**East/South ROW Edge**	
Location	July 7-8, 2011	Dec. 16, 2011	July 7-8, 2011	Dec. 16, 2011
12 Elvira Heights, Putnam			25.4 mG	10.6 mG
350 Church Street, Brooklyn	8.1 mG	1.5 mG		
87 Bassetts Bridge Road, Mansfield			28.4 mG	8.2 mG
48 Bassetts Bridge Road, Mansfield	6.6 mG	2.2 mG		
385 Storrs Road, Mansfield			38.8 mG	4.1 mG
164 Stafford Road, Mansfield	8.2 mG	1.7 mG		
4 Scalise Drive, Columbia			5.8 mG	2.8 mG

Measurement locations were approximately at ROW edges. Conductor heights above ground are not the same at each location.

Q. What type of information do these measurements provide?

A. The measurements of magnetic fields are only a snapshot of conditions at a single moment in time at a specific location. Within a day, and over the course of days, months, and seasons, the MF level changes at any given location, depending on the amount and patterns of power supply and demand within the state and surrounding region. A measurement taken at any given moment may or may not be representative of a MF level that is typical or average at that location. Thus, since the July measurements were taken at a time of relatively high current loadings, they are similar to the values one would expect with peak-day loads. On the other

hand, the December measurements are lower and closer to (although somewhat less than) the levels associated with annual average loads.

Q. Did CL&P provide calculated estimates of EF and MF along the ROW before and after the proposed construction, as required by the Council's BMP?

A. Yes.

Q. How were EF and MF calculated for this purpose?

A. As described more fully in Section 7 at 7.3.2, CL&P estimated (1) annual peak load (APL) conservatively from ISO – NE's projected 90/10 system peak loads, (2) peak-day average loads (PDAL) over 24 hours at 80% of the system's hourly peak load (based on the 90/10 peak-load days) and (3) annual average loads (AAL) based on a 60 % annual load factor for the New England Transmission System. EF and MF were calculated using computer algorithms developed by the Bonneville Power Administration, an agency of the United States Department of Energy. The "pre-project" conditions included transmission system changes approved by ISO-NE and included in their system reliability models as of December 2010, and which have expected in-service dates before 2015, including the Rhode Island Reliability Project, the Greater Springfield Reliability Project and the Manchester to Meekville Junction Project. The "post project" conditions for modeling the new and existing lines assumed a 2020 system topology, including the construction of not just Interstate but also the Central Connecticut Reliability Project, the remaining NEEWS Project. That assumption was made so as to reflect the higher possible power flows – and thus higher levels of magnetic fields - that the completed NEEWS projects could together enable along the Interstate ROW. For the MF calculations, CL&P then conservatively modeled power flows over the Connecticut Import interface at its upper limit for APL, at 75% of the upper limit for PDAL and at 60% of the upper limit for AAL.

Another assumption for all EF and MF calculations was that the bottom conductor height of each line above ground was a typical conductor height for that each line at midspan. Because at most locations along a ROW the line conductors are higher above ground than these assumed values, the calculated EF and MF values at ROW edges in such locations will be higher than measured values, all else equal.

The Application and FMDP present calculations of magnetic field levels at 25-foot intervals for the each base design, alternative design, and route variations at AAL, APL and PDAL, together with associated electric field levels. We consider the AAL case to be most useful reference for predicting field levels for any 'typical' day. Accordingly, we used these levels to develop the profiles and tables presented in the text of the Application, and the comparisons made in this testimony.

Q. How would you characterize the nature of the calculation estimates for MF levels?

A. As the result of the choice of conservatively low conductor heights, conservatively high system load projections and generator dispatches to produce relatively high New England East-West and Connecticut Import interface power transfers, the MF calculations will yield conservatively high estimates.

Q. How are the estimated pre-Project and post-Project magnetic field levels presented in the Application?

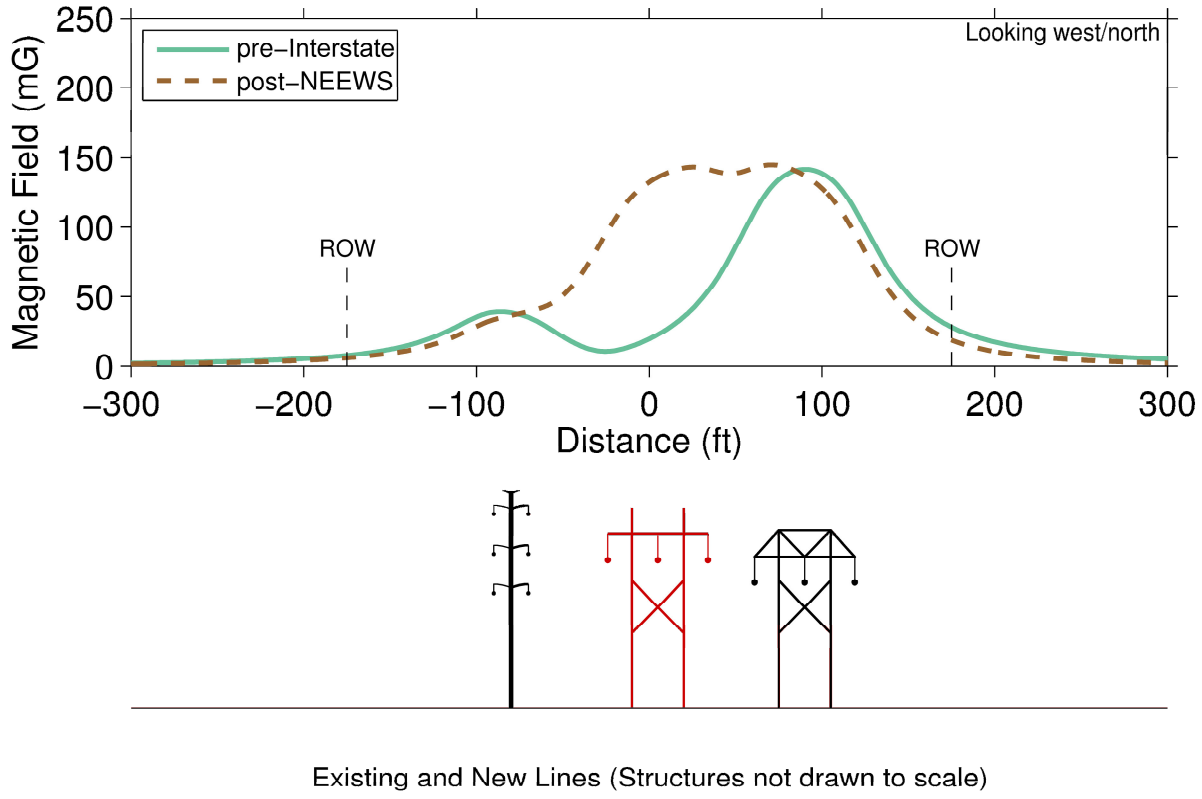
A. First, in the main text of Section 7, the estimated edge-of-ROW AAL electric and magnetic fields at each edge of the ROW are presented in tabular form for each ROW cross section. An example of such a table (from p. 7-19 of the Application), relating to Cross Section 1, is provided below:

Table CCM-2: Pre-Interstate (2015) and Post-NEEWS (2020) EMF Levels at the Edge of the ROW at Annual Average Loading (AAL) – Card Street Substation to Babcock Hill Junction – XS-1

Cross-Section	Magnetic Field (mG)		Electric Field (kV/m)	
	West/South ROW	East/North ROW	West/South ROW	East/North ROW
XS-1 – Pre	**7.6**	**28.2**	**0.06**	**1.20**
XS-1 – Post	**5.8**	**18.7**	**0.06**	**1.18**

In addition, the Application provides a figure illustrating the pre-Interstate (2015) and post-NEEWS (2020) curves of magnetic fields across and beyond the ROW, covering a distance of 300 feet from the center of the ROW in each direction. An example of these figures (from p. 7-18 of the Application), again relating to Cross Section 1, is provided below:

Figure CCM-3: Profile XS-1: Card Street Substation to Babcock Hill Junction – Magnetic Fields under Pre-Interstate (2015) and Post-NEEWS (2020) Conditions at AAL



Where a BMP configuration has been identified for part of a Cross Section, both the "base case" and BMP values are provided in Section 7.

Finally, there is extensive additional information concerning magnetic fields in the FMDP (Appendix 7B), which we will discuss later in this testimony.

Q. Do you have any corrections or supplements to the pre and post project magnetic field calculations presented in the Application?

A. Yes. We have a correction:

The calculated magnetic field tables for each cross section provided in Appendix 15C (Volume 1A) of the Application does not include data for the Mount Hope Underground Variation and some of the data was wrongly labeled. Corrected Appendix 15C tables are provided as Attachment CCM-10.

Q. Are you able to characterize the change in the overall magnetic field environment at the edges of and beyond the ROW that would be associated with construction of the new line, before considering potential reduction of the post-Project fields by the adoption of low-cost BMP line designs?

A. Yes. Of course, the specifics are different for each Cross Section. However, overall, the post-NEEWS AAL magnetic fields at the edges of and beyond the ROW are quite similar to the pre-Project fields. Pre-project, the fields on the west/north ROW edge range from 1.2 mG to 17 mG; post-NEEWS, the range is from 2.2 mG to 25.1 mG. On the east/south ROW edge, the pre-Project range is 5.1 mG to 35.2 mG, and the post-NEEWS range is 11.2 mG to 24.1 mG. Pre-construction, the fields are (with some exceptions) generally higher along the east/south edge than along the west/north edge, and this remains the case after construction. For

the great majority of Cross Sections, the fields on the east/south edge are modestly reduced by the construction, and those on the west/north edge are modestly increased.

Calculating weighted averages of the AAL magnetic field levels before and after construction of the Project provides a reasonable impression of the overall change in the magnetic field environment brought about by the Project. We calculated the edge-of-ROW AAL fields, weighting the levels for each Cross Section according to the length of the Cross Section as a proportion of the total length of the Connecticut portion of the project. Here are the results:

Table CCM-3
Weighted Average of AAL Magnetic Fields (Base Line Design)

	West/North ROW Edge	East / South ROW Edge
Pre-Project	5.54 Mg	23.02 mG
Post-NEEWS	8.79 mG	18.81 mG

If the increase on the west/north edge is netted against the decrease on the east/south edge, the difference is less than 0.1 mG.

Q. Why is there so little change in the overall magnetic field environment with the construction of the new 345-kV line?

A. As the Council has recognized in its BMP, locating a new line on an existing ROW adjacent to an existing line offers the opportunity to phase the conductors of the new line so that there will be partial cancellation of the magnetic fields associated with each of the two lines. As a result, the fields associated with the two lines at the ROW edge will be much lower than those that would be associated with a single line carrying the same amount of current, and lower than those that would be associated with each line if constructed on its own right-of-way. In this respect, using an existing ROW for a new line is itself a "no-cost" magnetic field

reduction strategy. Also in this case, the aggregate post-construction current loadings on the two lines in the ROW are much higher than the modeled pre-construction load, but the higher load is shared between two optimally phased lines, which produces significant field cancellation. The cancellation is particularly effective for the Card Street to Lake Road circuits, because they share the same terminal points and thus tend to share load equally. The circuits from the Lake Road Switching Station to the Rhode Island border have different terminal points in Rhode Island, so the currents in the two circuits will rarely be equal.

6.2 BMP Line Designs in "Focus Areas"

Q. How do you use the term "Focus Area" in the Application?

A. The BMP require that a transmission line applicant consider low-cost engineering designs to reduce magnetic fields in "publicly accessible areas" and particularly where portions of a project are adjacent to residential areas, public or private schools, licensed child day-care facilities, licensed youth camps, or public playgrounds. At the same time, the BMP establish the "benchmark" budget of 4% of project cost for such designs. The benchmark is 4% of the baseline project cost. In order to develop a presentation to the Council of potential low-cost MF-reducing designs that could be adopted consistently with the BMP, CL&P focuses on areas along the ROW where there are land uses that fit – or might be considered to fit – the description of those the Council has singled out for special attention. With respect to each of these "Focus Areas," CL&P considers a range of line design measures that could reduce magnetic fields, estimates the reductions that could be achieved, and estimates a cost for each measure. With this information, CL&P presents, and the Council may order, MF-reducing measures for specific parts of the project, consistently with the BMP.

Q. Where does CL&P provide this information concerning MF-reducing line designs, their effects, and their cost?

A. This information is presented in CL&P's FMDP, which is Appendix 7B to the Application.

Q. How many Focus Areas are considered in the Field Management Design Plan?

A. There are five Focus Areas, designated A through E. Their locations are indicated on the map included as FMDP Figure 1, a copy of which is Attachment CCM-11 to this testimony.

Q. Please provide a summary description of each of the Focus Areas and CL&P's analysis in the FMDP of potential MF-reducing line designs.

A. A summary description of each of these areas and CL&P's analysis is provided below:

6.2.1 Focus Area A

Focus Area A is an approximately 2.3-mile-long section of ROW in Coventry and Mansfield. Homes have been developed near each side of the ROW along crossing streets. The Council may or may not consider this are to be an adjacent "residential area". However, given the comparatively sparse settlement elsewhere along the ROW, this part of it appears to be a reasonable candidate for MF-reducing designs. The AAL magnetic field comparison for the ROW, before considering additional BMP measures is as shown in Table CCM-4 below:

Table CCM-4: Magnetic Field Comparison for Focus Area A: Base Line Design

XS-2 and XS-6 Configurations	Magnetic Fields for Annual Average Load Case		
	Maximum Level on ROW (mG)	North/West ROW Edge Level (mG)	South/East ROW Edge Level (mG)
Pre-Interstate (2015)	140.5	4.6	28.0
Post-NEEWS (2020) - Base-Line Case	146.9	7.2	18.4

CL&P analyzed six alternate line designs for Focus Area A, with estimated incremental costs for this section ranging from approximately $300,000 to approximately $9,300,000. Designs that resulted in a more than 15% decrease in magnetic field levels on one edge of the ROW, as compared to the magnetic fields with the base-line H-frame design, caused increases on the other side, though the increased levels were still lower than pre-Project levels. On balance, the most effective design for reducing MF was the Delta configuration, which decreased fields by 28% on one side of the ROW and increased them by 12% on the other, as shown in Table CCM-5 below:

Table CCM-5: Focus Area A
Base Line / BMP Comparison

Focus Area A XS-2 Cross Section Configuration	Typical Structure Height (ft)	Magnetic Field for Annual Average Load Case					Cost	
		Maximum Level on ROW (mG)	North ROW Edge		South ROW Edge		Selection Amount ($)	Project Increase (%)
			Level (mG)	Change (%)	Level (mG)	Change (%)		
Base Line Design H-Frame	85	146.9	7.2		18.4		$310,320,459	-
Alt 2 – Delta Configuration	110	143.6	5.2	-28%	20.6	12%	$13,040,737	1.3%

Similarly, as compared to the base line design, the MF at the nearest corners of the nearest homes went down on one side of the ROW and up on the other, as shown in the following table:

Table CCM-6: MF Levels at Nearest Corners of Homes in Focus Area A (AAL)

Facility	Distance to Nearest Edge of ROW (ft)[a]	Magnetic Fields for Annual Average Load Case		
		2015 Pre-Interstate (mG)	2020 Post-NEEWS	
			Base Line Design (mG)	Delta Design (mG)
Homes North of ROW	4	4.4	6.7	4.9
Homes South of ROW	5	25.2	16.2	18.3

[a] Distance is to the home closest to the ROW edge. Homes further from ROW edges will have lower field levels.

While the Delta design appears to qualify as an MF-reducing line design, the Council may consider that the magnetic field reduction it offers on one side of the ROW is offset by its slight increase of fields on the other side, the incremental visual impact of its increased height, and its incremental cost.

6.2.2 Focus Area B

Focus Area B is a 0.9-mile-long segment of ROW in Mansfield. It passes by the Mount Hope Montessori School, which is both a licensed child day-care facility and a school. The Application states that in this Focus Area the line also passes near two home-based child day-care facilities. However, since the Application was filed, one of those facilities (the Come Play With Me Day Care) has apparently ceased operations, since it is no longer listed on the CT Department of Public Health website as a licensed day-care facility.

The pre-Project and post-NEEWS edge-of-ROW levels of magnetic fields in Focus Area B are the same as those in Focus Area A, shown in Table CCM-4 of this testimony, and as with Focus Area A, the Delta design appears to be the preferable MF-reducing design, were one to be implemented. (See Table 7 at page 7B-18). However, as with Focus Area A, the Delta design only achieves a reduction on one side of the ROW, with a slight increase on the other. The effects at the school and the remaining day-care facility are even less impressive. As shown in Table CCM-7 below, the baseline H-frame design actually reduces the AAL magnetic field

levels at the nearest corner of the Mount Hope Montessori School and the one remaining day care in this Focus Area, to a greater extent than the Delta configuration would.

Table CCM-7: MF Levels at Nearest Corners of Statutory Facilities in Focus Area B

Facility	Distance to Nearest Edge of ROW (ft)	Magnetic Fields for Annual Average Load Case		
		2015 Pre-Interstate (mG)	2020 Post-NEEWS	
			Base Line Design (mG)	Delta Design (mG)
Mount Hope Montessori School	137	1.7	1.2	1.4
Green Dragon Day Care	196	2.7	0.9	1.7

The Delta design would be 25 feet taller than the base line H-frame design, and would add more than $1,000,000 to the Project cost. Accordingly, CL&P recommends a standard H-frame line as the BMP design for this focus area.

6.2.3 Focus Area C

Focus Area C abuts Focus Area B. It is the Hawthorne Lane area discussed previously in this testimony. As noted there, the Hawthorne Lane residents are concerned with the visibility of the ROW and lines after the new line is built. The proximity of their homes to the ROW also resulted in the designation of this Focus Area. The edge-of-ROW pre-Project and post-NEEWS magnetic fields levels, with the base line H-frame construction, are the same for this Focus Area as for Focus Areas A and B. The BMP alternative that CL&P designed and analyzed at the request of the residents, a vertical configuration of both the existing and new lines on a relocated ROW (the Hawthorne Lane ROW Shift), results in a reduction of an already low magnetic field level on the side of the ROW that is nearer to the Hawthorne Lane homes, and an increase on the other side, as follows:

Table CCM-8: Focus Area C

Focus Area C XS-2 Cross Section Configuration	Typical Structure Height (ft)	Magnetic Field for Annual Average Load Case					Cost	
		Maximum Level on ROW (mG)	North ROW Edge		South ROW Edge		Selection Amount ($)	Project Increase (%)
			Level (mG)	Change (%)	Level (mG)	Change (%)		
Base Line Design H-Frame	85	146.9	7.2		18.4		$3,311,244	-
Alt 7 (Hawthorne Lane ROW Shift) Vertical Configuration of Two Lines on Relocated ROW	130	80.2	2.0	-72%	22.9	25%	$5,084,530	0.8%

The Hawthorne Lane ROW Shift also results in a small reduction of fields at all but one of the nearby homes, beyond that achieved by the base line design, as follows:

Table CCM-9: MF Levels at Nearest Corners of Homes in Focus Area C with Alternative 7 (Hawthorne Lane ROW Shift)

Facility	Distance to Nearest Edge of ROW (ft)[a,b]	Magnetic Fields for Annual Average Load Case		
		2015 Pre-Interstate (mG)[c]	2020 Post-NEEWS	
			Base Line Design (mG)[c]	Alternative 7 (mG)
Homes North of ROW	125 (70)	2.6	2.5	0.5
Home South of ROW	185 (240)	2.0	0.6	1.0

[a] Distance is to the home closest to the ROW edge. Homes further from ROW edges will have lower field levels.
[b] Distances from ROW edges before ROW shift are shown in parentheses.
[c] Pre-Interstate and Base Line Design magnetic fields based on current ROW limits before relocation during the Project.

As shown in this table, pre-Project AAL magnetic fields at the nearest homes are reduced by the base line H-frame design. Under these circumstances, CL&P recommends the base-line configuration as the BMP design. However, as we previously testified, if the Hawthorne Lane residents perform all of the conditions required to make the Hawthorne Lane ROW Shift feasible, and the Council were to order it, CL&P would be prepared to construct it.

6.2.4 Focus Area D

Focus Area D is a one-mile-long section of ROW in Brooklyn. There are two home-based child day-care facilities to the north of the ROW (only one of which is close to the ROW) and homes are located along both sides of the ROW. The northern side of the ROW has more homes than the south. The comparison of pre-Project and post-NEEWS AAL levels using the base line H-frame design is the same as that for Focus Areas A, B, and C. As with Focus Areas A and B, of all the alternate designs analyzed, the Delta configuration appeared to be most consistent with the BMP criteria. The comparison of the base line and Delta options is shown in Table CCM-10 below:

Table CCM-10: Focus Area D

Focus Area D XS-6 Cross Section Configuration	Typical Structure Height (ft)	Magnetic Field for Annual Average Load Case					Cost	
		Maximum Level on ROW (mG)	North ROW Edge		South ROW Edge		Section Amount ($)	Project Increase (%)
			Level (mG)	Change (%)	Level (mG)	Change (%)		
Base Line Design H-Frame	85	146.9	7.2		18.4		$5,118,233	-
Alt 2 – Delta Configuration	110	143.6	5.2	-28%	20.6	12%	$6,529,045	0.7%

In this area, the 28% reduction would be achieved at the edge of the ROW where there are more homes, and on the side where there is a day care near the ROW. The comparative MF levels at the two day-care facilities in this Focus Area are:

Table CCM-11: MF Levels at Nearest Corners of Statutory Facilities in Focus Area D

Facility	Distance to Nearest Edge of ROW (ft)	Magnetic Fields for Annual Average Load Case		
		2015 Pre-Interstate (mG)	2020 Post-NEEWS	
			Base Line Design (mG)	Delta Design (mG)
Jacqueline Ben Day Care	11	4.2	5.9	4.5
Susan Kirkconnell Day Care	497	0.4	0.1	0.3

As with Focus Areas A and B, the Council may consider that, given the modest changes in the magnetic field levels resulting from the use of the base-case line design, the benefit of the Delta design in reducing magnetic fields on one side of the ROW is offset by the additional visual impact of the taller structures. The height consideration may have more significance for this Focus Area than for others. This segment of ROW is approximately 2,800 feet west of the Danielson Airport, and the Federal Aviation Administration has issued Notices of Presumed Hazard (NPHs) for seven H-frame structures along the existing 345-kV line. The new structures could also result in NPHs. Coordination with the FAA would be required to resolve issues related to the NPHs. This effort could be complicated by the choice of the taller structures.

6.2.5 Focus Area E

Focus Area E is a residential area known as "Elvira Heights." A number of homes in Elvira Heights are located a short distance southeast of the ROW, just beyond a parallel gas-pipeline ROW. The new line in this area would be constructed farther away from these homes than the existing line. The base-case H frame line design produces higher magnetic field levels on both edges of the ROW when compared to the 2015 pre-Interstate conditions, as shown in Table CCM-12:

Table CCM-12: Magnetic Field Comparison for Focus Area E: Baseline Construction

XS-12 Configuration	Magnetic Fields for Annual Average Load Case		
	Maximum Level on ROW (mG)	North/West ROW Edge Level (mG)	South/East ROW Edge Level (mG)
Pre-Interstate (2015)	36.1	1.2	7.2
Post-NEEWS (2020) - Base-Line Case	112.7	2.2	20.4

CL&P analyzed the effect on MF levels of six alternative line designs for the new line, including a split-phase configuration. None of them would achieve a magnetic field reduction on either ROW edge, as compared with the base-line design. *See,* Table 15 at page 7B-24 of the

Application. Accordingly, CL&P analyzed four additional alternatives, each of which would involve rebuilding the existing line in this focus area in addition to building the new line. In general, CL&P is reluctant to rebuild existing lines as a BMP measure, as they are rarely low-cost options, particularly when the cost of necessary line outages is considered. However, of the four additional alternatives that were based on this approach, Alternative 9 appeared to be feasible within the BMP guidelines. This BMP alternative would involve reconstructing the existing line along its existing center line, and constructing the new line along side it, both on steel -pole structures with Delta-configured conductors. A comparison of the base line design and this alternative is shown in Table CCM-13.

Table CCM-13: Focus Area E: BMP Design Comparison

Focus Area E XS-12 Cross Section Configuration	Typical Structure Height (ft)	Magnetic Field for Annual Average Load Case					Cost	
		Maximum Level on ROW (mG)	North ROW Edge		South ROW Edge		Section Amount ($)	Project Increase (%)
			Level (mG)	Change (%)	Level (mG)	Change (%)		
Base Line Design H-Frame	85	146.9	2.2		20.4		$3,141,826	-
Alt 9 Two Delta Configurations with Pole Located on H-Frame Centerlines	110	73.2	1.8	-18%	13.3	-35%	$7,415,909	2.0

The magnetic fields at the nearest corner of the nearest home in Focus Area E would be modestly reduced if the alternative two-Delta configuration was implemented, rather than the base design, as shown in Table CCM-14:

Table CCM-14: MF Levels at Nearest Corners of Homes in Focus Area E

Facility	Distance to Nearest ROW Edge (ft)	Magnetic Fields for AAL Case 2020 Post-NEEWS		
		2015 Pre-Interstate (mG)	Base Line Design (mG)	Alternative 9 (2 Delta) (mG)
Homes Southeast of ROW	113	1.4	3.7	2.8

CL&P has strong reservations with respect to this design option and did not include its extra cost in the Project's cost estimate. The incremental cost to achieve a small reduction in field levels is $4.3 million, which would almost certainly be localized. In addition, the use of this alternative would affect environmental resources. Specifically, the use of Delta configurations for the new 345-kV line and the rebuilt existing line would:

- Decrease the amount of upland and wetland forest vegetation removal required along the north edge of the ROW by 10 feet, resulting in a 0.8-acre reduction in total forest removal (of this 0.8 acre, approximately 0.2 acre is forested wetland).

- Increase the amount of vegetation disturbed along the ROW, due to the construction activities within the ROW near both the existing 345-kV line and new 345-kV line. Assuming that the entire 140-foot-wide presently managed portion of the ROW would be affected, along with the 80-foot-wide area of additional vegetation removal along the north side of the ROW (refer to XS-12 BMP), 19.2 acres of scrub-shrub and forest vegetation would be affected. In comparison, the use of the base-case H-frame design for the new 345-kV line (with the existing line left in place) would affect approximately 11.3 acres of primarily forest vegetation including a minimal amount of scrub-shrub (managed) vegetation.

- Increase temporary and permanent effects to wetlands and watercourses as a consequence of rebuilding the existing line segment. This existing 345-kV line extends for approximately 0.2 mile through a wetland (W20-197); two of the existing transmission line structures (Nos. 9306 and 9307) are located in this wetland. Removing the existing H-frame structures and installing the new Delta line design structures would require temporary access and crane pads that would have to be located in wetland W20-197. The new Delta line structures also would have to be located in this wetland, and would represent a permanent loss of approximately 252 cubic yards of wetland habitat for three structures. In comparison, approximately 141 cubic yards of wetland habitat would be permanently lost for two H-frame structures installed in the same wetland. There would be an increase of approximately 0.3 acres of temporary impacts to wetland for the additional crane pads and no additional impacts for access roads.

6.2.6 BMP Conclusion

Q. In presenting the cost of the Connecticut portion of the Interstate Reliability Project, what assumptions has CL&P made with respect to incremental cost for BMP designs?

A. As stated in the Executive Summary (p. ES-23) and elsewhere in the Application, the estimated capital cost for the Project in Connecticut (including substation costs) of $213.7 million assumes that CL&P's base-line design is used throughout. Under the Council's 4% guideline, $8.5 million is the guideline budget for low-cost magnetic field mitigation. This amount would cover, for instance, the Delta design in Focus Areas A and D and the two-Delta design in Focus Area E.

Q. What is CL&P's recommendation for BMP expenditures?

A. CL&P leaves that judgment to the Council. However, CL&P does note the unusual circumstances of this case, where the pre-construction magnetic fields along the ROW edges are changed very little by the project. In such a case, the Council may well conclude that no incremental costs for additional MF reduction are warranted. Or the Council could determine that, given the significant collateral benefits of the Hawthorne Lane ROW Shift, allocation of funds to it (equal to approximately 0.8% of the Project cost) is a better use of funds than constructing the BMP designs identified for Focus Areas A, D, or E. CL&P does not request approval of this alternative, but would be prepared to implement it, provided that the Hawthorne Lane Residents are able to effect all of the conditions precedent to the necessary real estate transactions.

Q. Is CL&P prepared to build any of the BMP alternative designs for the Focus Areas identified in the FMDP if so ordered by the Council?

A. Yes.

Q. Whether the Council selects the base line design throughout the Project or orders other line designs identified in the Application, will the Interstate ROWs provide an adequate buffer zone as required by the BMP to protect the public health and safety,

taking into consideration, among other things, the residential areas, the private schools, and the licensed child day-care facilities along the proposed route and the existing overhead lines on the ROW?

A. Yes. The horizontal and vertical clearances of the existing and proposed lines will be in full compliance with the National Electrical Safety Code, and the lines will comply with the BMP. The existing ROW is typically 300 feet wide or more in all populated areas, and that width will provide an adequate buffer zone.

7.0 UNDERGROUND ALTERNATIVES TO THE PROJECT ROUTE

Q. In its analysis of line-route alternatives for the Project 345-kV lines, what challenges did CL&P face?

A. Alternatives must meet routing objectives in three states while achieving the required reliability improvements to the transmission system. In particular, practical route alternatives were defined by the locations of the existing substations and switching stations, CL&P's Card Street Substation, CL&P's Lake Road Switching Station, National Grid's West Farnum Substation and National Grid's Millbury Switching Station, to which the new 345-kV transmission lines must connect cost-effectively and efficiently, while minimizing adverse environmental, cultural and economic effects.

Q. What were the specific route selection objectives used in the initial planning and in the identification of alternative routes for Interstate?

A. Route selection objectives included:

- Comply with all statutory requirements, regulations and state and federal siting agency policies.

- Maximize the reasonable, practical and feasible use of existing linear corridors (e.g., transmission lines, highways, railroads, pipelines).

- Minimize adverse effects to sensitive environmental resources, significant cultural recourses (archaeological and historical) and on designated scenic resources

- Minimize conflicts with local, state and federal land use plans and resource policies

- Minimize the need to acquire property by eminent domain

- Maintain public health and safety

- Achieve a reliable, operable, and cost-effective solution

Q. Did overhead line construction on existing ROWs best meet these objectives?

A. Yes, it did.

Q. Did CL&P nevertheless consider an all-underground line and route for the Project?

A. Yes we did, as we are required to do by statute.

Q. What circumstances warrant consideration of underground transmission cable systems?

A. As the Council recognized in its Docket 370 Opinion concerning GSRP, underground electric cables may be used in situations where overhead transmission lines are undesirable or impractical due to environmental, social, construction or regulatory issues. An underground cable system will be considered for applications where overhead line construction is impossible or impractical, such as where extensive water bodies must be crossed (as in the case of the Long Island Sound cables). Overhead lines are often found to be impractical in densely settled urban areas such as New York City and Boston. In some circumstances (as was the case with a 24-mile segment of 345-kV line on the Middletown – Norwalk project), expansion of an overhead line ROW can require the acquisition of so many houses that the social

cost is undesirable and the economic cost is close to that of the extra cost of underground line construction. Finally, Connecticut statutes require applicants seeking approval of electric transmission lines from the Siting Council to consider both all-underground construction of the proposed line and, as discussed later in this testimony, underground construction of segments of a 345-kV line that, if built overhead, would be adjacent to a "residential area" or other specified land uses, sometimes collectively called, for convenience, "statutory facilities".

Q. What considerations must be taken into account in evaluating an underground alternative to an overhead 345-kV line?

A. First, the fundamental differences between the transmission technology of overhead lines and underground cable systems must be considered. If underground construction is found to be technically achievable, its impact on reliability and operability of the system must still be considered. Second, the availability and suitability of a potential route must be evaluated. Finally, when all of these considerations have been taken into account, the cost of underground line construction is evaluated, and often proves decisive.

Q. What are the technical differences that must be considered for evaluating 345-kV underground line facilities?

A. There are many technical considerations. For instance,

(1) When long lengths of underground 345-kV cables are installed in suburban or rural settings, which usually are remote from strong electrical sources, the large amounts of cable-charging current associated with long cable lengths, combined with moderate system strength, require careful consideration to prevent damage and disruptions to the transmission system and potential damage to customer equipment;

(2) Because underground 345-kV cables have much lower current-carrying capability, to achieve the same power-transfer capacity as an overhead transmission line, multiple underground cables must be installed;

(3) Special switching devices and large shunt reactors may be required to compensate for the high capacitive charging of underground 345-kV cable systems so as to prevent unacceptably high system voltages during normal operating conditions. These devices add operating complexity, decrease system reliability, require additional land, and add appreciable cost;

(4) When underground cables are installed in isolated segments of an overhead 345-kV transmission line, a line transition station must be installed where the overhead transmission line conductors and the underground cables connect. Within the transition station, switching equipment to isolate the underground cables from the overhead line conductors and large shunt reactors may be installed, depending upon the underground cable segment's location in the line and its length;

(5) When transmission lines or transformers are switched in a transmission system that has a circuit made up of overhead line and underground cable sections, potential problems can arise because of traveling wave reflections; and

(6) Because of these technical considerations and lower electrical impedances of cables, detailed 60-Hertz load-flow and harmonic transient voltage studies would have to be conducted by power-system engineers to determine the maximum length of 345-kV underground cables that could be installed at any location on the transmission grid without adversely affecting the New England transmission system.

Q. Please explain the transmission system operational considerations related to the use of underground cables.

A. Complexity in operation of 345-kV underground cable systems can arise as follows:

(1) When a long underground cable circuit or circuit segment is initially energized, even though it may not be carrying any load, all associated shunt reactors need to be energized to maintain voltages within acceptable levels. When this circuit starts to carry load, the voltage on portions of the system will instantaneously drop until a sufficient percentage of shunt reactors can be disconnected. If the shunt reactors are not sized properly, or the steps in which a shunt reactor's impedance is changed are too large, unacceptable voltage swings can occur on the system; and

(2) Because only a portion of the shunt reactors are in service (typically one-third) and the remaining portion of the shunt reactors cannot be connected instantaneously to increase their compensation for the capacitive charging of the cables, voltages could rise to unacceptably high levels within portions of the transmission system. Unlike an all-overhead transmission system, when long underground cables are present, system operators must be thoroughly trained on the sequential steps that must be followed when placing a system element in service or removing it from service and the interdependence of their actions on the transmission system to ensure that voltages remain within acceptable ranges. In critical or emergency situations, the time required to perform these crucial operating steps could be detrimental to the integrated transmission system.

Q. Please explain the power-quality concerns presented by the use of underground cables.

A. Day-to-day switching events, like the energizing and de-energizing of transmission circuits that occur in the normal operation of the transmission system, can cause amplification of harmonic voltages and current that can lead to system component failures and severe power quality problems. These failures/problems can have a detrimental effect on customer equipment and processes.

Q. Are underground cables more reliable because they are less likely to be damaged by storm events and other external forces?

A. No, extra high voltage lines, such as the 345-kV line in this instance, are not more reliable when buried cables are used rather than overhead conductors. Although outages on underground cables caused by storms or other external forces occur less frequently, when an outage does occur – whether as a result of external forces or internal defects a significantly longer time is required to isolate a faulted segment of cable before repairs may commence; and once the faulted area is located, repair times can take weeks to complete vs. hours or a few days for most overhead line failure modes.

Q. What assumption did CL&P make as to the use of underground technology in its evaluation of all-underground line routes from Card Street Substation to the Connecticut/Rhode Island border?

A. We assumed that there was no technical "fatal flaw" (e.g., serious overvoltage conditions) that would prevent building a 345-kV cable system underground.

Q. What assumption did CL&P make as to the particular underground cable system technology that would be employed in an all-underground alternative?

A. CL&P assumed that a solid-dielectric, cross-linked polyethylene (XLPE)-insulated cable system would be used, and that the cables and associated splice vaults would be

installed and maintained in accordance with standard procedures. Nine cables would be installed; six would be operated at any one time.

Q. Does the Application describe XLPE-insulated cable systems?

A. Yes, Appendix 14A in Volume 1A of the Application contains a very useful tutorial on the XLPE and other underground cable technologies.

Q. What criteria were used to evaluate potential underground line-route options?

A. Criteria included siting away from significant environmental resources; availability of useable ROW for the construction work area (typically 40 to 60 feet wide) and burying three splice vaults (each typically 10 feet x 10 feet and 32 feet in length, external dimensions) every 1,600 feet; engineering considerations such as relatively straight and direct routes with gradual slopes and inclines (to minimize construction and maintenance costs and avoid downhill cable migration); and social considerations, such as minimizing installation through residential areas and central business districts, as well as avoiding potential conflicts with other in-ground utilities, and land availability (2 to 4 acres) for line transition stations.

Q. Of the 2-4 acres needed for a line transition station, how much land is needed for a fenced area around the equipment?

A. For the transition stations that would be used in this project, a fenced area of approximately 1.5 to 2 acres would be needed for the above-ground electrical equipment, the overhead and underground lines, and access road. Approximately 1.7 acres would be needed for connecting three sets of underground 345-kV cables to one overhead 345-kV line at a typical transition station. That area would increase if compensating shunt reactors were required. The

additional land outside the fenced-in area is necessary for setback distances from property lines, cable and overhead line entries, access and site-specific requirements.

Q. What "all-underground" construction between Card Street Substation and the state border did CL&P consider?

A. CL&P considered two "all-underground" line-route alternatives involving the use of a combination of highway and transmission line ROWs. One 39.1-mile route would use a combination of ROWs (road and transmission line) with a 1.1-mile segment overhead. The other route would be aligned entirely underground along road ROWs and CL&P's ROWs.

Q. What did CL&P's evaluation of these alternatives conclude?

A. The Council's regulations require a route to be "technically, environmentally, and economically practical". These "all-underground alternatives" were assumed to be technically practical although causing operating complexity. CL&P concluded that using either of these "all-underground" lines would be less reliable than the proposed overhead lines, significantly more costly (with high costs to Connecticut consumers) and would pose environmental and engineering issues.

Q. Briefly describe the cost comparisons of the "all-underground" variations.

A. For the "all-underground" line with a 1.1-mile segment overhead, the initial capital cost is estimated to be approximately $1.1 billion as compared to $193 million for all-overhead lines, with life-cycle costs estimated to be $1.6 billion as compared to $319 million for all-overhead lines. For the entirely "all-underground" alternative, the initial capital cost is also estimated to be approximately $1.1 billion, with life-cycle costs estimated to be $1.6 billion. This vast cost differential typically becomes much greater when the cost to Connecticut ratepayers is considered, because the excess costs of underground line construction, as compared

to overhead line construction, must be assumed to be "localized" under the rate treatment explained by the need panel in their testimony. By way of illustration, considering the preliminary estimated initial capital cost for the line of $193 million (overhead) as compared to $1.1 billion for the "all underground" alternative, the cost to Connecticut ratepayers for the overhead line construction would be $52.1 million ($193 M x 27% = $52.1 M), as compared to $959.1 million for underground line construction [$1,100 M - $193 M = $907 M + $52.1 M = $959.1 M]. In either case, Connecticut ratepayers would also pay a 27% share of the Card Street Substation and Lake Road Switching Station costs (which we assume for this comparison purpose to be the same for both overhead and underground line construction) and the same share of the cost of the Rhode Island and Massachusetts construction.

Q. Are the proposed Interstate facilities cost effective and the most appropriate based on a life-cycle cost analysis of the facilities and underground alternatives to the facilities?

A. Yes.

8.0 ROUTE VARIATIONS AND THE REBUTTABLE PRESUMPTION FOR STATUTORY FACILITIES

Q. Why have you presented "route variations" – alternatives to sections of the proposed route?

A. The Application presents alternate routes for two reasons. The longest of the alternatives – the Willimantic South overhead and underground alternatives – were developed as alternatives to traversing the USACE properties in Mansfield and Chaplin. The other four route variations were developed to analyze the feasibility of avoiding constructing the new line overhead in proximity to statutory facilities or homes.

Q. Do you expect that either of the Willimantic South variations will be a necessary alternative to traversing the USACE properties?

A. No. At the time we developed the Willimantic South variations, we had not fully developed the "No ROW Expansion Option" for the USACE properties. Should CL&P not succeed in obtaining additional easement width through the USACE properties, it will still be able to locate the new line there by employing the No Row Expansion Option. Although this would be a more expensive and complex endeavor, it would be preferable to a 12-mile greenfield overhead line route or an 11.5-mile underground line route, from both cost and environmental standpoints. In addition, we are now hopeful that the USACE will grant the additional easement width required for the 4.8-Acre Minimal ROW Expansion Option, which will allow the existing line to be left in place when the new line is constructed. Accordingly, CL&P is not pursuing the Willimantic South route variations at this time.

Q. Please explain why the other four route variations are being presented to the Council.

A. Section 16-50p(i) of the General Statutes establishes a rebuttable presumption that construction of an overhead 345-kV line "adjacent to" any of certain specified land uses, sometimes referred to by the convenient term "statutory facilities" would be inconsistent with the purposes of the Public Utilities Environmental Standards Act. These statutory facilities include public or private schools, licensed child day-care facilities, licensed youth camps and public playgrounds. The presumption may be overcome by a showing that an underground construction necessary to avoid building the new line next to the statutory facility will impose an unreasonable burden on ratepayers. These route variations were developed in order to analyze whether the presumption could be overcome.

Q. Will the new 345-kV overhead lines in the Project be adjacent to any licensed youth camps and public playgrounds?

A. No, they will not.

Q. Will it be adjacent to any schools or licensed day-care facilities?

A. Yes, one of the new lines may be adjacent to certain home-based child-care facilities and a licensed child day-care facility/school. The areas that include such facilities were treated as BMP focus areas, described as Focus Areas B and D, respectively.

Q. The final category of statutory facilities is "residential areas." Will the new 345-kV lines in the Project be adjacent to any residential area, as the Council has applied that term?

A. It is possible that the Council may consider groups of homes along the existing ROW to be sufficiently dense and integral to be considered a residential area, and in some cases an adjacent residential area. These areas were treated as BMP focus areas, described as Focus Areas A, C, D and E, respectively, in the preceding section of this testimony.

Q. Did CL&P evaluate if overhead line construction on any of these sections of the ROW could be avoided by re-routing the line as an overhead line to a new ROW?

A. Yes. We identified both an overhead and an underground line and route alternative to a section of ROW in Brooklyn that would be adjacent to a home day-care facility and to residences. This is the section of ROW previously discussed as Focus Area D. The location of the Brooklyn Overhead Variation is shown on Figure 15-6 from the Application, a copy of which is Attachment CCM-12 to this testimony. We were unable to identify any practical and feasible overhead alternatives for circumventing the other Focus Areas with overhead line-route variations.

Q. Please describe the Brooklyn Overhead Variation.

A. The Brooklyn Overhead Variation would extend for approximately 3.3 miles in Brooklyn and Pomfret on a new "greenfield" 150-foot-wide ROW. Easements would have to be obtained from private landowners.

Q. Please describe the underground line-route variations presented in the Application.

A. As noted previously in Section 7 of this testimony, the Application identified one underground variation, the Willimantic South Underground Variation, which we have since withdrawn from consideration. The three other underground variations identified in the Application are alternatives to the overhead line construction in Focus Areas A, B, and D. Their locations are shown generally in dashed lines on Attachment CCM-13, and in detail on the aerial-photography-based alignment maps in Volumes 9 and 11 of the Application. These variations would be constructed within CL&P's existing ROW, except for transition stations that would need to be built in whole or in part on property adjacent to CL&P's existing ROW but outside of it. These three variations are called the Mansfield Underground Variation, the Mount Hope Underground Variation, and the Brooklyn Underground Variation.

Q. What would be the purpose of each of these variations?

A. Each would replace a portion of the proposed overhead line with an underground cables segment, in order to avoid building an overhead 345-kV line on the existing ROW in the vicinity of potential statutory facilities and/or nearby residences (should the Council determine that the residences constitute a statutory "residential area") and that the cost of underground line construction would not be unreasonable.

Q. What facilities would be required for the underground line variations?

A. Each would require the installation of a 345-kV cable system consisting of power and other cables within conduits in a trench and within splice vaults (one per set of three XLPE cables), and two line transition stations.

Q. Please describe the Mansfield Underground Variation.

A. The Mansfield Underground Variation would extend for about 0.7 mile in the western portion of Mansfield, replacing 0.7 mile of the overhead line in the vicinity of a group of seven homes that are within 300 feet of either side of the ROW along Highland Road and Stone Ridge Road. The proposed new overhead line would be installed adjacent to and north of the existing line; three homes are within 300 feet of the nearest conductor on that line. The existing 345-kV line would separate the new overhead line from the south/east ROW edge; four homes would be within 300 feet of the south/east ROW edge. The underground cables variation would be installed within the existing CL&P ROW. Two line transition stations would be required - the western line transition station would be located partially within and adjacent to CL&P's existing ROW, on a parcel of privately-owned land situated southwest of Woodmont Drive, and the eastern line transition station, which also would encompass a privately-owned site within and adjacent to CL&P's existing ROW, would be located east of Highland Road and Stone Ridge Road, near Conantville Brook. CL&P would have to acquire easement rights to install the underground cable system within the overhead line ROW, and would have to purchase 2 to 4 acres of land for each transition station. The Mansfield Underground Variation would avoid a new overhead line being constructed in the vicinity of he homes in Focus Area A. It is illustrated by Figure 15-2 at page 15-17 of Volume 1A and Ex. 3 of Volume 9 of the Application.

Q. Please describe the Mount Hope Underground Variation.

A. The Mount Hope Underground Variation as presented in the Application would extend for 1.1 miles in the southeastern portion of Mansfield, west of Mansfield Hollow State Park, replacing 1.1 miles of the overhead line. *See,* Application, Vol. 9. This variation was designed to avoid the Mount Hope Montessori School (also a licensed child day-care facility) and two licensed home day-care facilities, described in the discussion of Focus Area B. However, as previously noted, one of these day-care facilities (the Come Play With Me Day Care) has apparently surrendered its license. Since this facility was the most westerly facility that this variation was designed to avoid being adjacent to an overhead line, the variation could be shorter than presented, terminating on NU property to the east of Storrs Road, rather than traversing Storrs Road.

The remaining licensed child day-care facility (Green Dragon) would be separated from the new overhead line by the existing line, and would be about 340 feet away from the new line. The area of the school that is nearest to conductors of the new line if build overhead, a play-yard, would be about 240 feet away. The cables in the underground variation would be located in the existing CL&P ROW. CL&P would have to obtain underground line easement rights and purchase land for each transition station in the configuration presented in the Application, but could locate the westerly station on CL&P land if it were re-configured in light of the new status of the Come Play With Me Day Care. The Mount Hope Underground Variation is illustrated by Figure 15-4 at page 15-40 of Volume 1A, and in Ex. 3 of Volume 9 of the Application.

Q. Please describe the Brooklyn Underground Variation.

A. The Brooklyn Underground Variation would extend for 1.4 miles starting at a point northeast of the proposed 345-kV transmission line structure No. 208 on CL&P's ROW

and end near proposed structure No. 222 on CL&P's ROW north of Day Street Junction, replacing 1.4 miles of the overhead line in the vicinity of home-based child day-care facilities located in Focus Area D. One facility would be eleven feet north of the ROW, about 135 feet from the nearest conductor of the new line if it is built in a Delta configuration. The other facility is 497 feet from the closest point of the north edge of the ROW. That facility is likely not adjacent to the new line due to intervening properties and the distance from the ROW. The cables in the underground variation would be located in the existing CL&P ROW. CL&P would have to acquire up to four acres of privately-owned property for the western transition station, as well as underground easement rights. The Brooklyn Underground Variation is illustrated by Figure 15-4 at page 15-40 of Volume 1A, and in Ex. 3 of Volume 9 of the Application.

Q. Has CL&P estimated the cost of each of the potential underground variations, as compared to the cost of the section of overhead line that each would replace?

A. Yes, we have prepared planning grade estimates of the initial capital cost of each of the variations, including required transition stations, in comparison to the cost of the segment of overhead line that each would replace.

Q. Have you considered what the costs of the underground variations to Connecticut ratepayers would be as compared to the costs of the overhead segments that they would replace?

A. Yes, we have.

Q. How have you calculated this comparison?

A. Approximately 27% of costs for transmission improvements that qualify for regional rate support are allocated to Connecticut based on its New England load share. "Localized" costs are allocated 100% to Connecticut. Such "localized" costs typically include

the incremental costs above those for a standard baseline design transmission facility that are incurred to meet local siting requirements. These incremental costs can be expected to include both the excess costs of BMP overhead line designs and the much larger incremental costs of underground construction that is ordered for locations where standard overhead line designs are feasible and practical and would be called for by good utility practice. In the Application, CL&P estimates the capital cost to Connecticut consumers of the underground variations and compares those costs to those of the overhead line segments that each variation would replace, assuming that the overhead segment would include localized BMP costs, as follows:

Table CCM-15
Estimated Connecticut Share of Initial Capital Costs of Underground Variations Compared to Those for Section of Overhead Line Each Variation Would Replace, Assuming Localization of BMP Overhead Costs and Underground Costs Exceeding Baseline H-Frame Costs
(All Costs in $ Million)

UG Variation	Cost to CT Consumers of UG Variation	Cost to CT Consumers of OH Segment Replaced (inc. localized BMP costs)	Multiple	Application Reference
Mansfield	$55.7	$2.2	25	15-37, 15-38
Mount Hope	$61.1	$1.5	41	15-61, 15-62
Brooklyn	$77.2	$3.3	23	15-103, 15-104

Q. Have you calculated what the costs of the underground variations to Connecticut ratepayers would be as compared to the costs of the overhead segments that they would replace if 100% of the costs were allocated to Connecticut?

A. Yes, even if only the capital costs are compared, without assuming that the full cost of an overhead line would be recovered in regional rates, the cost differential between overhead segments and the underground variations that would replace them is sufficiently large as to impose an unreasonable burden on Connecticut ratepayers, considering that no material

reduction in EMF exposure would be provided by the large investment in underground construction. The cost comparison is shown in Table CCM-16:

Table CCM-16
Estimated Initial Capital Costs of Underground Variations
Compared to Those for Section of Overhead Line Each Variation Would Replace,
Assuming Localization of BMP Overhead Costs and Underground Costs
Exceeding Baseline H-Frame Costs
(All Costs in $ Million)

UG Variation	Cost to CT Consumers of UG Variation	Cost to CT Consumers of OH Segment Replaced (inc. localized BMP costs)	Multiple	Application Reference
Mansfield	$58.2	$4.7	12.4	15-37, 15-38
Mount Hope	$65.0	$5.4	12	15-61, 15-62
Brooklyn	$82	$8.2	10	15-103, 15-104

Q. Is CL&P recommending that the Council order any of the overhead or underground line variations?

A. No.

Q. Why not?

A. The reasons why CL&P is not proposing to construct any of the overhead or underground line variations are that compared to the proposed overhead line configuration and route, each would be vastly more expensive, raise potential electric system reliability issues (in the case of the addition of underground cable system segments), result in increased environmental effects, and/or require the acquisition of additional property or easement rights from private landowners. Moreover, underground variations may not result in magnetic field levels along the ROW that are significantly different than what could be accomplished using BMP line-design proposals. The high cost of that construction, particularly after "localization" of the incremental cost of undergrounding, would pose an unreasonable burden on Connecticut

ratepayers. In addition, the Brooklyn overhead variation would require substantial additional acquisition of private land for new easements and development of a new "greenfield" ROW, with significantly greater effects to environmental resources, such as forest vegetation, wetlands and watercourses. General descriptions of the potential environmental effects for the overhead and underground variations are included in Appendix 15A in Volume 1A of the Application. Tables 15-8 (p.15-36), 15-16 (p.15-60), 15-23 (p.15-82), 15-31 (p.15-106), 15-43 (p. 15-142), 15-55 (p. 15-174). These tables and the accompanying discussion provide useful comparisons of the overhead line as compared with each of the overhead and underground line-route variations and demonstrate that the Project's overhead lines are superior.

Q. Were any other alternatives considered and eliminated?

A. Yes, in CL&P's August 2008 MCF, CL&P identified overhead and underground variations for an approximately 0.6-mile segment within approximately 400 feet of a group of homes along Elvira Heights in Putnam (Focus Area E). However, MF calculations showed that AAL magnetic fields at the east edge of the ROW – the edge toward the group of homes – would be greater with either of these variations than they would be with the proposed line. Additionally, this Overhead Variation, which would have required a new "greenfield" ROW, was estimated in 2008 to cost an additional $6.3M and this Underground Variation, which would have required 2 new line transition stations, was estimated in 2008 to cost an additional $136.6 million. Accordingly, these variations were not pursued further.

Q. If the groups of homes in BMP Focus Areas A, C and E were considered to constitute "adjacent residential areas," so that the statutory presumption applied to part or

all of each of the Focus Areas (A-E), would CL&P consider that the presumption has been rebutted?

A. Yes. The presumption may be rebutted by showing that the costs of underground line construction would impose an unreasonable burden on ratepayers. The cost estimates provided above show that the cost of underground line construction, particularly for Connecticut consumers, would be severe. Moreover, such an investment would be particularly unreasonable in light of the effectiveness of overhead line designs in lowering magnetic field levels along the edge of the ROW in areas of most interest. The huge investment in underground construction would produce very little difference in magnetic field levels along the edges of the ROW, as shown in Table CCM-17.

Table CCM-17: Comparison of Magnetic Field Levels at AAL for Overhead Lines and the Underground Variations (mG)

	Pre-Interstate (2015)	Post-NEEWS (2020)		
ROW Edge	**Existing Configuration**	**Base Line H-Frame Design**	**Underground Variation**	**BMP Configuration (if not H-frames)**
	Mansfield Underground Variation			
North	4.6	7.2	2.8	5.2
South	28.0	18.4	24.6	20.6
	Mount Hope Underground Variation			
North	4.6	7.2	2.8	N/A
South	28.0	18.4	24.6	N/A
	Brooklyn Underground Variation			
West/North, XS-6	4.6	7.2	2.8	5.2
East/South, XS-6	28.0	18.4	24.6	20.6
West, XS-7	6.4	20.0	4.5	N/A
West, XS-7	6.4	20.0	4.5	N/A
Elvira Heights Variation (Considered and Eliminated)				
North	1.2	2.2	2.6	1.8
South	7.2	20.4	21.2	13.3

Moreover, the construction of the proposed overhead line would actually lower magnetic fields at some statutory facilities, including the Mount Hope Montessori School, and constructing the new line underground would achieve a very small incremental reduction, as shown in Table CCM-18:

Table CCM-18: Magnetic Field Levels at Statutory Facilities Near the Mount Hope Underground Variation Route

Facility	Distance to Nearest Edge of ROW (ft)	Magnetic Fields for Annual Average Load Case (mG)		
		Pre-Interstate	Post-NEEWS	
			Overhead H-Frame Line Configuration	Underground Variation
Mount Hope Montessori School	137	1.7	1.2	0.8
Green Dragon Day Care	196	2.7	0.9	2.9

9.0. COMPLIANCE WITH STATUTORY AND BMP REQUIREMENTS

Q. Please summarize CL&P's efforts to comply with the statutory and BMP requirements regarding EMF.

A. CL&P has complied with the statutory and the BMP requirements regarding EMF, as follows:

- CL&P has provided an update of scientific research and group positions re: MF;
- CL&P has provided measurements and calculations that were developed in accordance with the BMP;
- CL&P has prepared an FMDP with a base design that incorporates standard utility practice with no-cost MF mitigation design features, and with modified line designs that incorporate low-cost MF reduction designs;
- CL&P's base line FMDP designs, would produce MF levels at the ROWs edges that are essentially the same as the pre-project fields; and
- CL&P's ROWs would provide an adequate buffer zone between any new or modified lines and any adjacent statutory facilities.

Q. Has the Company complied with other MF standards?

A. Yes, the IEEE International Committee for Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have issued guidelines for long-term public exposures to MF. The ICES reference level is 9,040 mG; the ICNIRP reference level is 2,000 mG. Projected MF levels for Interstate are well below these guideline levels.

10.0 SAFETY

Q. Would the proposed transmission line facilities and substation and switching station additions pose any safety risk to the public?

A. No. The construction of proposed transmission line facilities and additions to Card Street Substation, Killingly Substation and Lake Road Switching Station would not pose a safety threat or create any undue hazard to the general public, including persons or property along the area traversed by the proposed Interstate facilities. All work would be designed and constructed in accordance with all applicable national, electric utility industry, state and, to the extent practical, local codes.

Q. What would happen if an outage or fault occurred on the transmission or substation equipment?

A. High-speed protective relaying equipment would automatically detect abnormal system conditions (e.g., a faulted overhead transmission line) and would send a protective trip signal to circuit breakers to isolate the faulted section of the transmission system. Protection will also be provided by a Supervisory Control and Data Acquisition system ("SCADA"). The

SCADA system allows for remote control and equipment monitoring by the Connecticut Valley Electric Exchange ("CONVEX") System Operator.

Q. What fire protection systems will be maintained at the Card Street Substation, Killingly Substation and Lake Road Switching Station?

A. Fire/smoke detection would automatically activate an alarm at CONVEX and the system operators would then take appropriate action.

11.0 CONCLUSION

Q. Please conclude and summarize your testimony.

A. CL&P proposes to construct the Connecticut portion of Interstate in compliance with all statutory requirements, the Council's regulations and applicable industry codes and standards. The new 345-kV lines will be constructed almost entirely within existing ROW, using best construction practices. For the BMP focus areas, CL&P evaluated both the base line design and alternative line designs for magnetic field reductions in the FMDP to specifically address the Council's policies reflected in its BMP. CL&P is prepared to build any of the alternative line designs if so ordered by the Council. Underground line construction should not be ordered because of its unreasonable impact on Connecticut ratepayers, particularly in light of the relatively low MF levels that can be achieved by construction in accordance with the Council's BMP.

Attachments to Carberry – Case – Mele Testimony

No.	Description	
CCM-1	CT Portion of the Project: Figure 1-2	
CCM-2	Sample Plan & Profile	
CCM-3	Sample Photo & Photosimulation	
CCM-4	Example of Posted Sign for Public Comment Hearings	
CCM-5	Mansfield Hollow: Figure 10-1	
CCM-6	3 Options for Mansfield Hollow & Costs	
CCM-7	DEEP Comments on Mansfield Hollow Environmental Analysis dated February 27, 2012	
CCM-8	A	Hawthorne Lane Proposed Design
	B	Hawthorne Lane Shift Design
CCM-9	A	Highland Ridge Golf Range Drawing – Relocation of Structure 39
	B	Highland Ridge Golf Range Drawing – Relocation of Structure 38 and Elimination of Structure 39
CCM-10	Corrected Appendix 15C Tables	
CCM-11	Focus Areas: FMDP Figure 1	
CCM-12	Brooklyn Overhead & Underground Variations: Figure 15-6	
CCM-13	Proposed Route & Route Variations: Figure 15-1	