STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Eversource Energy Application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements.	DOCKET NO. 461 August 25, 2015

DIRECT TESTIMONY OF KENNETH B. BOWES, RAYMOND GAGNON AND JACQUELINE GARDELL ON BEHALF OF THE CONNECTICUT LIGHT AND POWER COMPANY DOING BUSINESS AS EVERSOURCE ENERGY CONCERNING ENGINEERING, DESIGN, SITING, CONSTRUCTION, OUTREACH AND EMF CHARACTERISTICS OF THE GREENWICH SUBSTATION AND LINE PROJECT

INTRODUCTION

Q. Please identify yourself.

A. [Mr. Bowes] I am Kenneth B. Bowes, Vice President – Engineering employed by The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource Energy"). My resume is attached (See Tab 1 – Resumes).

[Mr. Gagnon] I am Raymond Gagnon, Director - Transmission Projects, employed by Eversource Energy Service Company ("Eversource Service"), agent for Eversource Energy (the "Company"). My resume is attached (See Tab 1 – Resumes).

[Ms. Gardell] I am Jacqueline Gardell, Project Manager, employed by Eversource Service. My resume is also attached (See Tab 1 – Resumes).

Q. What is the relationship of Eversource Service to the applicant, Eversource Energy?

A. Eversource Service provides administrative and engineering services to Eversource Energy operating company subsidiaries. Eversource Service has provided the in-house resources for the development of the Greenwich Substation and Line Project (the "Project").

Q. Does the Company expect to call on any other personnel to respond to planning, engineering or other technical issues?

A. Eversource Service employees, including John Case, Robert Russo, Salvatore Giuliano, David Ferrante and Joseph Swift, may be called upon to respond to questions relating to analytical, planning or engineering design topics. In addition, the Company may call Dr. Gabor Mezei of Exponent, Inc. to respond to questions relating to electric and magnetic field issues and Les Hinzman of Power Engineers to respond to construction and cable issues. The resumes of potential witnesses are attached (See Tab 1 – Resumes).

Q. What responsibility have you had in connection with the Application to the Siting Council?

A. We have supervised the preparation and submission of the Application and interrogatory responses. The Application was compiled under our supervision by Eversource Service staff and engineering and environmental consultants.

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to provide a concise summary of the Project. We will cover eleven primary topics:

1. Overview of the Project;
2. Proposed Greenwich Substation;
3. Cos Cob Substation Modifications;
4. Preferred Route and Transmission Supply Lines;
5. Cost and Schedule;
6. Need;
7. Construction;
8. Electric and Magnetic Fields;
9. Safety and Security;
10. Municipal, State and Federal Consultations; and
11. Statutory Compliance.

In addition, our testimony includes one clarification to the Application. Finally, the Company's environmental consultant, Michael Libertine, is filing Direct Testimony regarding environmental matters concerning the Project on this date.

1. OVERVIEW OF THE PROJECT

Q. Please describe the Project.

A. The Project consists of a new 115-kilovolt ("kV") bulk substation and associated underground transmission supply lines (or "circuits") to add transformation capacity and relieve distribution feeder overloads. The transmission supply lines would

extend approximately 2.3 miles from the Cos Cob Substation on Sound Shore Drive to the new substation to be located at 290 Railroad Avenue in Greenwich. Modifications to the existing Cos Cob Substation are also required as part of the Project.

Q. Please briefly describe the purpose of the Project.

A. Eversource is proposing the Project to provide immediate load relief to the electric distribution supply system in Greenwich by establishing the new bulk substation near the center of the customer electrical demand (or "load") to avoid overloads on both transformers at Cos Cob Substation and distribution feeders that supply the Greenwich network and Prospect Substation.

Q. Please indicate the proposed location of the new underground transmission supply lines.

A. Figure ES-1, provided as Attachment 1, illustrates the Preferred Route for the Project. The Preferred Route is approximately 2.3 miles in length and would be located within existing public roadways and associated rights-of-way, as well as on public and private properties.

Q. Please generally describe the Preferred Route.

A. The Preferred Route (depicted in yellow on Figure ES-1) is described as follows: Beginning at Cos Cob Substation, the Preferred Route would exit this substation under the Metro-North Railroad ("MNRR"), turn west along Station Drive (beneath the elevated portion of Interstate 95 ["I-95"]), and extend to Town-owned property west of Indian Field Road via open trench line installation construction. The route would turn southwest and extend beneath the MNRR and I-95 via an underground pathway created by horizontal directional drilling ("HDD") crossing to an area west of the end of Kinsman

Lane. The route would then travel a short distance via open trenching into Bruce Park to another HDD staging area. A second HDD crossing would extend west beneath the Park and its waterbodies. West of Bruce Park, the route would transition back to open trenching and generally follow Davis Avenue, Indian Harbor Drive and Museum Drive west before turning north on Arch Street and crossing again beneath an elevated portion of I-95 and the MNRR to Railroad Avenue. The route would turn west and follow Railroad Avenue to the proposed Greenwich Substation site.

Q. Please explain the variations to the Preferred Route presented in the Application.

A. Eversource presented four variations to the Preferred Route. The Bruce Park Underground Open Trenching Variation would eliminate an HDD crossing of the Park by using an open trench along Kinsman Lane and Bruce Park Drive. The MNRR and I-95 HDD Crossing Variation (Green Variation) would avoid an open trench crossing of Indian Field Road by using the area of Station Drive to the east of Indian Field Road as the staging area for the crossing to the Town's Maintenance Facility or the terminus of Kinsman Lane. These variations are illustrated in Figure G-8A, provided as Attachment 2. Based on Town and community input, Eversource presented additional Bruce Park Variations. These variations are illustrated on Figure G-8B, provided as Attachment 3. The Orange Variation would avoid open trenching along or off to the side of Kinsman Lane by open trenching to the west to a point in Bruce Park where a HDD work site would be set up to perform an HDD under the eastern-most water body in Bruce Park, crossing westward under the remainder of Bruce Park, coming up along Davis Avenue. The Blue Variation would open trench south off to the west side of Kinsman Lane in

grassy area and then continue in the Park to a location to a site where an HDD work site would be set up. This HDD work site is the same as the HDD work site with the Orange Variation and it places the HDD work further away from residential properties than the HDD work site associated with the Preferred Route (Yellow).

2. PROPOSED GREENWICH SUBSTATION

Q. What was the process for selection of a site for the new Greenwich Substation?

A. Beginning in 2012, Eversource followed an established process that considered engineering, environmental, community and economic factors in conducting its search for a potential site for the new Greenwich Substation, in an area located north of MNRR and north of I-95. Four substation location sites were ultimately identified and were evaluated by Eversource. The Company's primary selection criteria for locating a new substation included, but were not limited to:

- Proximity to customer demand (or "load pocket");
- Proximity to existing distribution feeders;
- Proximity to existing transmission electrical circuits;
- Proximately to public water supply, watershed and aquifer areas;
- Ease of access for both construction and maintenance;
- Zoning and adjacent land uses;
- Earthwork requirements;
- Suitability of a site to accommodate the substation; and,
- Minimizing effects on the environment.

In addition to the above criteria, the Company also considered other relevant factors including community impacts, cost, construction complexities, and timing.

Q. Please describe the proposed site for the proposed Greenwich Substation.

A. The proposed site for the new substation is 290 Railroad Avenue in Greenwich (the "Proposed Site"). The Proposed Site is 0.81 acre in size and is located within a General Business zoning district. It is currently developed with an existing commercial building, is surrounded by other commercial properties and the MNRR and is in close proximity to Eversource's existing Prospect Substation located at 330 Railroad Avenue.

Q. Please describe any alternate site for the proposed Greenwich Substation.

A. Eversource identified the property located at 281 Railroad Avenue as the alternate site (the "Alternate Site"). The Alternate Site is 0.75 acre in size and is also located within the General Business zoning district. It is currently used as a storage area for materials (pole yard) and has been used for additional parking for Eversource's former Greenwich Area Work Center, which had been located at 330 Railroad Avenue. Commercial and residential properties are located on the east and west sides of the Alternate Site, and residential properties are located across Woodland Drive to the north.

Q. How does the Proposed Site satisfy Eversource's selection criteria?

A. The Proposed Site is located within the customer load pocket north of I-95 and the MNRR, provides optimal connections to existing distribution feeders and affords two routes for connecting to the distribution system via Railroad Avenue and Field Point

Road. There is direct access to the Proposed Site from Field Point Road and Railroad Avenue. There are no residential properties abutting the Proposed Site, and it is surrounded by other commercial properties and in close proximity to transportation infrastructure, so a substation on the Proposed Site would be compatible with the existing land uses in the immediate vicinity. The property is level, and there would be no major earthwork requirements for development on this property. There are no utility encumbrances on the site nor are there any municipal sewer facilities on the site. No wetlands or watercourses are located on the property, and it is located outside both the 100-year and 500-year flood zones.

Q. How does the Alternate Site satisfy Eversource's selection criteria?

A. This property is located with the customer load pocket, north of I-95 and the MNRR, and there are routes for distribution feeder egress, via Railroad Avenue and Woodland Drive, respectively. There is direct access from Railroad Avenue and Woodland Drive. The property is level, and there would be no major earthwork or clearing requirements for development on this property. This property is located outside of the 100-year and 500-year flood zones, and there are no wetlands or watercourses.

Q. Why was the Proposed Site selected over the Alternate Site?

A. The Company has determined that use of the Alternate Site for substation equipment would likely cause it to exceed State and local noise regulations/ordinances at the property line, due to the proximity of residential properties to the east and west. Therefore, at a minimum, Eversource estimates that at least three abutting properties would have to be acquired to mitigate noise from the substation.

Q. Did the Company consider any property on Old Track Road as an appropriate location for the new substation?

A. The Company considered a commercial property located on Old Track Road, also within a General Business zoning district, as a site for the new substation.

Q. Why was that site rejected?

A. This property was rejected as a viable site based on engineering, constructability and cost factors, as well as the visual impacts to the surrounding residential properties. Although the parcel is of sufficient size to construct a substation and the location is proximate to the load pocket, the new transmission lines would need to be extended at least an additional 0.25 mile, when compared to the Proposed Site, and to be built around the existing culvert and sewer lines crossing beneath Railroad Avenue. Additionally, the new distribution feeders exiting the new substation would have to be significantly longer to connect to all of the existing distribution feeders currently serving downtown Greenwich. Future expansion of additional feeders would require extending the existing distribution system across the Horseneck Brook culvert, which would be costly. Also, this property would require additional easements to use the privately-owned Old Track Road for access and installation of electric conduits. Finally, this property was viewed as a less favorable option due to its proximity to the abutting residential properties, located at a higher elevation, to the north. Residents would be able to look directly down into the substation yard.

Q. Were there any other concerns about the Old Track Road Property?

A. Yes, there is no direct access to public roads, so the Company would need to acquire easement rights for access/egress to the site as well as for installation of both

distribution feeders and the new transmission lines. Although Stone Avenue (northwest of the parcel) is a public road, Town ownership of the road ends before abutting the Old Track Road property. The significant elevation change from Stone Avenue to Old Track Road would present constructability challenges. Similarly, Spring Street (to the northeast) is also a public road, but Town ownership of this road ends before abutting the Old Track Road property.

Q. Were any other sites considered?

A. Yes, Eversource also considered its property at 330 Railroad Avenue in Greenwich.

Q. Please summarize the properties considered and the key factors considered in the site evaluation process.

A. Table H-1 of the Application presents a site evaluation summary that includes the properties considered and the key factors evaluated in the site evaluation process, as follows:

Table H-1 Site Evaluation Summary

Site Selection Review Criteria	SITES EVALUATED IN GREENWICH SUBSTATION SEARCH AREA			
	Proposed Site	Alternate Site		
	290 Railroad Ave	281 Railroad Avenue	330 Railroad Avenue	Old Track Road
Proximity to Customer Load	**Within load pocket**	Within load pocket	Within load pocket	Within load pocket
Proximity to Existing Feeders	**Existing distribution feeders in street**	Existing distribution feeders in street	Existing distribution feeders in street	0.25 mile extension of distribution feeders needed via new easement
Proximity to Existing Transmission Circuits	**2.3 miles**	2.3 miles	2.3 miles	2.6 miles
Ease of Access	**Direct access from Field Point Road and Railroad Avenue**	Direct access from Railroad Avenue and Woodland Drive	Direct access from Railroad Avenue, Field Point Road and Prospect Street	Limited vehicular access; additional/expanded access rights would be required from one or more landowners
Size (acres)	**0.81**	0.75	0.92*	2.49
Consistency with Existing Land Uses	**Commercial Neighbors**	Commercial and Residential Neighbors	Commercial Neighbors	Commercial and Residential Neighbors
Earthwork requirements	**Level terrain - limited grading needed**	Level terrain - limited grading needed	Significant earthwork and grading needed	Level terrain - limited grading needed
Site Constraints	**Existing building**	Existing utility easements require relocation - would likely need to purchase adjacent property to meet noise regulations at the property line	Existing building, distribution substation, municipal sanitary sewer line and culvert**	Existing gas easement; easements required for access and utility installations
Environmental Effects	**None**	None	In 500-year Floodplain; Horseneck Brook flows under property in culvert	None

* Does not include 0.35 acre occupied by the existing distribution Prospect Substation and 0.25 acre by existing culvert and sewer line.

** The time required to locate an alternate route (working with the municipality) and then move the municipal sanitary sewer off of the property, in addition to undertaking the supplemental earthwork and the design modifications required to construct the substation in the 500-year flood plain, would likely delay project schedule and jeopardize the facility's target in-service date.

Q. What are the key features of the proposed Greenwich Substation?

A. The Greenwich Substation would be supplied from two underground 115-kV transmission supply lines originating from Cos Cob Substation on Sound Shore Drive. The two new transmission supply lines would enter the Greenwich Substation via underground pipes and terminate at gas insulated switchgear ("GIS") equipment, which would be housed in a building measuring approximately 121 feet long by 32 feet wide along Railroad Avenue; an angled façade paralleling Field Point Road would extend the southern footprint of the building an additional 13 feet in length. The main roof of the building would be 31 feet high, with matching tower fascia on the east and west ends extending to approximately 36 feet high. A small, rear annex on the building's east end would extend approximately 19 feet southward into the substation yard. The Substation yard would be surrounded by an eight-foot high, wrought iron-style fence for security.

Q. What equipment would be installed at the proposed Greenwich Substation?

A. The GIS building would house GIS equipment consisting of six 115-kV circuit breakers and associated disconnect switches along with protective relay and control equipment as well as the battery and charger associated with the transmission equipment. In addition, the Substation yard would also be outfitted with three 115-kV circuit switchers with integral disconnect switches and three 60-Megavolt-Ampere ("MVA") power transformers that would step down the voltage from 115 kV to 13.2 kV. The three 60-MVA transformers would contain insulting oil (not containing polychlorinated biphenyls or "PCBs"). The transformers would be installed on foundations, and each would have secondary containment sufficient to contain 110% of

the volume of insulating oil in the transformer. One metal switchgear enclosure (measuring approximately 108 feet long, 24 feet wide and 14 feet tall) would also be installed to house the switching equipment and the relaying and control equipment for the 13.2-kV distribution feeders. A pump house is also required to support the high pressure fluid filled ("HPFF") transmission cables and maintain the requisite liquid pressure under all loading conditions (measuring approximately 50 feet long, 12 feet wide and 12 feet tall). An emergency generator would be installed in proximity to the pump house. Up to three 65-foot tall lightning masts would also be installed within the yard. Adequate space has been provided for a future mobile transformer.

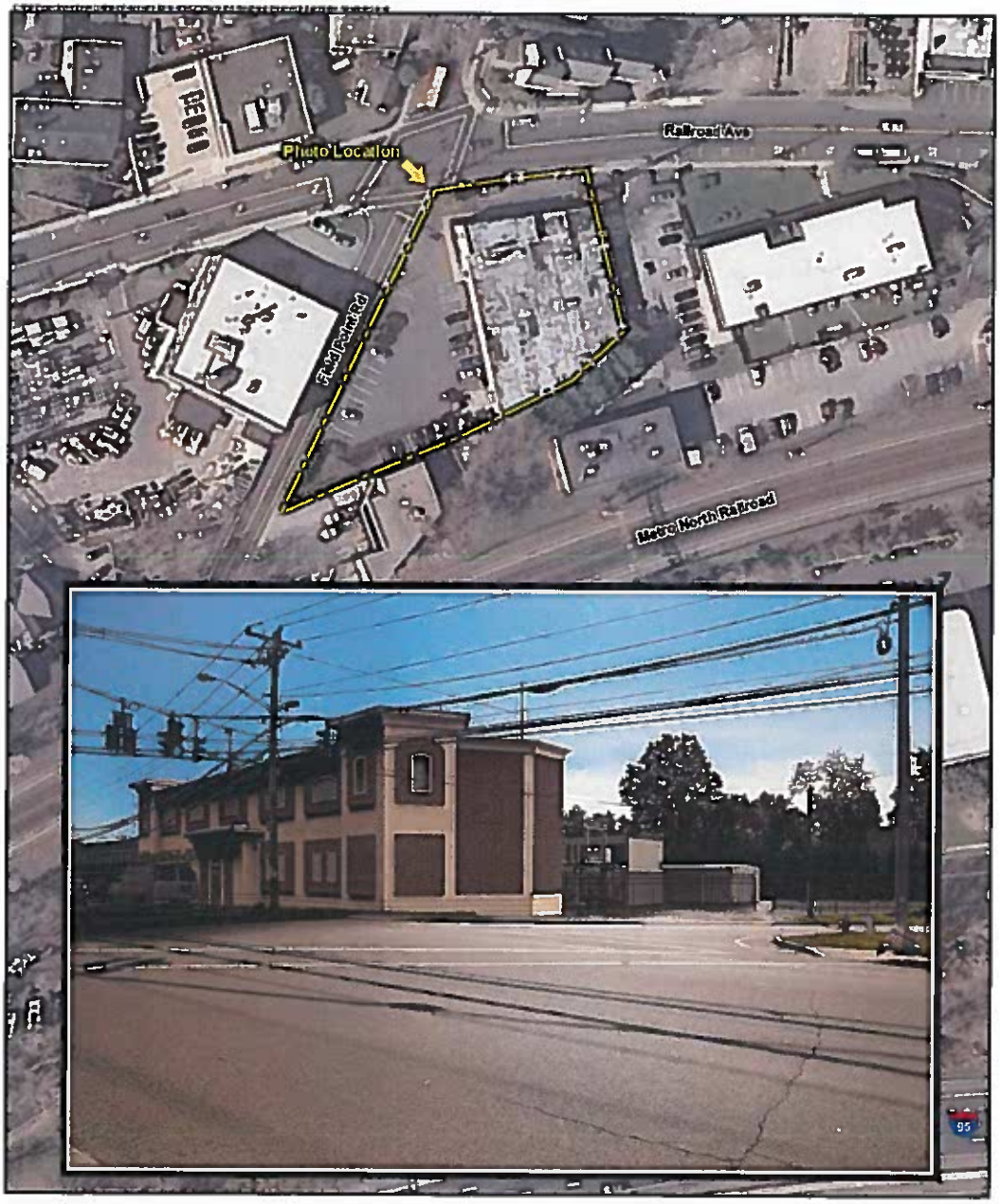
Q. What would the GIS building look like?

A. Typically, Eversource uses a corrugated metal building enclosure for a GIS building. Based on the proximity of the Greenwich Substation site to the commercial center of Town and input from the Town, Eversource is proposing an alternate design for a pre-cast concrete facade with brick accents set back over 16 feet from the edge of the property line along Railroad Avenue.

Q. Has Eversource provided a rendering?

A. Eversource provided a rendering in the Application as Figure G-2, as follows:

Figure G-2 Proposed Greenwich Substation Rendering



Legend

= : = Subject Property Boundary

Figure G-2
Proposed Greenwich Substation Rendering

Proposed Greenwich Substation
290 Railroad Avenue
Greenwich, Connecticut

EVERSOURCE ENERGY

ALL-POINTS

Q. Is the Town satisfied with the proposed design for the Greenwich Substation?

A. Eversource has had an on-going dialogue with Town officials over the proposed design for the Substation. In particular, on a number of occasions, Eversource representatives appeared before the Architectural Review Committee and the Planning and Zoning Commission. By letter dated April 6, 2015, the Town included a number of comments about the proposed design. Eversource has addressed those comments with the following design features:

- Hired an independent architect to redesign the building to more closely resemble the former Eversource Area Work Center at 330 Railroad Avenue;
- Varied the building facade to add scale and focal features by adding brick veneer, windows, a front door, and other architectural elements to the design;
- Reconfigured the building to break up the façade length by incorporating a projecting doorway and tower sections;
- Reconfigured the building to break up the building height by incorporating tower fascia on the east and west ends and reducing the height of the main roof;
- Moved the building back from Railroad Avenue to provide additional separation between building and the curb and sidewalk;
- Reoriented the battery portion of the building extending it to the south, along the east side of the property, thereby limiting the view into the substation from the east; and
- Extended the length of the building on the west side to allow the overhead door into the GIS building to be on the back of the building, accessible from the substation yard, rather than at the intersection of Field Point Road and Railroad Avenue.

Eversource made significant modifications to its design to address the Town concerns. However, additional significant design changes to address the remaining comments, such as moving the GIS building back and adding plantings inside the substation fence, would reduce the spacing between the equipment and conflict with clearance requirements and/or would be unwarranted based on the added costs. In its design, Eversource must preserve the functionality of the GIS building and the substation as a whole, to serve its intended purpose as well as balance costs of additional design features (which costs will be borne by customers) based on their potential for visual enhancement.

Q. What will be the construction sequence for the Greenwich Substation?

A. The construction sequence for the Greenwich Substation is expected to be as follows:

- Installation of temporary erosion and sediment controls, where necessary, to be maintained, inspected and replaced as required during construction;
- Installation of temporary construction fencing for site safety and security;
- Removal of the existing building;
- Grading and drainage improvements;
- Foundation construction including excavation form work, steel reinforcement and concrete placement;
- Erection of steel-support structures for electrical equipment and excavation for installation of control and power conduits and ground-grid conductors;
- Construction of the GIS building, installation of transformers and associated equipment, construction of a distribution switchgear enclosure and a pump house;

- Testing and installation of interconnections; and
- Final cleanup, installation of permanent site security measures and restoration.

Q. What does Eversource propose for the ground surface of the Substation yard?

A. The ground surface of the Substation yard would be covered with trap rock.

Q. Please describe the lighting.

A. The Greenwich Substation would have low-level lighting for safety and security purposes. Additionally, lighting would be installed within the Substation yard to facilitate work at night or under emergency conditions and during inclement weather.

Q. How would the Company access the proposed Greenwich Substation?

A. The Substation would be accessed by a new approximately 20-foot wide gated entrance from Field Point Road.

Q. Please describe the results of the noise analysis for the Greenwich Substation.

A. The noise analysis for the Greenwich Substation determined that noise from the Greenwich Substation would be minimal, namely the steady state noise from the new transformers as well as infrequent impulse noise from switching and circuit breaker opening and closing. Existing noise conditions at the Cos Cob Substation would not significantly change because no new transformers are being added. Of course, there will be temporary increases in construction related noise during construction in the vicinity of the Project's work sites. Construction noise is exempted under the Connecticut noise control regulations.

Q. How would Eversource mitigate construction noise effects?

A. To the largest extent possible, general site construction hours would be limited to 7 am to 7 pm, Monday through Saturday when human sensitivity to noise is lower. Because of the difficulty of scheduling outages for interconnecting to the transmission system and the time required for cable and pipe pulling and for splicing activities, there could be relatively short periods when some work will need to take place during hours beyond the 7 am to 7 pm Monday through Saturday period.

3. COS COB SUBSTATION MODIFICATIONS

Q. What work is required at Cos Cob Substation?

A. New equipment must be installed at Cos Cob Substation to support the proposed underground transmission lines. New equipment includes: circuit breakers, disconnect switches (manual and motor operated), instrumentation potential transformers, cable termination structures, bus support structures, an A-frame line structure, underground conduits and duct banks for communication and control cables and underground lines and bus sections, a monopole line structure, a steel structure and accessory equipment to reconstruct the mobile transformer position, relays and control and communication equipment (within the existing control enclosures), bus work, underground cable vaults, as well as foundations, where required. Existing equipment that will be removed includes: steel A-frame line structures and a wood H-frame structure, strain overhead bus sections, a line trap, a manual disconnect switch, a wood pole structure with guy wires and a lattice line structure.

Q. What is the tallest height of any of the new equipment?

A. The monopole line structure is the tallest new structure and would be approximately 85 feet in height.

Q. Will the substation fenced-in yard be expanded?

A. Yes. The Cos Cob Substation fence would be partially extended approximately 140 feet on the south side of the substation, within an existing easement area on property owned by the State of Connecticut (Department of Transportation).

Q. What construction steps would be followed for the modifications to the Cos Cob Substation?

A. The construction would occur in several stages and would generally consist of the following activities.

- Installation of temporary erosion and sediment controls, where necessary, to be maintained, inspected and replaced as required during construction;
- Installation of temporary construction fencing for site safety and security;
- Grading and drainage improvements;
- Foundation construction including excavation form work, steel reinforcement and concrete placement;
- Installation of equipment;
- Testing and installation of interconnections; and
- Final cleanup, site security and restoration.

Q. Will the appearance of Cos Cob Substation be materially altered?

A. No.

Q. If the new Greenwich Substation is built, will Prospect Substation continue to function as a substation?

A. No. Substation equipment, including transformers, at Prospect Substation will be removed. With the removal of the transformers, the site will not function as a substation. The site will continue to contain equipment to support its use as a critical distribution tie station for the existing 27.6-kV system, including customers directly supplied at 27.6 kV and the secondary underground network supplying downtown Greenwich. The existing fence will remain.

Q. If the new Greenwich Substation is built, will Byram Substation continue to function as a substation?

A. No. Substation equipment, including transformers, at Byram Substation will be removed. The site will continue to contain equipment used to maintain appropriate voltage in the western portion of Greenwich, along with the existing fence.

4. PREFERRED ROUTE AND TRANSMISSION SUPPLY LINES

Q. Has Eversource identified any viable alternative routes to the Preferred Route?

A. Eversource identified the Southern Alternative and the Northern Alternative as viable alternative routes to the Preferred Route.

Q. Briefly describe the Southern and Northern Alternatives.

A. The Southern Alternative would originate to the south of the Preferred Route and after crossing under elevated portion at I-95 would extend along South Shore Drive, in place of the use of Station Drive in the Preferred Route. The HDD under I-95

would occur from private property along Sound Shore Drive. The Northern Alternative would primarily run along U.S. Route 1, mainly within the public ROW. Off-road easements for vault locations would be necessary. These alternative routes are shown on Figure ES-2, provided as Attachment 4

Q. As compared with the Preferred Route, what are the disadvantages of these alternative routes?

A. Both routes are not as desirable as the Preferred Route due to physical constraints and increased community and environmental impacts.

Q. Please summarize these routes and key factors considered in the final selection of the Preferred Route.

A. Table H-2 of the Application presents a summary of the analysis of these routes and key factors, as follows:

Table H-2 Route Analysis Summary

Key Factors	Preferred Route	Southern Alternative	Northern Alternative
Route Length	2.3* miles	2.2 miles	3.1 miles
ConnDOT Encroachment Agreement Required	No	No	Yes
ConnDOT Encroachment Permit	Yes	Yes	Yes
ConnDOT Rails License Agreement	Yes	Yes	Yes
MNRR License Agreement	Yes	Yes	Yes
Impacts on Environmental and Cultural Resources	Minimal	Minimal	Moderate
Underground Utilities Congestion	Least	Greater	Greatest
Constructability Challenges[1]	Minimal	Greater	Greatest
Easements Required[2]	10	6	10
Estimated Number of Vault Locations	6	6	8

*If Bruce Park open trench or other alternative crossing variation is selected, the Preferred Route would be slightly longer.

[1] Includes length and angle of HDD, need for all off-road easements, limited work hours, and space constraints.

[2] Estimated; all with varying complexities.

Q. What route identification criteria were considered by Eversource?

A. Eversource considered system benefits (reliability and operability), potential property impacts, environmental impacts, engineering (technical) feasibility and cost.

Q. What route selection objectives for the transmission circuit were considered by Eversource?

A. Eversource applied the following set of route selection objectives for the transmission circuit, which have been established based on experience of utility facility siting and construction in Connecticut:

- Comply with all statutory requirements, regulations and State and federal siting agency policies;
- Achieve a reliable, operable, constructible and cost-effective solution;
- Maximize the reasonable, practical and feasible use of existing linear corridors (e.g., transmission lines, highways, public roadways, railroads, pipelines);
- Minimize the need to acquire property;
- Minimize adverse effects to environmental resources;
- Minimize adverse effects to significant cultural resources (archaeological and historical);
- Minimize adverse effects on designated scenic resources;
- Minimize conflicts with local, state and federal land use plans and resource policies; and
- Maintain public health and safety.

Q. Describe generally the route selection process.

A. The Company began the route selection process by evaluating overhead, underground and marine routes with the Project Study area. The Company initially

identified 12 potential route options with several variations. These routes included four overhead routes, five underground options, one marine route and two combination routes. After analyzing and comparing key factors associated with the route options, three potentially viable underground line routes were identified for further consideration: the Preferred Route, Southern Alternative, and Northern Alternative. The Preferred Route was selected by the Company as the most feasible route for building the new transmission supply lines based on its length and impacts to the environment, cultural, and community resources.

Q. Briefly explain the overhead routes considered.

A. Eversource considered an Overhead Southern Route, an Overhead Central Route, an Overhead Northern Route and an Overhead MNRR Corridor with two variations.

Q. Why were these overhead routes rejected by Eversource?

A. Eversource rejected all of the overhead routes based on one or more of the following factors: absence of existing ROW/required public and private property easements/acquisitions, substantial clearing, impacts to historic districts, impacts on very densely populated areas and MNRR restrictions that would increase the cost of the Project, substantially lengthen the construction schedule, and jeopardize the Project's in-service date.

Q. Did the Connecticut Department of Transportation ("ConnDOT") comment on the overhead routes?

A. Yes. ConnDOT commented on the overhead routes, concluding that the *"North Easements would have a serious detrimental impact to the Department and*

Metro-North Railroad (MNR) .... Both the Middle Easement and South Easement are undesirable since they would prevent the Department from making improvements to I-95." ConnDOT's letter is provided as Attachment 5.

Q. What were the additional underground routes and why were they rejected?

A. As described in Section H.4.2.3 of the Application, Eversource also considered an Underground Central Route and an Underground Central Route using Existing Distribution ROW. These routes were rejected because of the availability of a more feasible alternative, namely the Preferred Route, and due to the high level of community impact and the probable property acquisitions.

Q. Why was the marine route into Cos Cob Harbor rejected?

A. As explained in Section H.4.3 of the Application, the marine route was rejected because it was significantly longer than the land routes considered and due to additional permitting, construction and maintenance challenges.

Q. Please explain why combination routes were rejected.

A. As explained in Section H.4.4 of the Application, two combination routes were considered and rejected, in part, due to the availability of more feasible alternatives. The first, a marine/underground route, was also rejected, in part, due to impacts to Cos Cob Park, the need to cross private property, and the challenges of a marine route. The second, an overhead/underground route, was also rejected, in part, due to greater community impacts and potential property acquisition requirements.

Q. Does the Preferred Route avoid private or public schools, licensed child day-care facilities or licensed youth camps?

A. Yes.

Q. Does the Preferred Route avoid public playgrounds and residential areas?

A. No. The Preferred Route would traverse Bruce Park and settled areas that might be considered residential areas, including Station Drive, Intrieri Lane, Kinsman Lane, Davis Avenue, Arch Street, and Railroad Avenue.

Q. How does Eversource intend to limit impacts to Bruce Park?

A. Eversource is proposing the use of HDD through Bruce Park to minimize impacts. Only temporary effects to portions of Bruce Park would occur during construction of the lines and the HDD. These areas would be restored after completion of the construction.

Q. Has Eversource's preference for the Preferred Route changed since the filing of the Application?

A. No.

Q. Did any agencies of the Town of Greenwich express an opinion about the Preferred Route?

A. Yes, the Greenwich Inland Wetlands and Watercourses Agency, in a letter to Eversource dated March 27, 2015, a copy of which is attached as Attachment 6, stated:

> *The Preferred Route with Horizontal Directional Drilling ("HDD") appears to the Agency to pose the least potential of causing adverse wetland impacts out of all of the alternatives, including the open trench variant of the Preferred Route, which would require coffer damming across Indian Harbor north of Davis Avenue.*

Q. Did the Inland Wetland and Watercourse Agency consider the Orange or Blue Variations in their deliberations?

A. No. The Orange and the Blue Variations were developed based on comments received during the MCF process which ended on May 6, 2015.

Q. What technology is proposed for the two new underground transmission supply lines?

A. Eversource plans to use HPFF transmission cables for the two new underground transmission supply lines.

Q. Please explain the use of HPFF cables in the proposed underground 115-kV line system.

A. The Project's HPFF underground 115-kV line system would consist of three 8-inch electrical cable carbon steel pipes in a common trench. Each of the two, three-phrase cables would consist of 3500-kcmil segmental copper conductor insulated to 115 kV with laminated paper insulation and would be approximately three inches in diameter. Two of the steel pipes would house the HPFF lines, while the third (fluid return) pipe would be dedicated for fluid circulation. The trench would also accommodate two 4-inch PVC conduits housing fiber optic cables and three 2-inch PVC conduits for distributed temperature sensing fibers.

The system would be installed in a trench encased in low-strength concrete slurry, also known as fluidized thermal backfill ("FTB"), and capped by a protective layer of high-strength concrete. Trenching for installing the transmission supply lines will require excavations measuring, at a minimum, approximately 4.5 feet wide by 5.5 feet deep.

Q. What are the other components of the underground transmission supply system?

A. The other components of this system would include splice vaults, cable splices, grounding, insulating fluid reservoir, pump house, terminations (at the substations), and a cathodic protection system.

Q. What facilities are required to support HPFF cables that are not required for XLPE cables?

A. A pump house is required for HPFF cables to maintain the requisite liquid pressure under all loading conditions and to provide for fluid circulation to even out hot spots along the line route.

Q. What equipment would be contained in the pump house?

A. The pump house would contain circulating pumps, valves and other controls to maintain fluid pressure, recorders, alarms, and a reservoir tank sized to accommodate fluid expansion and contraction as the load on the circuit cycles. It would be serviced by two separate distribution circuits with automatic transfer for backup in case of power loss.

Q. Please describe the pump house.

A. The pump house would be approximately 12 feet high and 50 feet long by 12 feet wide. The exterior of the pump house would be steel-sheeting.

Q. Where would the pump house be located in the substation yard?

A. The pump house would be placed in the southwest corner of the Greenwich Substation yard, along the fence line adjacent to Field Point Road.

Q. What benefits does the HPFF technology offer as compared with XLPE cable systems?

A. As noted on pages H-29 and H-30 of the Application, as compared with XLPE cable systems, HPFF technology offers the following benefits:

- The HPFF cable can be provided in longer lengths, so fewer vaults and cable splices will be required along the route, resulting in a more cost-effective Project (less labor and material costs). Fewer vaults also results in fewer cable splices and accessories, which improves reliability since accessories have a higher rate of failure;

- A double circuit HPFF cable system can take advantage of a single splice vault, unlike XLPE cables, which would require separate vaults for a double circuit installation. Fewer vaults results in less excavation than a comparable XLPE cable system, and require a smaller footprint, have a shorter construction window, and, as such, result in less impact to the community;

- HPFF cable systems have the ability to circulate the dielectric fluid to smooth out (mitigate) hot spots along the cable route, effectively increasing the circuit capacity. This provides a great advantage over XLPE cable systems when running parallel to existing heat sources (i.e., existing distribution circuits near the substations, capable of de-rating the circuit or in the deeper installations of the route, such as the HDD crossings) whereas XLPE cables must be sized for the worst case condition;

- The three power cables for each circuit are installed in a single 8-inch pipe versus a duct bank consisting of three individual 8-inch PVC conduits encased in concrete as used for the XLPE cable system;

- HPFF cable systems can be upgraded with forced-cooling equipment to expand the load carrying capacity in the future with minimal impacts; and,

- The load at the Greenwich Substation does not require the larger conductors that are available with XLPE cable technology.

Q. Why was HPFF technology selected for this Project?

A. At every stage in its planning process, Eversource considers alternatives that would accomplish a project's objectives at a lesser cost. Here, HPFF would accomplish the Project's objectives at a lower cost.

5. COST AND SCHEDULE

Q. What is the estimated cost of the Project?

A. $140 million.

Q. What is the estimated cost of the substation work and underground transmission line work?

A. The estimated cost of the substation work for both substations and distribution feeder work is $68 million, and the estimated cost of the underground transmission line work is $72 million.

Q. Does Eversource expect that any of the costs of the Project will be "regionalized"?

A. Yes, Eversource expects approximately $12M of the estimated costs for the transmission facility to be regionalized. However, the Independent System Operator – New England makes the final determination.

Q, Please explain how the costs that are not regionalized will be allocated.

A. The costs on the Project are recovered through two Federal Energy Regulatory Commission ("FERC") tariffs and Connecticut Department of Energy and Environmental Protection ("CT DEEP") based rates. For the Project's transmission

equipment within the FERC jurisdiction, the two FERC transmission tariffs are Regional Network System ("RNS") rate or Schedule 1 and the Local Network System ("LNS") rate or Schedule 21 Category A. Connecticut's electricity customers (not just Eversource customers) would pay approximately 25% of the costs that would be regionalized based on 2014 data. In addition, Connecticut's electricity customers would pay approximately 64% of the costs that would be localized under the LNS rates. Lastly, the distribution costs are only borne 100% by Eversource's Connecticut customers.

Q. What is the anticipated timetable for construction?

A. Fourth Quarter 2016 – Second Quarter 2018.

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

A. Second Quarter 2018.

Q. What is the service life of the equipment?

A. In excess of 40 years.

6. NEED

Q. Please describe briefly the efforts to improve the reliability of the transmission system in Southwest Connecticut.

A. Since 2002, several major improvements to the transmission system in Southwest Connecticut ("SWCT") have been completed. Those improvements have included: Bethel-Norwalk Project (Docket No. 217), Long Island Cables Project (Docket No. 224), Middletown to Norwalk Project (Docket No. 272), Glenbrook Cables Project (Docket No. 292) and Stamford Reliability Cable Project (Docket No. 435).

Q. Why are additional improvements necessary?

A. Fairfield County is the economic engine of Connecticut, accounting for more than 70 percent of the State's commerce. The Town of Greenwich is literally at the geographic end of the Eversource electric system, and it presents many challenges to serve the ever growing demands for electricity. The residential customers in Greenwich are also unique in their levels of electric usage - using more than 2 times the electricity of the average Connecticut residential customers.

Q. Has Eversource collaborated with any third parties in its efforts to enhance the electric infrastructure in SWCT?

A. Yes, Eversource has strengthened our partnership with ConnDOT and MNRR with a transmission line/railroad tree trimming project from Stamford to Greenwich on the New Haven commuter rail line. This collaborative project improved both the reliability of the electric system and transportation infrastructure, and is now a model used in the rest of Connecticut.

Eversource also provided turn-key project services to MNRR at the Cos Cob Substation location with the transformer replacements and additions at the MNRR 35K substation – to effectively double the capacity, and double the redundancy of their electric infrastructure supplying the rail system.

Q. What would the Project accomplish?

A. Simply stated, the Project would serve customer load in Greenwich and provide additional resiliency beyond Cos Cob Substation.

Q. What substations currently serve the load in Greenwich?

A. Cos Cob, Prospect, Byram, North Greenwich, Mianus and Tomac Substations currently serve the load in Greenwich.

Q. Why is a new substation necessary?

A. The vast majority of the load in Greenwich is served from a single bulk substation, Cos Cob Substation, which serves approximately 130.5 MVA of electric load at 27.6kV. It feeds three distribution substations at 27.6 kV in Greenwich (Prospect, Byram and North Greenwich Substations), supplies power directly to large commercial customers and the secondary network, and provides a backup power source at 27.6 kV to two other substations in Greenwich (Mianus and Tomac Substations). A new substation would provide new capacity and an additional bulk substation source, to lessen the load at Cos Cob Substation and avoid projected transformers overloads.

Q. When did the need for a new substation in Greenwich arise?

A. On June 13, 2011, Mr. Bowes publically committed to a new substation in Greenwich, following a string of cascading outages on the 27.6kV system supplying the distribution substations in Greenwich.

Q. Please summarize the need for this Project.

A. The proposed Greenwich Substation would provide immediate load relief to the distribution supply system in Greenwich, greatly improve the reliability of the electric power system and accommodate anticipated future load growth for approximately the next 30 years.

The Project will also extend transmission supply lines to a point near the highest load concentration, in an area currently served only by distribution feeders from

the east. It would improve the reliability of the 27.6-kV electric system serving Greenwich by reducing the high level of load served by Cos Cob Substation via lengthy parallel distribution feeders extending to central Greenwich. Lastly, the new substation would further the Company's initiative of infrastructure improvements in Greenwich by addressing existing constraints at area substations by avoiding equipment overloads.

Q. Is the Project part of a long range plan for expansion of Connecticut's power grid that serves the public need for adequate, reliable and economic service?

A. Yes.

Q. Did Eversource consider a "no action" alternative?

A. Yes. A "no action" alternative was rejected because customers throughout Greenwich would be at increased risk in 2017 when, under certain contingencies, transformers at Cos Cob Substation are projected to reach their capacity limits. In addition, distribution 27.7-kV feeders are overloaded under certain contingencies today. Additionally, anticipated future demand growth could not be reliably served. Thus, no action would undermine the Company's comprehensive efforts to improve the adequacy of Greenwich's electric power system.

Q. Are there any transmission alternatives to the Project?

A. No. This Project provides an additional source of capacity that cannot be accomplished with new or upgraded transmission facilities alone.

Q. Did Eversource consider non-transmission alternatives?

A. Yes, as discussed in Section F.3 of the Application, Eversource considered a wide range of long-term electric system alternatives, including distribution alternatives and demand side management alternatives.

Q. What was the outcome of Eversource's analysis of non-transmission alternatives?

A. Eversource concluded that while some of the alternatives might reduce customer demand in Greenwich by small increments, none of the alternatives would achieve the reliability and power source of supply diversity of the electric distribution system that the Project would achieve, in the location near the center of customer demand and in a cost effective manner.

Q. What are the benefits the Project would achieve that other alternatives cannot achieve?

A. The Project would achieve the following benefits that other alternatives cannot achieve:

- reducing dependence on a single heavily-loaded bulk substation that is approaching its permissible load rating (Cos Cob Substation) by transferring part of the load serving customer demand to the proposed new bulk substation;
- reducing dependence on a heavily-loaded non-bulk substation (Prospect Substation) by transferring the job of serving customer demand to the proposed new bulk substation;
- providing an independent and separate power source for the 27.6-kV distribution feeders load so that if a problem occurs on a circuit that serves the secondary network, the customers supplied by the 27.6-kV distribution feeders will not be interrupted or otherwise adversely affected; and
- extending the bulk power transmission system to the center of the customer demand.

Q. Eversource announced the need for this substation in 2011. How was Eversource able to defer the need until now?

A. Eversource implemented interim measures to bolster the functioning and capacity of substations and the distribution system in the Greenwich area. Those measures are summarized in Table E-4, as follows:

Table E-4 Greenwich Interim Measures

	Substation	In-service Date	Initiative	Company Investment (millions)
1	Cos Cob	2010	Upgrade switchgear – 27 kV	$3.8
2	Cos Cob	2012	Tie connection between two transformers	$1.2
3	Cos Cob	2012	Add a new 30-MVA transformer	$4.8
4	Byram	2011	Upgrade equipment – install two reclosers	$0.2
5	Mianus	2012	Upgrade equipment – Install underground cable and switching to serve load from Cos Cob	$0.8
6	Distribution Feeder Improvements	2012	Replace distribution cables from Cos Cob Substation to Prospect Substation	$2.0
7	North Greenwich	2012	Add an aerial feed to North Greenwich Substation and upgrade right-of-way	$8.4
8	North Greenwich	2010-2012	Replace three distribution transformers	$14.0
9	Distribution Underground Cable Improvements	2012	Replace underground distribution cable from Cos Cob Substation to Sound Shore Drive	$1.1
			Total	$36.3

Q. Are there any additional interim cost-effective measures available to Eversource to defer the Project?

A. No.

Q. Why not?

A. Greenwich is electrically isolated and overly reliant on Cos Cob Substation, unlike other communities with comparable loads that are served by multiple bulk substations.

Q. In Section F.3.1 of the Application, Eversource references a distribution alternative that would expand Cos Cob Substation, modify Prospect Substation, add to the distribution duct bank system and modify the current distribution loop schemes involving Cos Cob Substation and Prospect Substation. Why was this alternative rejected?

A. The Company rejected the distribution alternative because (1) the estimated cost would exceed the cost of the proposed Project while providing less capacity than the Project and (2) the same reliability benefits achieved by the Project cannot be achieved by the distribution alternative. The cost of the distribution alternative would be approximately $50 million higher than the Project cost and achieve a capacity increase that is actually 60 MVA lower than the Project capacity increase (more money for less capacity). Moreover, the distribution alternative would not address the long term reliability needs that are met by the proposed Project by adding capacity and bringing a reliable power supply source to the center of the customer demand.

Q. In particular, why isn't a microgrid a technically feasible alternative to the Project?

A. Generally, generation assets in microgrids in Connecticut, range from 400 kW to 5 MWs, well below the capacity needed in Greenwich to provide demand relief starting in 2018 and to accommodate future load growth. In addition, as recognized by the CT DEEP, in its 2014 Integrated Resources Plan for Connecticut, *"there are many technical, operational and economic challenges with implementing microgrids." Those challenges include "... ensuring overall power quality to customers while the microgrid is islanded from the rest of the distribution system .... through a complex system of measurement and communications equipment and engineering applications to ensure system stability, voltage control, and frequency control. The microgrid also requires security systems and ongoing maintenance .... and major capital requirements as the system ages."*

Q. Are there any solar initiatives underway in Greenwich?

A. Eversource works closely with the Connecticut Green Bank, and its statewide program called Solarize Connecticut. The Town of Greenwich was selected to participate in the Solarize Connecticut program in 2013. As of June 30, 2015, Eversource has interconnected 92 solar PV installations in the Town of Greenwich since 2010, and currently has 28 applications in progress. The total nameplate interconnected generation is 963 kW with another 417 kW in progress. This existing distributed generation is included in Eversource's actual measured loads and the 28 applications in progress are accounted for in Eversource's future load projections. On a customer count basis, Eversource has a total of 116 customers that have installed distributed generation or

about 0.4% of its 27,995 customers in the Town. Solar, just like energy efficiency, is a component of the solution for the energy needs of Connecticut, and Eversource is actively involved with programs that benefit our customers.

Q. Can solar energy avoid or defer the need for the Greenwich Substation and Line Project?

A. Unfortunately, solar energy cannot avoid nor delay the need for the Project as it cannot provide enough additional capacity nor does solar generation align with the timing of the peak loads in the Town - loads typically are ramping up in the late afternoon when there are limited amounts of sunshine left to the day.

Q. Are there any other types of renewable generation, such as wind or geothermal, that could avoid the need for the Project in a cost-effective manner?

A. No, both wind and geothermal require much higher capital costs and are limited to certain locations, even if it were feasible for either technology to provide sufficient capacity.

Q. Has Eversource fully considered the use of non-transmission alternatives not only individually but also in combination to provide sufficient demand relief to Greenwich's distribution system?

A. Eversource has fully considered the use of non-transmission alternatives not only individually, but also in combination to provide sufficient demand relief to Greenwich's distribution system. However, such alternatives are not currently available, or available in sufficient amounts to meet the immediate needs that the Project would address. Further, such alternatives would not increase the reliability of the system with a new reliable capacity source sufficient to supply anticipated customer demand for the

long-term future or extend the bulk power transmission infrastructure closer to the demand center.

7. CONSTRUCTION

Q. Please describe the open cut trenching technique.

A. Open cut is the common method for installing an underground HPFF circuit and would be utilized in all areas, except where an HDD or pipe jacking is proposed. Typically, for open cut trenching, mechanical excavation is required to remove the concrete or asphalt road surface (for roadways), topsoil, and sub-grade material to the desired depth. Removed material is relocated to an appropriate off-site location for disposal. Once a length of trench is opened and shoring installed, where required, the steel pipes are placed, welded, x-rayed, and assorted conduits are assembled and lowered into the trench. The area around the pipe and conduits is filled with a low strength thermal concrete and capped with a layer of high strength thermal concrete. After the concrete is allowed to set up, the trench is then backfilled and the site restored. Backfill materials would be clean excavated material, thermal sand and/or FTB. The minimum dimensions for open trench construction are approximately 4.5 feet wide by 5.5 feet deep.

Q. Please describe the HDD technique.

A. HDD is a steerable trenchless method of installation for underground pipes, conduits and lines in a shallow arc, along a prescribed bore path by using a surface-launched drilling rig. HDD is used when open trench excavation is not practical, such as under rivers, highways, railroads or areas of congested development.

Q. Please describe the HDD installation process.

A. HDD is proposed as part of the Preferred Route beneath the MNRR and I-95 and beneath Bruce Park and its waterbodies. The HDD installation would consist of three individual bore holes, approximately 14 to 20 inches in diameter, spaced a minimum of 10 feet apart. HDD crossings require both sending and receiving pits at either end of the trenchless span. The sending areas typically measure approximately 100 feet by 150 feet (about 15,000 square feet), although in some instances a modified (slightly reduced) area can be arranged to meet the specific conditions of a site. Receiving areas require an area measuring approximately 750 feet long by 25 feet wide. After the three bore holes have been drilled and reamed to the required diameter, two 8-inch steel pipes, each with one 2-inch and one 4-inch PVC conduit attached, would be pulled together through the two outer holes while the 8-inch fluid return pipe with one 2-inch conduit would be pulled through the center hole.

Q. Please describe the pipe jacking technique.

A. Pipe jacking is proposed as part of the Preferred Route to cross under the MNRR corridor. It is a trenchless installation involving auguring or hand-mining operations that simultaneously jacks or pushes a casing into the excavated cavity. Once the casing is installed, three steel pipes and the PVC conduits would be installed inside the casing pipe using specially designed spaces. The entire casing is then backfilled with thermally designed grout that solidifies the installation from any movement and helps dissipate heat away from the line system.

Q. What construction steps would be followed for the installation of the underground circuit?

A. The construction would occur in several stages and generally consist of the following activities:

- Pre-Construction Planning – Prior to starting construction, Eversource would complete pre-construction planning activities. Eversource's pre-construction planning activities would include, but not be limited to: conducting surveys to identify existing underground and overhead infrastructure and developing plans for the temporary or permanent relocation, if required; conducting analyses of soil and groundwater conditions and preparing plans for handling; and identifying locations of construction storage yards and construction support areas and obtaining approvals for their use.

- Construction Procedures – Eversource would deploy appropriate erosion and sedimentation controls (i.e., catch basin protection, silt fence or straw bales) at locations where pavement or soils would be disturbed; excavate the trench for the HPFF pipe; install the pipes and conduits in sections of approximately 40-foot lengths; encase the pipes and conduits in a low strength thermal concrete; and backfill the trench.

Q. Has Eversource identified potential storage and staging areas?

A. No. To the extent possible, such areas would include Eversource property, 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 route. Final locations would be identified as part of the Development and Management ("D&M") Plan process.

Q. What area of the duct bank trench would be open at any given time and how would public safety be maintained during non-work hours?

A. Trenching, conduit installation, and backfilling would proceed progressively along the route such that relatively short sections of trench (typically 200

feet per crew) would be open at any given time and location. Work zones around the trench area usually range from approximately 600 to 800 feet. During non-work hours, temporary cover (steel plates) would be installed over the open trench within paved roads to maintain traffic flow over the work area. After backfilling, the trench area would be repaved using a temporary asphalt patch or equivalent.

Q. Please explain the location of splice vaults and how public safety would be maintained during construction.

A. At intervals of up to approximately 2,800 feet along the line route, pre-cast concrete splice vaults would be installed below ground. The length of an underground cable section between splice vaults (and therefore, the location of the splice vaults) is determined based on engineering requirements (such as the maximum allowable cable pulling tensions; maximum allowable cable sidewall pressure; cable weight/length that can fit on a reel and be safely transported) and land constraints.

Q. Are there any special construction requirements for splicing HPFF lines?

A. Splicing HPFF lines requires a "clean room" atmosphere, which would be provided by an enclosure or vehicle (large panel truck) located over the manhole access points during the splicing process.

Q. Would clearing be required for the installation of the splice vaults?

A. Eversource expects that the splice vaults would be primarily located within the existing paved roadways, so limited clearing of vegetation may be necessary in some locations for the splice vaults.

Q. How would construction vehicles and equipment access the Project route?

A. Construction vehicles would access the Project route via city and state roads along the route.

Q. Where would construction vehicles park?

A. During work hours, construction vehicles would park within the protected area of the construction site. Traffic cones and police presence would ensure safe traffic flow. After hours, such vehicles would be primarily parked in staging areas. Given the congested nature of the Preferred Route, the Project team will strive to limit the number of contractor vehicles at the work sites.

Q. How would Eversource access the underground circuit for maintenance?

A. Eversource would only access the underground circuit for maintenance through the vaults. The area directly around the splice vault would be cordoned off and police would be retained to control traffic flow.

Q. How would Eversource access the splice vaults for maintenance?

A. Each vault would have two entry points to the surface. After backfilling, these entry points would be identifiable as manhole covers, which would be set flush with the ground or road surface. Traffic control and barriers would be used to cordon off the entry point to provide a safe working area.

Q. What would the area covered by the Preferred Route look like once the construction is completed?

A. The road surface, as well as any off-road surface, would be returned to its original state after construction.

8. ELECTRIC AND MAGNETIC FIELDS

Q. What are Electric and Magnetic Fields?

A. 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 arrangement and spacing of the line 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 arrangement and spacing of the line 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 MF 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 the directions of current flow.

Q. Has Eversource evaluated the effect of the Project on the current range of levels of EF and MF along the Preferred Route?

A. Yes. Section M, as corrected by the EMF Errata filed with the Council on July 21, 2015 ("EMF Errata"), of the Application provides a thorough analysis of the effect of the Project on EF and MF levels.

Q. Has Eversource considered the Council's EMF Best Management Practices?

A. Yes. The design of the Project is consistent with the Connecticut Siting Council's Electric and Magnetic Field Best Management Practices, Revised on February 20, 2014 ("BMP").

Q. Has Eversource complied with the Council's EMF BMP concerning line designs? If so, explain how.

A. Yes. Per the BMP, "*...MF is reduced by the underground cable design (refer to page 9 [of the BMP] for further information). However, special circumstances may warrant some additional cost in order to achieve further MF mitigation for underground lines. The utilities are encouraged, prior to submitting their application to the Council, to determine whether a project involves such special circumstances.*" Because Eversource proposes the transmission supply lines to be constructed with HPFF technology (also referred to as "pipe-type cable"), the fields are reduced with cable proximity and the material characteristics of the steel pipe. Calculated MF levels would be less than 0.5 mG (refer to section L.3.2.2) for average annual load conditions. According to a survey done by the Electric Power Research Institute ("EPRI") in 1993, "*the average of measurements from all the rooms in the house*

[mean for the houses measured in the study] was calculated (the all-room mean magnetic field). The all-room mean magnetic field for all houses studied was 0.9 mG." Based on the magnetic field level anticipated from the proposed transmission supply lines, Eversource concluded that the Project does not create any special circumstances that require Eversource to achieve further magnetic field mitigation.

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

A. Yes. Eversource retained scientists at Exponent, Inc. ("Exponent") to perform such analysis. Appendix G.1 of the Application includes a report from Exponent with a systematic literature review critical evaluation of epidemiology and *in vivo* studies published from April 1, 2012 to July 31, 2014.

Q. What was Exponent's conclusion?

A. Exponent concluded that no recent studies provide evidence to alter the conclusion that the scientific evidence does not confirm that EMF exposure is the cause of cancer or any other disease process at the levels we encounter in our everyday environment.

Q. What are the major sources of EMF associated with the Project and sources that currently exist in the vicinity of the areas included in the Project?

A. The proposed underground transmission supply lines and nearby existing overhead and underground distribution lines are the major sources of EMF. Transformers and other equipment within the proposed Greenwich and Cos Cob Substations are also potential EMF sources, but would cause little or no exposure to the

general public. The strength of fields from equipment inside a typical substation decreases rapidly with distance, and reaching very low levels at relatively short distances beyond substation perimeter fences. The exception is where transmission and distribution lines enter the substation property. Thus, measuring and calculating the EMF levels associated with the transmission lines addresses potential EMF exposure close to substations.

Q. Will there be measurable EF from the cables that comprise the transmission lines?

A. No, EF from HPFF cables are contained within the sheaths of the individual cables so that EF outside the cable will be zero.

Q. Has Eversource arranged for measurements of existing MF levels along the Preferred Route to be made, as required by the BMP?

A. Yes. Spot measurements of MF were taken by Eversource on March 3, 2015 at selected locations along the Preferred Route. The measurements were taken walking across Arch Street. The measurement path is shown in Figure M-5 and the results are depicted in Figure M-6 of the Application. Those measurements are summarized in Table M-3 of the Application:

Table M-3

MF Levels - Arch Street (milliGauss, mG)		
Maximum	Average	Median
2.96	1.91	1.92

Q. Were MF measurements taken at the affected Substation properties?

A. Yes, Eversource performed measurements on March 3, 2015 as follows:

1. Cos Cob Substation – on a horizontal transect of the proposed route across the access road to the substation. Nearby sources of MF include the existing overhead transmission lines and overhead and underground distribution lines entering and exiting the substation. Those measurements are summarized in Table M-2 of the Application:

Table M-2

MF Levels - Cos Cob S/S (milliGauss, mG)		
Maximum	Average	Median
12.24	8.74	8.06

2. Proposed Greenwich Substation – along a perimeter path. Nearby sources of MF include overhead and underground distribution lines entering Prospect Substation. Those measurements are summarized in Table M-4 of the Application:

Table M-4

MF Levels - Greenwich S/S (milliGauss, mG)		
Maximum	Average	Median
26.64	8.17	6.03

The measurement area for Cos Cob Substation is shown on Figure M-3 and the results depicted in Figure M-4 of the Application. The measurement area for the proposed Substation is shown on Figure M-7 and the results depicted on Figure M-8 of the Application.

Q. What type of information do these measurements provide?

A. The measurements of MF 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. In contrast, the EF is quite stable over time.

Q. Did Eversource provide calculated estimates of MF along the Preferred Route?

A. Yes.

Q. How were MF calculated for this purpose?

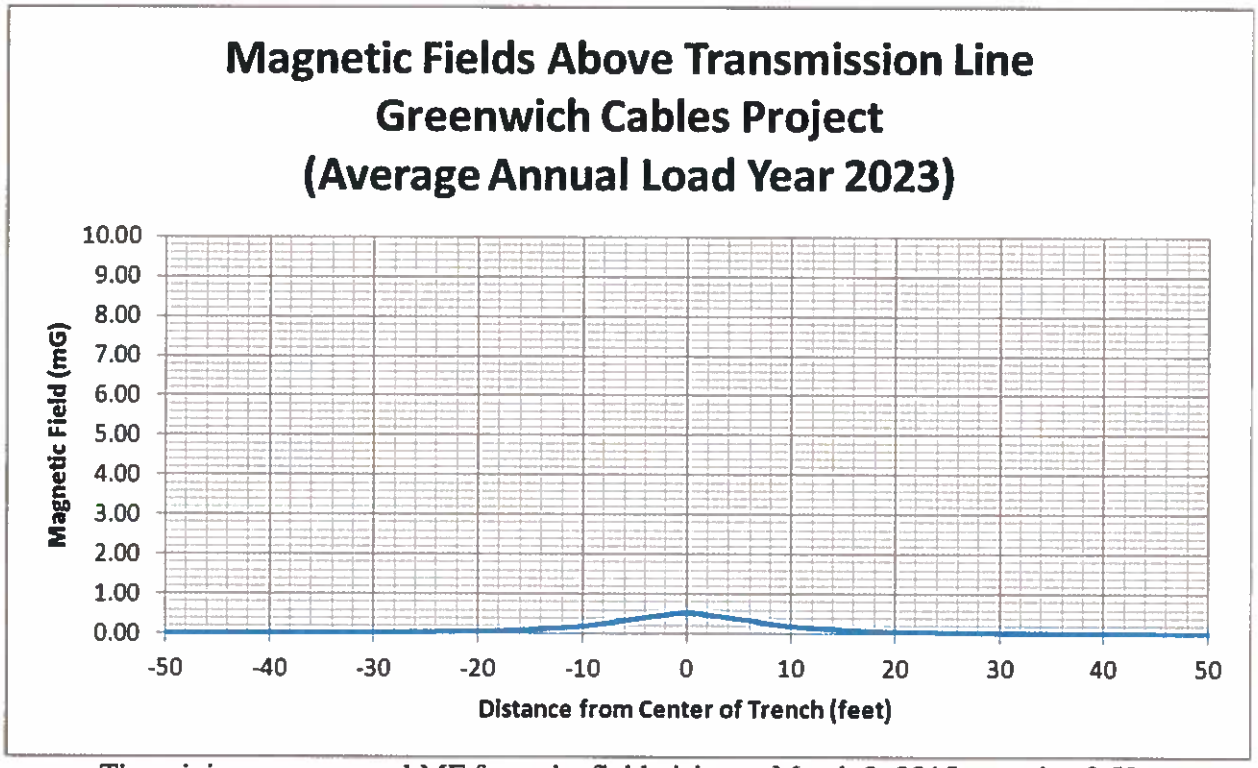
A. As described more fully in Section M.3.2, as corrected by the EMF Errata, Eversource estimated (1) annual peak load (APL) conservatively from ISO-NE's projected 90/10 system peak loads, (2) peak-day average loads (PDAL) over 24 hours at 85% of the system's hourly peak load (based on the 90/10 peak-load days) and (3) annual average loads (AAL) based on the projected annual hourly average loads.

The Application presents calculations of magnetic field levels at 25-foot intervals for the base design at AAL, APL and PDAL. 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 Application.

Q. Where would the highest MF level occur and what is that level during AALs?

A. As noted in the EMF Errata, the highest MF level would occur directly above the center of the trench and would have a value of 0.52 mG during AALs. In Figure M-9 of Section M.3.2.2 of the Application, as corrected by the EMF Errata,

Eversource provided the following summary graph depicting the MF from the proposed transmission lines during AAL in 2023:



The minimum measured MF from the field visits on March 3, 2015 was also 0.52 mG in the vicinity of the Proposed Site.

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

A. The MF calculations will yield conservatively high estimates.

Q. How are the calculated MF levels presented in the Application?

A. Appendix G.2 of the Application, as corrected by the EMF Errata, presents the calculations.

Q. Did Eversource provide a Field Management Design Plan ("FMDP")? Why or why not?

A. No, an FMDP is not needed because the Project does not create any special circumstances that require Eversource to achieve further MF mitigation. As noted in the BMP, MF is reduced by the use of underground cables, and the use of HPFF cables results in greater reduction because of cable proximity and the material characteristics of the steel pipe.

Q. For the Preferred Route, are there any adjacent public or private schools, licensed child day-care facilities, or licensed youth camps?

A. No.

Q. Are there any public playgrounds adjacent to the Preferred Route?

A. Yes. The Preferred Route originates adjacent to Cos Cob Park and passes through Bruce Park.

Q. Has Eversource complied with all of the requirements in the relevant provisions of the statutes concerning EMF and the Council's BMP?

A. Yes, Section M of the Application, as corrected by the EMF Errata, and the documents in Appendix G fully comply with all of the requirements in the relevant provisions of the statutes concerning EMF and the Council's BMP.

Q. Please summarize Eversource's efforts to comply with the statutory and BMP requirements concerning EMF.

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

- Eversource has provided an update of scientific research and group positions re: MF; and

- Eversource has provided measurements and calculations that were developed in accordance with the BMP.

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 exposure to MF. As noted in Table 1 of the Exponent report, the ICES reference level is 9,040 mG; the ICNIRP reference level is 2,000 mG. Projected MF levels for the Project are well below these guideline levels.

9. SAFETY AND SECURITY

Q. Would the proposed Greenwich Substation, modifications to Cos Cob Substation and the proposed underground transmission lines pose any safety risk to the public?

A. No. The Project facilities and equipment would not pose a safety threat or create any undue hazard to the general public, including persons or property. All work would be designed in accordance with sound engineering practices and constructed in full compliance with the standards of the National Electrical Safety Code and good utility practices.

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

A. Protective relaying equipment would automatically detect abnormal system conditions (e.g., a faulted transmission line) and would send a protective trip signal to the respective circuit breakers to isolate the faulted section of the transmission

system. Protection would 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. Significantly, the protective relaying schemes include fully redundant primary and back up equipment.

Q. What fire protection systems will be included in the Greenwich Substation and are maintained at the Cos Cob Substation?

A. Smoke detection systems would automatically activate an alarm at CONVEX and the system operators would then take appropriate action. Additionally, the relay/control enclosure at the Greenwich Substation will be equipped with fire extinguishers; Cos Cob Substation is presently equipped with fire extinguishers.

10. MUNICIPAL, STATE AND FEDERAL CONSULTATIONS

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

A. Yes, we initiated the municipal consultation process with the Town of Greenwich on February 6, 2015, more than 60 days before the Application filing. There is no other municipality within 2,500 feet of the proposed Greenwich Substation, Cos Cob Substation or any portion of the Preferred Route or alternative routes presented in this Application.

Q. Has there been any dialogue with the Town after the municipal consultation filing?

A. Yes. The Project team has held two Project update meetings with representatives of the Town of Greenwich since the conclusion of the municipal consultation filing.

Q. Please summarize Eversource'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. Over the past 2 years, Eversource has implemented a comprehensive outreach strategy to inform elected federal, state, and local officials, municipal department heads, municipal Commissions and Agencies, residents, business organizations and other stakeholders about the Project and to solicit feedback. This outreach has included group and individual meetings and presentations, written communications, two Open Houses and phone calls.

Q. Did Eversource file any municipal location reviews pursuant to Connecticut General Statutes Section 16-50x(d) for the proposed Greenwich Substation?

A. Yes, on February 6, 2015, Eversource presented its Location Review Filing to the Greenwich Planning and Zoning Commission and the Greenwich Inland Wetlands and Watercourse Agency. A copy of the Filing is included in Eversource's Bulk Filing of June 26, 2015 in this Docket.

Q. Has Eversource consulted with federal and state agencies?

A. In connection with the permits and approvals that would be required for the construction and operation of the Project, Eversource consulted, and is continuing to consult with, the following federal and state agencies:

- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- CT DEEP, Natural Diversity Data Base
- Department of Economic and Community Development, Connecticut Historic Preservation Office
- ConnDOT
- CT DEEP, Office of Long Island Sound Programs.

11. STATUTORY COMPLIANCE

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

A. Eversource sponsored Open Houses at the Greenwich Town Hall Meeting Room on March 3, 2015 and July 15, 2015. Invitations were mailed to all property owners along the Preferred Route as well as abutting property owners to 290 Railroad Avenue and 281 Railroad Avenue. 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 applicable Application Guides, and to abutters of the proposed Greenwich Substation, for the Proposed Site and Alternate Site, and Cos Cob Substation, as required by section 16-50*l*(b). Legal notices of the Application were published in local newspapers, The

Greenwich Time and The Stamford Advocate, as required by section 16-50*l*(b). A copy of the Municipal Consultation Filing was placed in the local library and on the Project website (www.eversource.com). A project hotline (1-800-793-2202) and transmission project email address (TransmissionInfo@eversource.com) were utilized which allows residents and other stakeholders to communicate with the Project team.

Q. How was information presented at the open houses?

A. The information was presented using a series of informational kiosks. The Project team subject matter experts were present to address questions from attendees about the proposed Project.

Q. Were signs posted informing the public of the Council's public hearing to be held in Greenwich on September 1, 2015, in advance of that hearing?

A. Yes. On August 18, 2015, six 4-foot by 6-foot signs notifying the public of the hearing were posted by members of the Project team at various locations. (See Attachment 7 for content of such signs.) The signs were posted at:

1. Proposed Greenwich Substation Site at 290 Railroad Avenue – along Field Point Road frontage
2. Alternate Site at 281 Railroad Avenue – south side fence, and north side adjacent to Woodland Drive (2 signs)
3. Cos Cob Substation on Sound Shore Drive – on the fence at the entrance to the Substation
4. Intersection of Bruce Park Drive and Kinsman Lane
5. Arch Street Parking Lot - on the east side of Arch Street.

(See Attachment 8 for photo of sign posted at Cos Cob Substation)

MISCELLANEOUS

Q. Does Eversource have any clarifications to the Application?

A. Yes, the $68 million cost set forth on p. G-23 of the Application included costs not only for the Greenwich Substation and the distribution modifications, but also for the modifications to Cos Cob Substation.

CONCLUSION

Q. Please summarize your testimony.

A. Eversource proposes to construct the Greenwich Substation and Line Project in compliance with all statutory requirements, the Council's regulations and applicable industry codes and standards. The Greenwich Substation and Line Project is designed to add the much needed transformation capacity and avoid system equipment overloads. The Greenwich Substation is proposed near the center of the customer electrical demand. Cos Cob Substation would be modified and loads on the transformers reduced. The new 115-kV underground transmission lines would improve system reliability and provide a power source to the existing multiple lengthy distribution feeders originating from Cos Cob Substation.

Q. Does this conclude your testimony?

A. Yes.

Docket No. 461 Greenwich Substation and Line Project

Direct Testimony of Kenneth B. Bowes, Raymond Gagnon and Jacqueline Gardell

Tabs

Tab 1 Resumes

Attachments

Attachment 1 – Figure ES-1 – Preferred Route Map

Attachment 2 – Figure G-8A – MNRR/I-95 Crossing Variation

Attachment 3 – Figure G-8B – Additional Bruce Park Crossing Variations

Attachment 4 – Figure ES-2 – Alternate Routes

Attachment 5 – ConnDOT Letter dated January 23, 2015

Attachment 6 – Greenwich IWWA Letter dated March 27, 2015

Attachment 7 – Content of Posted Signs

Attachment 8 – Posted Sign Photo – Cos Cob Substation